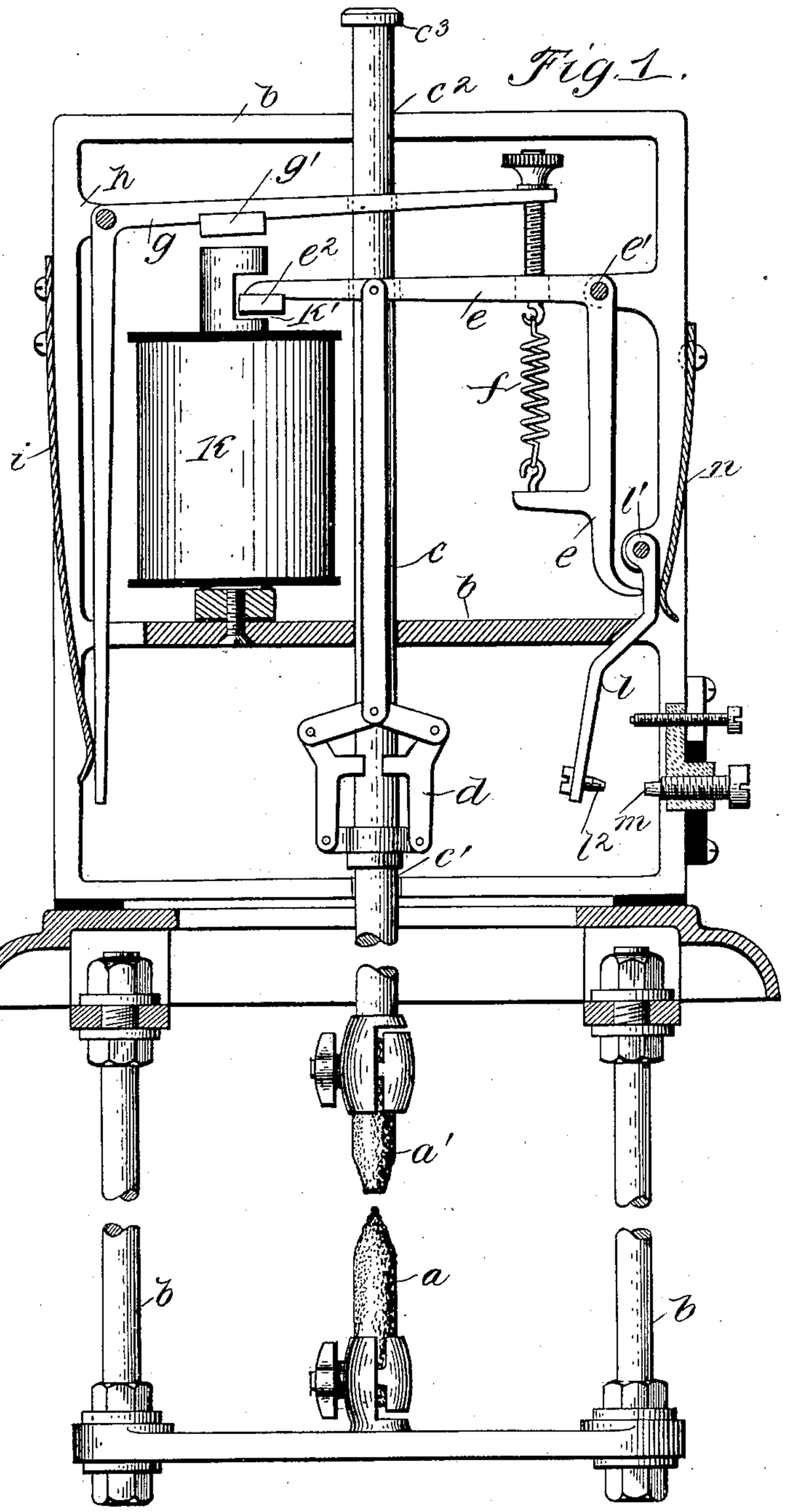
(No Model.) 2 Sheets—Sheet 1.

C. E. SCRIBNER.

ELECTRIC ARC LAMP.

No. 559,407. Patented May 5, 1896.

Fig. 1.



Witnesses:
Dr Wirt C. Sargent
W. Clyde Jones

Inventor:
Charles E. Scribner,
By Barton & Brown
Attorneys.

(No Model.) 2 Sheets—Sheet 2.

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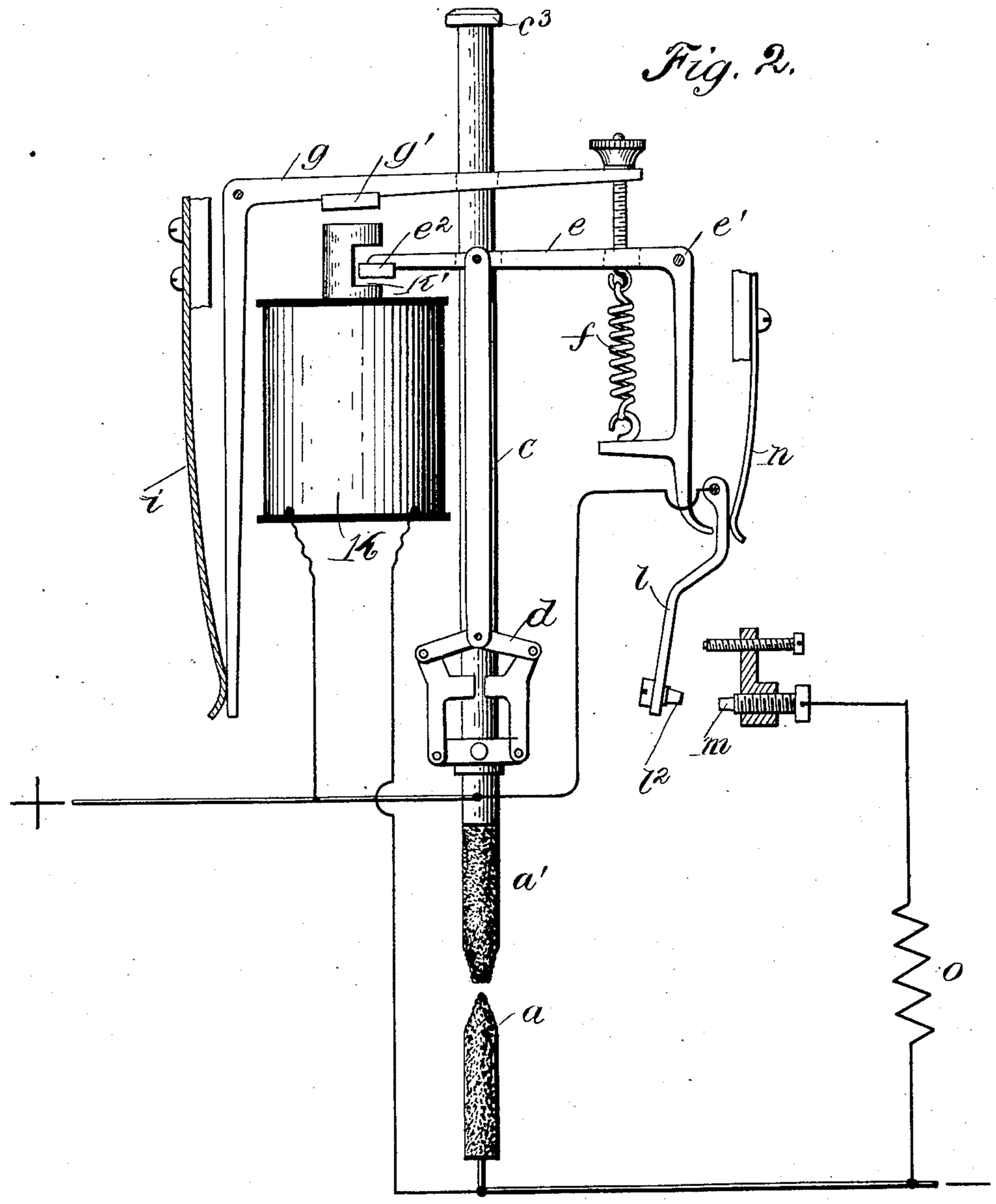
ELECTRIC ARC LAMP.

No. 559,407. Patented May 5, 1896.

Fig. 2.



Witnesses:
Dr Fitz E. Tanner.
W. Clyde Jones.

Inventor,
Charles E. Scribner,
By Parton & Brown
Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 559,407, dated May 5, 1896.

Application filed December 30, 1893. Serial No. 495,221. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Automatic Cut-Outs for Arc-Lamps, (Case No. 345,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to electric-arc lamps. Its object is to provide an automatic cut-out for such lamps adapted to be brought into operation by any abnormal increase of the resistance of the main circuit through the lamp-carbons.

My invention is especially applicable to arc-lamps of the type known as "open-circuit" lamps, in which the carbons are maintained in a separated relation during the idleness of the lamp and are brought together and subsequently separated to form the arc when current finds circuit through the lamp. In such a lamp it is necessary that the cut-out shall be brought into operation in the event of any failure of the mechanism to cause the initial contact of the carbons, as the sticking of the carbon-rod in its bearings or by an abnormal increase in the resistance of the arc, and the cut-out must remain in position to shunt the lamp during the persistence of the abnormal condition. It is further desirable that the carbon-rod shall be released from the clutch of the feeding mechanism during the closed condition of the cut-out, in order that the carbons may be permitted to come together as soon as they are free to do so to allow the lamp to resume its operation.

The essential elements of my improved cut-out consist in a normally open cut-out circuit, including some resistance in shunt of the carbons, an electromagnet also in shunt of the carbons, an armature for the electromagnet controlling the continuity of the cut-out circuit, the armature being normally out of range of its electromagnet, and mechanism actuated by the feeding-magnet of the lamp to bring the armature into the range of attraction of its magnet. When the feeding-magnet of the lamp is abnormally excited by the increased current shunted through it on account of the abnormal resistance between the carbons, it operates to force the cut-out armature into the field of attraction of its magnet, which thereupon attracts it and closes the cut-out circuit. A slight current continues to flow through this cut-out magnet, since it is in shunt of a small resistance in the cut-out circuit, which, coöperating with the residual magnetism of the electromagnet, is sufficient to retain the cut-out armature attracted and the cut-out circuit closed. In order that the carbon-rod may be free during this time, I may connect the feeding or clutch mechanism with this cut-out armature in such a manner that the carbon-rod is released from the clutch by the movement of the cut-out armature to its magnet, the feeding mechanism of the lamp being yieldingly connected with the clutch mechanism to permit this independent operation. It is obvious that the magnet which operates the cut-out and the feeding-magnet may be separate and distinct, but in practice I have preferred to use a single electromagnet for these purposes, this electromagnet being provided with two armatures working independently of each other.

My invention is illustrated in the accompanying drawings, and may be described with greater detail in connection with these illustrations.

Of the drawings, Figure 1 represents a side elevation of an arc-lamp equipped with my improved cut-out mechanism. Fig. 2 is a diagram showing the essential portions of the lamp and the circuit connections therewith.

One of the carbons *a* of the lamp is fixed in the usual manner in the bottom of the lamp-frame *b*. The other carbon *a'* is carried upon a longitudinally movable rod *c*, journaled in bearings in the upper portion of the lamp-frame *b*. The carbon-rod *c* moves through a clutch *d* of ordinary form, which is suspended by links from one arm of a bell-crank lever *e*, which is pivoted at its angle *e'* to a lug upon the lamp-frame *b*. This lever *e* constitutes the cut-out lever. It is connected through a spring *f* with the extremity of another bell-crank lever *g*, which is also pivoted at its angle to a lug *h* of the frame *b*. The other arm of the lever *g* is acted upon by a spring

i, whose force is thus transmitted through the lever *g* and the spring *f* to the lever *e*, moving the latter in a direction to lift the clutch *d* and the carbon-rod *c*. The lever *g* carries an armature *g'*, moving before the poles of an electromagnet *k*, which is constructed to have high resistance and is connected in shunt of the carbons *a a'*. This lever *g*, which thus controls the movable carbon through the medium of the spring *f*, lever *e*, and clutch *d*, I term the "feeding-lever." The cut-out lever *e* also carries an armature e^2, which moves in a recess cut in the poles of the magnet *k*. This recess is so formed that throughout the ordinary range of movement of armature e^2, under the influence of the feeding-lever *g*, it is not sensibly attracted either up or down, so that it does not affect the operation of feeding; but when permitted to fall sufficiently low it comes within the range of attraction of the lower polar surface, at *k'*, and moves toward it. The free arm of lever *e* is adapted to engage with a lever *l* near its fulcrum *l'*. This lever carries a contact-point l^2, adapted to register with a contact-anvil *m*. The contacts l^2 *m* are ordinarily maintained in separated relation by a light spring *n*, acting upon the lever *l*. The contacts l^2 *m* control the continuity of the cut-out circuit, the former being connected with the frame of the lamp and thus with the incoming main, and the latter with the outgoing main through a small resistance-coil *o*.

In the idle condition of the lamp, the feeding-magnet *k* being inert, the carbon-rod *c* is grasped by clutch *d* and is raised by the pressure of the spring *i*, as before observed. The armature e^2 is at such a distance from the polar surface *k'* of magnet *k* that it is not perceptibly attracted. The contact-points l^2 *m* are separated, thus opening the cut-out circuit. When now current is caused to traverse the lamp, magnet *k* is excited and attracts its armature *g'*, lowering the system of levers *g e* until the clutch *d* touches the floor or base of the lamp, and permits the carbon *a'* to descend into contact with carbon *a*. When these carbons touch, the magnet *k* is short-circuited and instantly loses its magnetism, permitting the system of levers *g e* to move toward their former position, thus causing the clutch to reëngage the carbon-rod and again lift carbon *a'*. The current through the carbons *a a'* persists and creates an arc between the carbon-points. The resistance of this arc being considerable, however, a portion of the current is caused to be shunted through the high-resistance feeding-magnet *k*, depending upon the length and resistance of the arc between the carbon, so that the levers *g e* are not permitted to return to their idle position, but are kept in a state of unstable equilibrium, in which the force of the spring *i* is balanced against the attraction of the magnet *k* for armature *g'*. As the carbons burn away and the resistance of the arc increases, magnet *k* becomes stronger and lowers the clutch *d* to reduce the length of the arc until finally the clutch touches the floor of the lamp and releases the carbon-rod. Then the operation is repeated as long as the carbons shall last. The recess in which the armature e^2 travels is so formed and of such size that the armature does not come sufficiently near the polar surface *k'* to be attracted during the normal range of vibration involved in the feeding of the carbons. When the descent of the carbon-rod is arrested by the stop c^3 coming against the lamp-frame, or by undue friction of the rod in its bearings, the magnet *k* continues to attract its armature *g'*, after the levers have been lowered sufficiently to cause the feeding of the carbons under normal conditions, until the armature e^2 is brought into the range of attraction of the polar surface *k'*. The armature e^2 then moves to this polar surface, the spring *f* yielding to permit its motion. The downward extension of lever *e* is thus brought against the lever *l*, and the latter is moved against the force of the spring *n*, closing the contact-points l^2 *m*, and thus completing the cut-out circuit about the lamp. The magnet *k* is thus largely demagnetized, but sufficient current continues to flow through it to hold the armature e^2 and maintain the shunt about the lamp. The feeding-armature *g'* is, however, released and allows the lever *g* to fall back. It will be observed that the clutch is still in its lowest position and that the carbon-rod is free as to the clutch, lever *e* being still drawn down. The spring *f* is constructed to have just sufficient tension to carry the weight of the clutch mechanism, but not sufficient to detach armature e^2 from magnet *k*. If now the carbon-rod becomes free from whatever obstacle has impeded its descent, it will bring the carbon *a'* again into contact with carbon *a*, whereby the magnet *k* will be short-circuited. Having then lost its entire magnetization it will release armature e^2, opening the cut-out circuit, and permitting the lamp to resume its operation.

Many modifications of my invention are possible without departing from its essential features, and I do not desire to be limited to the details of construction which I have shown and described; but

I claim as new and desire to secure by Letters Patent—

1. The combination with an electric-arc lamp, of a cut-out circuit about the lamp, a normally-energized electromagnet, an armature for said electromagnet controlling the continuity of the cut-out circuit, said armature being normally so far distant from the electromagnet as to be unattracted thereto, and mechanism actuated by the feeding-lever of the lamp to bring the said armature into range of its electromagnet under the influence of an abnormal resistance in the main circuit, substantially as described.

2. The combination with an electric-arc lamp, of a cut-out circuit including resist-

ance, a normally-energized electromagnet in shunt of the carbons, an armature for said electromagnet, controlling the continuity of the cut-out circuit, said armature being normally out of the range of attraction of its electromagnet, and mechanism controlled by the feeding-magnet of the lamp to cause or permit the said armature to be brought within the range of attraction of its electromagnet when the feeding-magnet is abnormally energized, substantially as described.

3. The combination with an open-circuit electric-arc lamp, of a cut-out circuit therefor, an electromagnet in shunt of the carbons, an armature therefor controlling the continuity of the cut-out circuit, clutch mechanism connected with and controlled by the said armature, a feeding-armature controlled by an electromagnet in shunt of the carbons, and a yielding connection between said feeding-armature and the cut-out armature, said feeding-armature being adapted when unduly attracted to bring the cut-out armature within range of its electromagnet, substantially as described.

4. The combination in an open-circuit arc-lamp, of a feeding-magnet and the feeding-armature thereof, an auxiliary cut-out armature for the same electromagnet, normally out of the range of attraction of the electromagnet, clutch mechanism directly connected with the cut-out armature, a cut-out circuit controlled by the cut-out armature, a yielding connection between the cut-out armature and the feeding-armature, and a spring adapted to maintain the carbons normally separated, through the medium of the feeding-lever and the said yielding connection, substantially as described.

5. The combination in an electric-arc lamp, of an electromagnet in shunt of the carbons, an armature normally out of range of attraction thereof controlling the continuity of the cut-out circuit, clutch mechanism suspended from said armature, a feeding-armature controlled by an electromagnet in shunt of the arc, the cut-out armature being adapted to be brought into the range of the attraction of its electromagnet when the feeding-armature is abnormally attracted, and a yielding connection between the said armatures of such tension as to carry the weight of the clutch mechanism and the movable carbon, but not sufficient to resist the attraction between the cut-out armature and its magnet, substantially as described.

In witness whereof I hereunto subscribe my name this 18th day of December, A. D. 1893.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,

LUCILE RUSSELL.