(No Model.)

3 Sheets—Sheet 1.

C. LEVER.

ELECTRIC ARC LIGHT.

No. 322,115. Patented July 14, 1885.

FIG. 2.

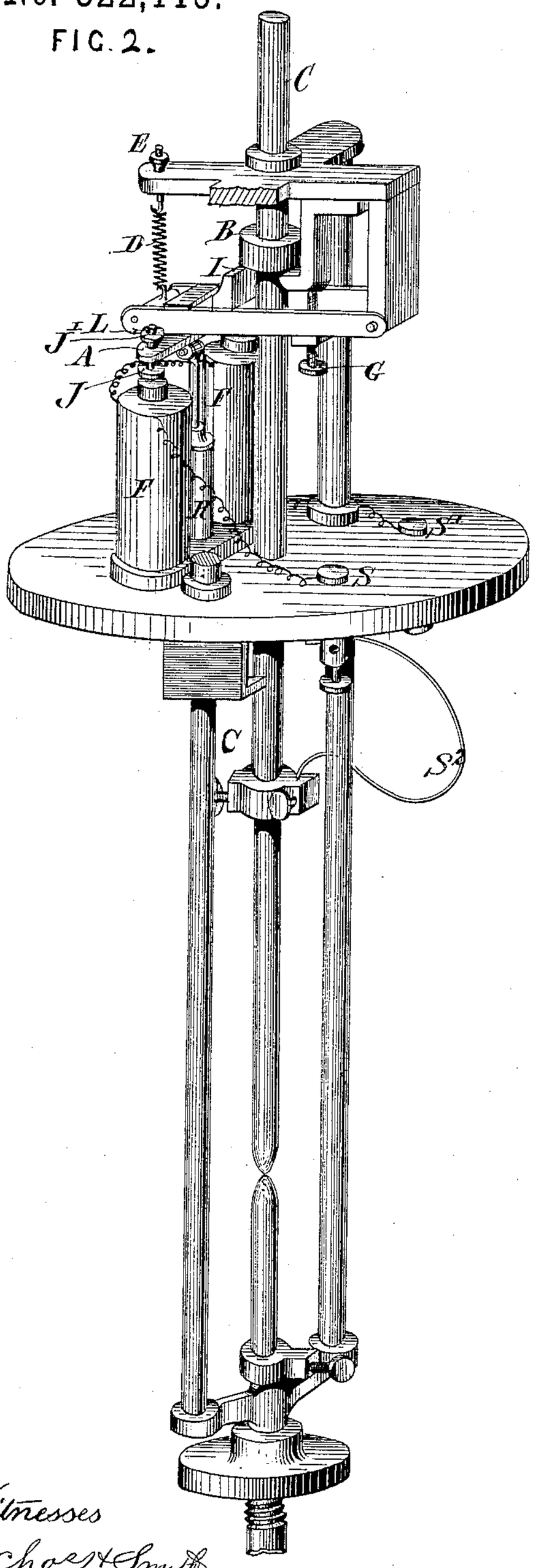
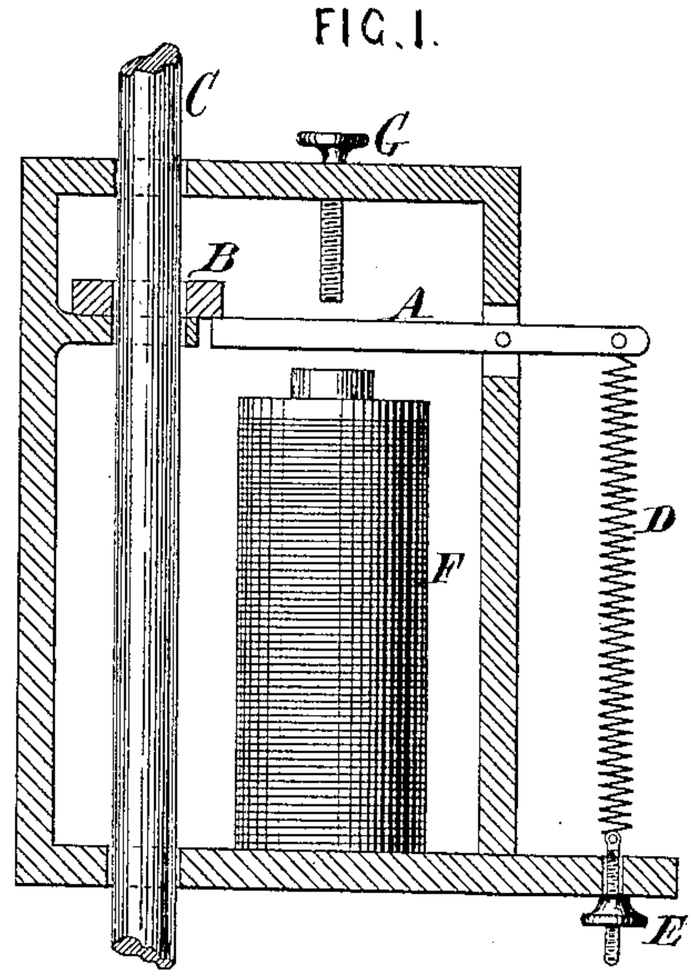


FIG. 1.



Witnesses

Chas. F. Smith

J. Stair

Inventor

Charles Lever

Lemuel W. Serrell

(No Model.) 3 Sheets—Sheet 2.

C. LEVER.

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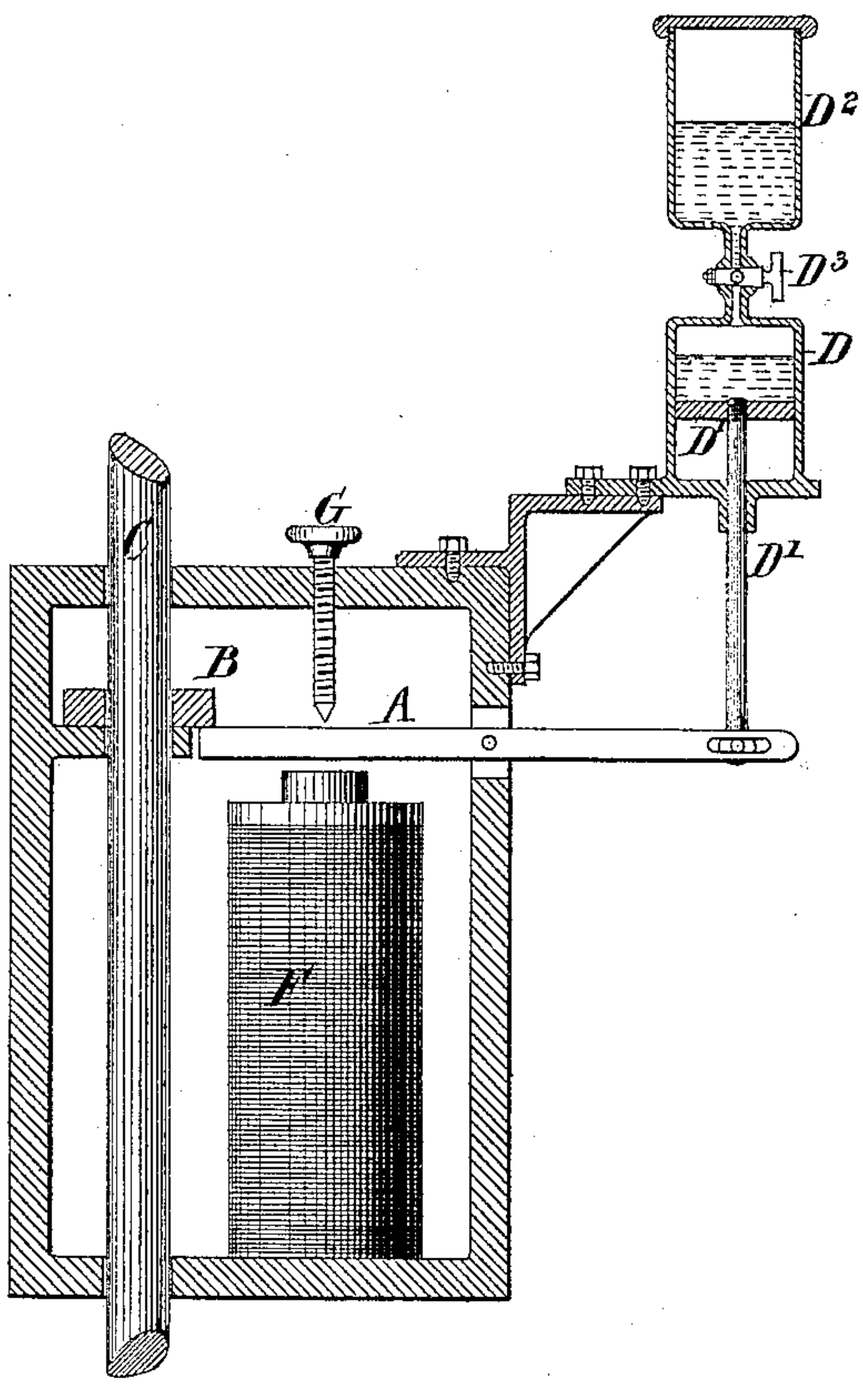
FIG. 3.



Witnesses

Chas. H. Smith

J. Staib

Inventor

Charles Lever

per Lemuel W. Serrell

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(No Model.) 3 Sheets—Sheet 3.

C. LEVER.

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FIG. 4.

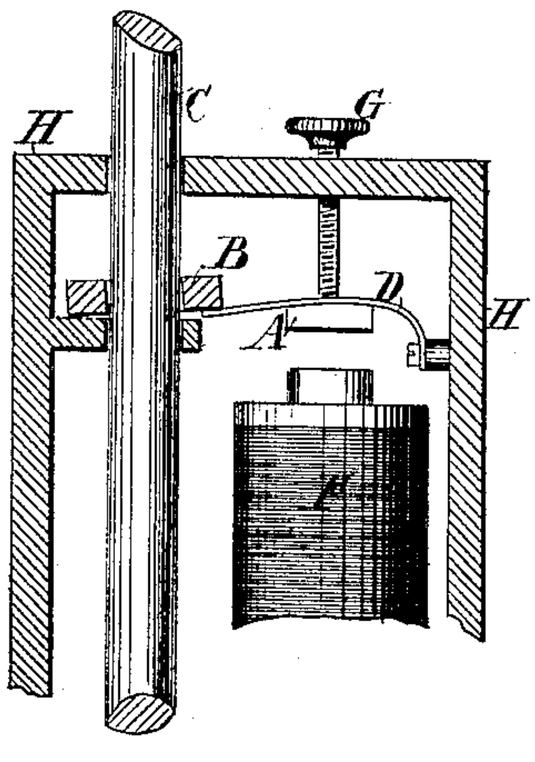


FIG. 5.

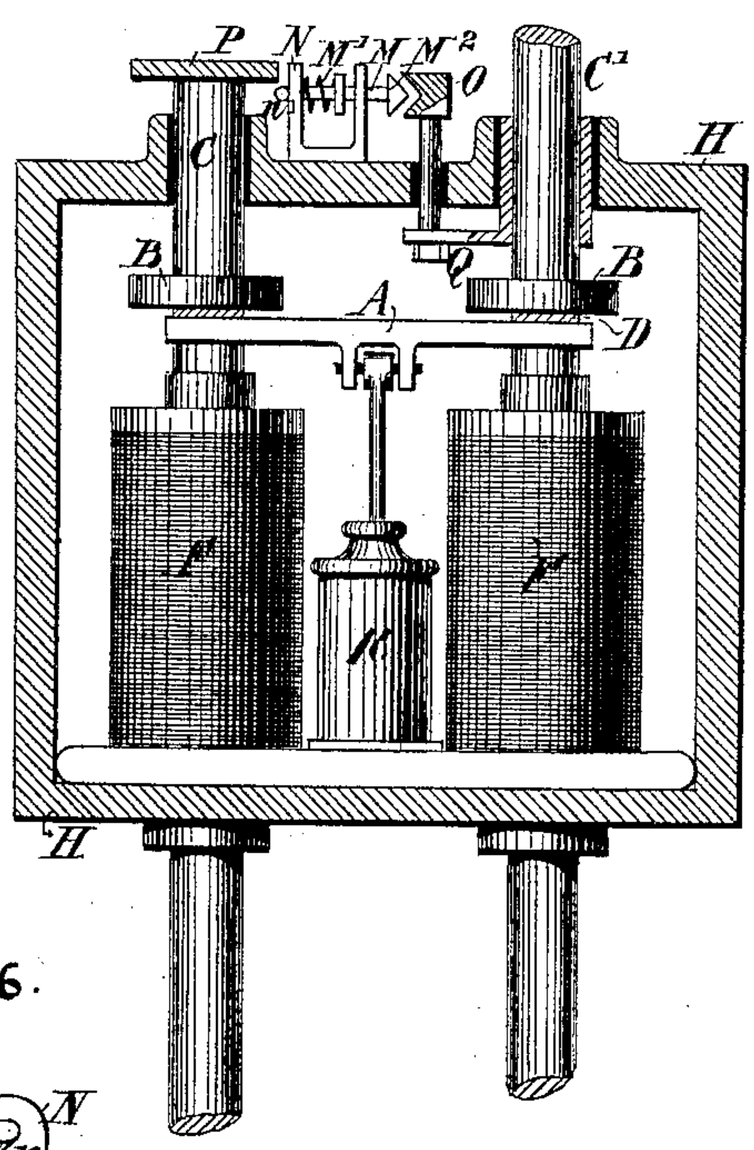
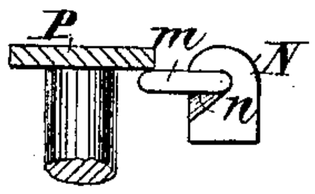


FIG. 6.



Witnesses

Chas. H. Smith

J. Stalb

Inventor

Charles Lever

Lemuel W. Serrell

UNITED STATES PATENT OFFICE.

CHARLES LEVER, OF BOWDON, COUNTY OF CHESTER, ENGLAND.

ELECTRIC-ARC LIGHT.

SPECIFICATION forming part of Letters Patent No. 322,115, dated July 14, 1885.

Application filed December 12, 1882. (No model.) Patented in England May 3, 1882, No. 2,092; in France November 3, 1882, No. 151,896; in Belgium November 4, 1882, No. 59,473, and in Canada October 26, 1883, No. 17,984.

To all whom it may concern:

Be it known that I, CHARLES LEVER, of Bowdon, in the county of Chester, England, have invented an Improvement in Electric-Arc Lamps, of which the following is a specification.

Letters Patent for this invention have been granted in Great Britain, dated May 3, 1882, No. 2,092; France, deposited November 3, 1882, granted February 8, 1883, No. 151,896; Belgium, deposited November 4, 1882, granted November 15, 1882, No. 59,473[B], and Canada, dated October 26, 1883, No. 17,984.

This invention has for its object improvements in electric lamps where the light results from the electric current passing between points or pencils of carbon.

The way I accomplish this invention is by commencing in an inverse manner to that usually employed in electric-arc lamps—*i. e.*, the carbon electrodes in the lamp do not make contact with each other before the electric current is sent through the lamp. The reason of this will be described hereinafter.

Instead of employing an electro-magnet or solenoid in the main circuit to separate the carbon points for the production of the voltaic arc, as is usually the case, I employ an armature-lever, in combination with a spring, gaseous, or liquid pressure, to separate the carbon points to the required distance for the display of the voltaic arc, this distance being regulated by means of a set-screw acting on the said armature-lever and limiting its movement. Acting on the opposite end of this armature-lever, and in an opposite direction to the spring, gaseous, or fluid pressure, is an electro-magnet in a shunt-circuit of a considerable greater resistance than that of the arc from which it is shunted or derived. The armature-lever is free to move on a pivot or fulcrum pin fixed to the casting, preferably of brass or other diamagnetic metal. This casting forms a frame that supports the shunt electro-magnet and clip or other device by which the said armature-lever can raise the upper-carbon holder, which slides through the said casting, by means of the said spring, gaseous or fluid pressure.

In the drawings, Figure 1 is an elevation, partly in section, of a portion of an arc lamp fitted with my improvement. Fig. 2 is a perspective view of the arc lamp complete. Fig. 3 is a sectional elevation illustrating how fluid-pressure may be used to raise and support the upper carbon. Figs. 4 and 5 are elevations, at right angles to each other, of a double-carbon lamp fitted with my improvement; and Fig. 6 is an elevation of part of the cut-out device shown in Fig. 5.

Referring to Fig. 1, A is an armature-lever, upon one end of which rests loosely a clip, B. This clip is simply a metal washer encircling the upper-carbon holder C, and which allows the upper-carbon holder to fall, by gravity, when the clip is at right angles to the said carbon-holder. At the other end of the armature-lever A is attached the spring D, the force of which can be regulated by any suitable means, such as adjusting the tension of the spring by a screw, E. The spring D must have, however, sufficient force on the armature-lever A, when no current is flowing through the lamp, to raise the upper-carbon holder C, with its carbon pencil, by means of the armature-lever A and clip B, to the required distance for the display of the voltaic arc.

G is a set-screw for adjusting the movement of the lever A and the length of the arc.

When the lamp is not in use, the carbon points are separated by means of the said spring D acting on said armature-lever A, so that when the electric current is sent through the lamp, the circuit of low resistance through the carbons being broken by their not making contact with each other, all the current momentarily goes through the shunt electro-magnet F; but immediately this takes place the shunt electro-magnet becomes so powerfully magnetized that it overcomes the force of the spring D on the armature-lever A, which raises the upper-carbon holder C, and it attracts the armature-lever A, thus loosening the clip B and allowing the upper-carbon holder C to fall by gravity until the upper-carbon pencil comes into contact with the lower carbon. As soon, however, as the carbons come in contact the shunt electro-magnet F loses nearly all its magnetism, the main circuit having then been closed, and consequently the spring

D raises the upper-carbon holder C and its carbon pencil to the regulated distance for the display of the voltaic arc. This action takes place so quickly that there will be no dangerous rise of temperature in the coils of wire on the shunt electro-magnet F; but as the resistance of the arc increases as the carbons are consumed more current flows through the shunt electro-magnet F until a point is reached when the force of the spring D, which keeps the upper carbon raised, is overcome by the force of the shunt electro-magnet F acting on the opposite end of the armature-lever A, whereupon the clip B will be loosened, thus allowing the carbon to fall until an equilibrium is established between the shunt electro-magnet F and the force of the spring D. This action takes place until the carbons are consumed.

Instead of employing a spring to act on the armature-lever, and thus raise the carbon pencil, as already described, a piston and piston-rod can be attached to the said armature-lever A, and in this case a column of mercury or gaseous or other fluid pressure can be made to act on the piston and raise the carbon pencil, as before, the pressure being then adjusted by means of a stop-cock on a tube. Fig. 3 shows such a modification in which the spring D is dispensed with, and instead of it I use a cylinder with a piston having its piston-rod D′ connected to the armature-lever A. The liquid—such as mercury—is supplied from the reservoir D^2, the supply being regulated as required by the tap D^3.

Fig. 2 shows an electric lamp complete constructed according to my invention, but where the armature-lever A, Fig. 1, is replaced by a lever, L, preferably of diamagnetic material. The armature A is here fixed at the same end of the lever L as the spring D.

E is the nut for adjusting the tension of the spring D, and I a projection attached to the lever L, which cants or tilts the clip B by means of spring D.

G is the set-screw, for adjusting the length of arc.

The iron screws J J, with large heads, passing through the armature A, serve as adjustable pole-pieces, and can be secured by means of lock-nuts J′ J′.

R is the dash-pot, and S S′ are the binding-screws, from which the electro-magnet is shunted or derived. The current entering at the positive binding-screw S passes through the insulated flexible wire or cable S^2 to the upper-carbon holder C, from thence through the arc and lower carbon and through the frame of the lamp to negative binding-screw S′. The side rods are insulated from each other, and the ends of the coils of the electro-magnets F F are connected to the binding-screws S S′, thus placing the electro-magnet in derivation from the arc.

In Figs. 4 and 5, the spiral spring D and armature-lever A are replaced by a flat spring, D, and armature A, the said spring being fixed to the frame H, and operating on the clip B, as already described.

I prefer to use the flat spring on lamps having two or more sets of carbons, although it can be used in a single carbon lamp.

It will be seen that any number of arc lamps constructed according to this invention can be worked in series or single circuit as well as in multiple arc or parallel circuit, because the regulation of the arc is effected solely in a shunt-circuit, and the lamps can be worked either by continuous or alternate currents; but the former are preferred as being more economical.

In order to prevent the arc forming between the carbon-holder and the lower-carbon point, should by accident one of the carbons fall out of its carbon-holder, or, in order, on a double carbon lamp, to automatically switch out one set of carbons and switch in another set, a simple cut-out device is used, which is constructed as follows: I have shown this cut-out device as applied to a double carbon lamp in Fig. 5, of which Fig. 4 is a side view. On the top of the brass frame H, which contains the shunt electro-magnet F F and armature, and also the spring D, which raises the upper-carbon holder C and pencil, is fixed a device similar to that used in small spring-guns—*i.e.*, a small metal rod, M, capable of rotating on its axis through a U-shaped piece of metal, N, cast on the top of the said brass frame H. A slot, *n*, is cut into this U-shaped piece of metal, as shown in the detail view, Fig. 6, and the small metal rod M is bent at right angles outside one of the open ends of this U-piece N. Between the two inside ends of the U-piece of metal is a spiral spring, M′, sliding on the said metal rod M, and which can give the metal rod a longitudinal motion when its bent arm *m* comes over the slot *n* in N. At the end of the metal rod opposite to the bent arm *m*, and outside the U-piece, is formed or attached a small conical or flat piece of metal, M^2, and at a short distance from this piece of metal M^2 is a metallic piece, O, insulated from the brass frame H, but connected by means of a wire or slip, Q, of low resistance with the second carbon-holder, C′, (or if applied to a single carbon lamp with the negative binding-screw of the lamp.) The bent arm *m* of M is at the outer end of the U-piece N nearest to the upper-carbon holder C, and the said carbon-holder C has a brass flange or rim, P, fixed at its upper end, so that when the brass flange or rim P comes into contact with the bent arm of the metal rod M, the weight of the carbon-holder C will cause the flange or rim P to give the bent arm of the metal rod a slight rotary movement. The bent arm *m* is, however, adjusted a little higher than the slot *n* in the U-piece, so that when the flange or rim P on the upper-carbon holder C comes into contact with the bent arm *m*, through the descent of said carbon-holder, it turns said arm until it comes opposite the said slot *n*, when the spring M′ draws the arm into the slot, and thereby gives

the metal rod M a longitudinal movement and brings its end M^2 into contact with the metal piece O.

It will be seen that the arc in the first pair of carbons is by this means cut out, and when the springs D D, or fluid or gaseous pressure, whichever are used, raise the upper-carbon holder C, the arc cannot be formed between the said carbon-holder C and the lower-carbon pencil, or vice versa, because the main current will then flow through the new circuit which has been formed by the cut-out device—viz., from the + binding-screw of the lamp through the brass casting and metal rod through the contact of the two metallic pieces, M^2 and O, to the second carbon-holder, C′, by means of the insulate slip Q of low resistance. Many other devices could be used for this purpose.

In a double carbon lamp, when the first pair of carbons are consumed, the cut-out device described can thus be used to switch the current from the first pair of carbons, C, to the second pair, C′.

This principle of regulation solely by means of a spring and a shunt-magnet or solenoid is applicable to the devices described in the specification of my Patent No. 255,521, dated March 28, 1882.

I do not claim in an electric-arc lamp an electro-magnet for drawing the arc in opposition to the action of a spring upon the lever-armature of said magnet. Neither do I claim a feed-regulating mechanism for electric-arc lamps consisting of an electro-magnet and a permanent magnet opposed in their action, the electro-magnet being in a shunt-circuit around the arc.

I do not claim the combination of a magnet in a shunt-circuit and a counterpoised armature-lever having a pawl pivoted to it and acting with a second counterpoised armature-lever carrying the carbon-holder as the means for regulating the feed of the upper carbon.

I claim as my invention—

1. In an electric-arc lamp, the combination of a tube holding the movable carbon, a clutch surrounding said carbon-tube, a pivoted lever-armature adapted to bear against said clutch, a spring to lift up the pivoted lever-armature to form the arc, and a shunt electro-magnet to attract the lever-armature in opposition to said spring and serving to regulate the arc, substantially as set forth.

2. In an electric-arc lamp, the cut-out device or switch consisting of projection P on carbon-holder C, in combination with the arm *m*, rod M, bracket N, having a slot, *n*, the spring M′, metallic piece M^2, insulated metallic piece O, and bar Q, connected with the carbon-holder C′ or the negative binding-screw of the lamp, substantially as described.

CHARLES LEVER.

Witnesses:

ARTHUR C. HALL,

ALBERT E. HALL,

U. S. Consulate, Manchester, England.