No. 678,066.

Patented July 9, 1901.

E. THOMSON.

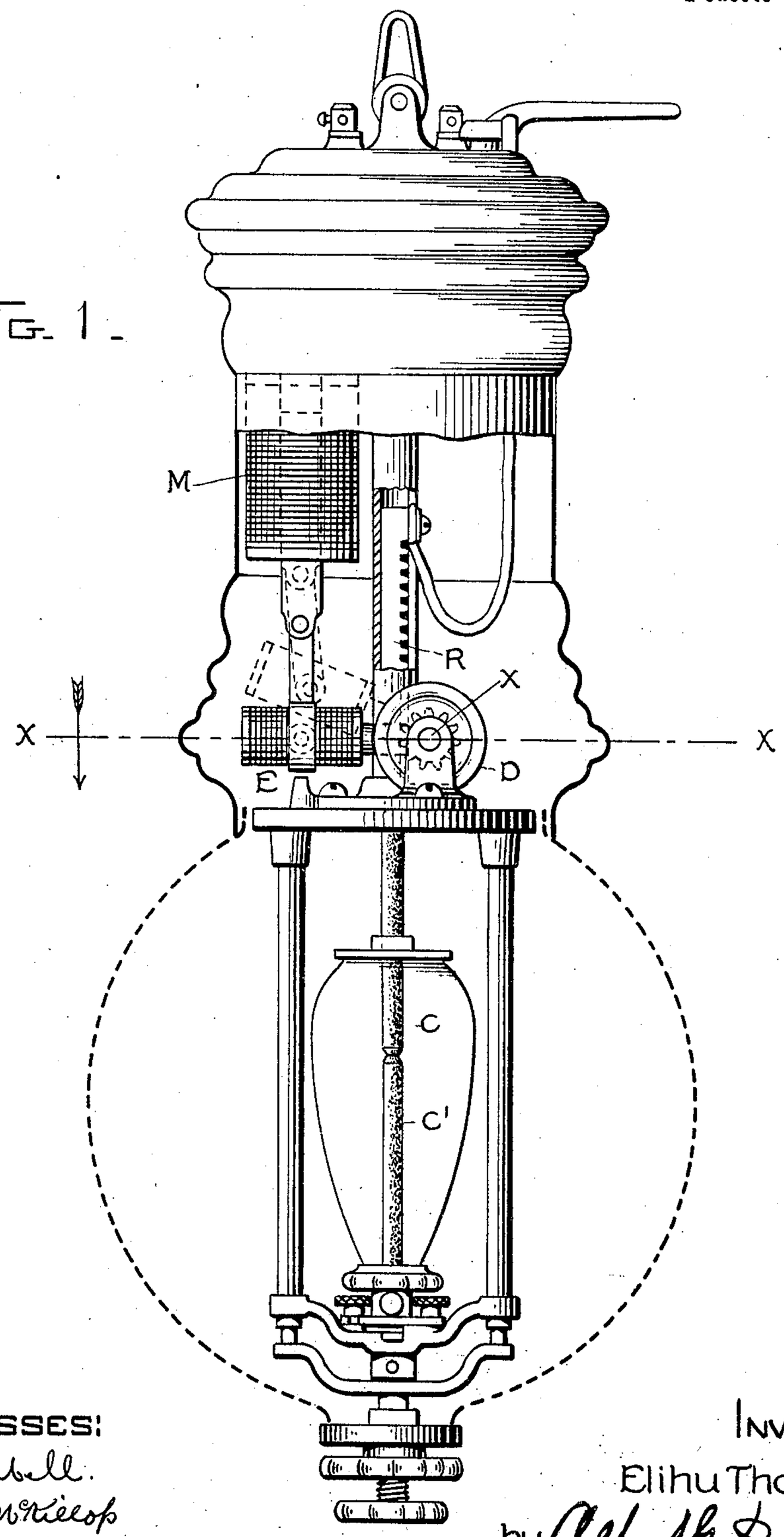
ELECTRIC ARC LAMP.

(Application filed Dec. 26, 1899.)

(No Model.)

2 Sheets—Sheet 1.

FIG. 1.



WITNESSES:
Robin Abell.
Dugald McKillop

INVENTOR:
Elihu Thomson.
by Albert G. Davis
ATTY.

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FIG. 2.

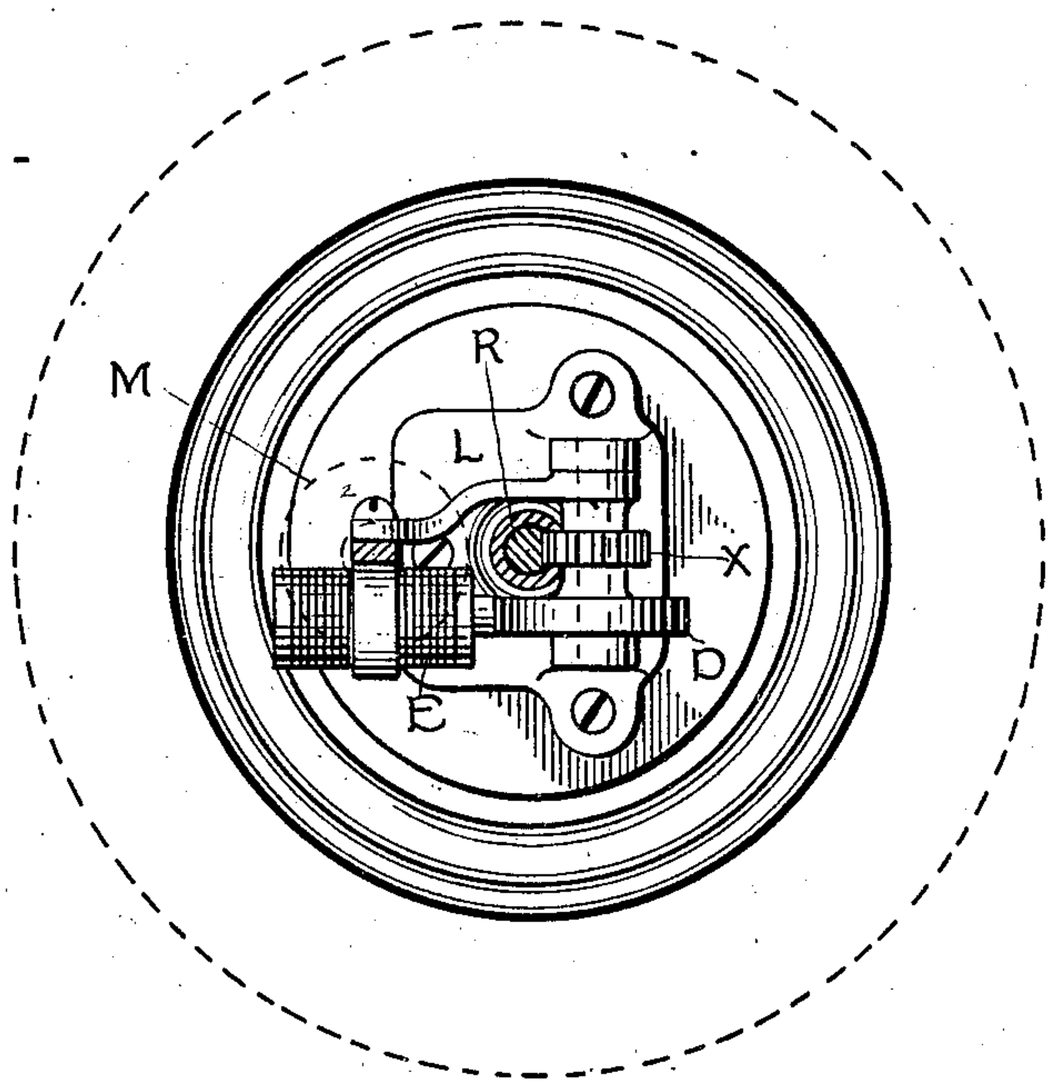

FIG. 3.

WITNESSES:
Rollin Abell.
Dugald McKillop

INVENTOR:
Elihu Thomson
by Albert G. Davis
ATTY.

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 678,066, dated July 9, 1901.

Application filed December 26, 1899. Serial No. 741,543. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Arc-Lamps, (Case No. 1,475,) of which the following is a specification.

The present invention relates to electric-arc lamps, the object being to effect a sensitive and quickly-responsive carbon-feed by an organization of simple and cheap construction.

In arc-lamps as usually constructed the feed of the movable carbon is regulated by the operation of a clutch, one or more movable parts of which are acted upon by a regulating-magnet to mechanically engage or disengage the clutching-faces and release or grip the movable carbon or its carrier. In devices of this kind the inertia of the moving parts between the clutch and the regulating-magnet and the range of motion necessary to permit mechanical engagement or disengagement with the carbon-carrier reduce the sensitiveness of the feed and permit a longer feed of the carbon than is desirable.

By the organization embodied in my present invention I provide a clutch which acts instantly to arrest or release the movable carbon at the required moment, the engaging parts which establish or release the disengagement being in a practically uniform relation at all times and clutching or unclutching by the establishment of a magnetic field around the engaging parts which is under the control of the arc. Thus the device is practically free from all defects arising from sluggish control due to inertia of masses of metal, and the feed is effected or arrested at perfectly definite limits, which may be made as narrow as desired and which conduce to the maintenance of a very steady arc.

In the present embodiment of my invention I have shown it as applied to a rack-feed lamp; but it will be obvious to those familiar with the construction of arc-lamps that it may be applied to any clutch-controlled lamp. An effective organization consists of an iron armature controlling the movement of the movable electrode, in close relation to which is a magnetic pole the strength of which may be varied to lock the armature or to permit it to slip in accordance with the variations of arc length. The arc may be sprung in any suitable manner; but I find it convenient to mount one element of the clutch in a support controlled by an auxiliary electromagnet under the influence of the lamp-current. Thus the lamp is started into action by springing the arc under the influence of the auxiliary electromagnet and establishing a periodical feed by the variations of magnetic strength in the parts of the gripping-clutch.

The invention comprises, in addition to the features just pointed out, other more specific features, which will be hereinafter more fully disclosed and which will be definitely indicated in the claims appended to this specification.

In the accompanying drawings, which illustrate the invention, Figure 1 is a side elevation, part of the casing of the regulating mechanism being removed, of an arc-lamp embodying my improvements. Fig. 2 is a horizontal section on a plane indicated by the line X X of Fig. 1 looking in the direction indicated by the arrow, and Fig. 3 is a diagram of the controlling-circuits.

In the drawings, M represents an arc-springing magnet or solenoid, the movable core of which is adapted to raise the movable carbon and establish an arc in the usual manner and may therefore be provided with the usual shunt and series windings. Connected with the movable core of the magnet M is the clutch, which constitutes the main feature of my present invention. This may be variously designed to permit its application to various types of lamps; but the essential feature common to all is the substantially constant relation of the clutch jaws or members, dispensing with the necessity of a considerable range of movement and the overcoming of inertia of moving parts in order to establish a gripping or releasing relation.

In the design of lamp shown in the drawings the movable carbon is connected to a rack R, coöperating with a pinion X, to the axis of which is secured an iron disk or a disk

shod with an iron periphery, in close relation or light contact with which is the pole-piece of an electromagnet E. An intervening septum of diamagnetic material, such as brass, should be employed in order to prevent sticking of the parts upon the disestablishment of the magnetic field. The magnet E or its controlling-coils are included in a circuit affected inversely by fluctuations of resistance in the arc—that is to say, the conditions are such that the magnetic field between the pole-piece of the magnet E and a movable clutch-shoe—say the wheel D—weakens when the arc increases above a determinate length and may actually be destroyed at a maximum length, thus permitting the carbon to slip and shorten the arc. In order to keep the coöperating pole-faces of the two members of the clutch in fixed relation, I pivot the magnet E upon the axis of the pinion X. By the term "fixed relation" I mean that there is no substantial relative movement. There is, in fact, a very slight movement, which is easily accommodated by the clearance of the journal. Just enough is desired to permit the grip on the wheel D to be firm or light. The magnet is connected by a link with the armature or core of the arc-springing magnet M. The lower limit of movement of the magnet E is controlled by a stop mounted on the floor of the lamp. I prefer to provide the clutch-magnet with a differential winding, one coil of which is in series with the arc and the other in a shunt around the arc, and the arc-springing electromagnet M may be similarly wound. These circuits are clearly indicated in Fig. 3, and as such windings are well known in the art they require no further description.

As thus organized the lamp operates as follows: Assuming that the carbons C C′ are in contact at the start and no current passing, the electromagnet E will not be drawn against the disk D. All the parts will therefore be free to move relatively. If now current be passed, the series winding of the electromagnets M and E is excited and the disk D locked against rotation by engagement with and pressure against the pole-face of magnet E. This relation is maintained until the derived circuit-winding checks further lifting. The shunt-winding on magnet E should have such relation to the series winding that at this time it will not sufficiently counterbalance the effect of the latter to cause release of the clutch. When the arc elongates by the burning of the carbons, the magnet M lowers the magnet E and the latter becomes weakened by the increasing effect of the shunt-coil, and in some cases the decreasing effect of the series coil, until at last the effect of the former is sufficient to permit the disk D to escape or slip over the pole-face, causing a feed of the movable carbon. The moment, however, the carbons are fed to the desired extent and before any of the mechanism can recover mechanically the instantaneous decrease of the resistance of the arc and the increasing value of the series winding restores the magnetic effect of the clutch, so that it grips and stops the motion of the disk. Thus the arrest or release of the movable carbon is instantaneous, a result impossible with a mechanically-released device, where time is consumed in overcoming the inertia of the moving parts. It will be evident that there is no loss due to such a cause in my present organization, since the parts of the clutch are at all times in a condition responsive to the weakening or strengthening of the magnetic field. I prefer to render the magnet M sluggish, which may be cheaply and effectively accomplished by surrounding its core with a band or circuit of copper or other conductor S. It may also be checked in the usual manner against jumping or sudden fluctuations of movement by dash-pots. I have not deemed it necessary to show the latter, as they are of common adoption in the art.

It will of course be understood that while I have shown an organization in which the magnet E is bodily under the control of the arc-springing magnet M, I do so merely for convenience in the type of lamp shown in the drawings. It will, however, be understood from what has hereinbefore been said that the improved clutch might be used independently as a simple means of feed control and the arc established in other ways. It is desirable that the magnetically-controlled elements of the clutch should form part of an open magnetic circuit, since such an organization is quick to magnetize and demagnetize. Instead of a single-pole magnet, as shown, however, one of the horseshoe or multipolar type may be employed.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A clutch for an arc-lamp having a magnetizable clutch member controlling the movable carbon, means controlled by the arc for varying the magnetization of said member to vary the clutch-grip, and thereby to regulate the feed, and an independent lifting-magnet to strike the arc.

2. A clutch for an arc-lamp having its engaging clutch-faces in uniform relation, a feed-regulating circuit varying in current strength under arc fluctuations, means for generating a field of force between the clutch-faces governed by the current to vary the clutch-grip and thereby regulate the feed, and an independent lifting-magnet.

3. A clutch for an arc-lamp having engaging faces of magnetic material in constant gripping relation and forming an open magnetic circuit for rapid magnetization and demagnetization, connections for establishing a magnetic field when the arc is struck, a demagnetizing-circuit controlled by the arc length and an independent lifting-magnet for striking the arc.

4. A clutch for an arc-lamp having engaging faces of magnetic material in constant gripping relation and forming an open mag-

netic circuit for rapid magnetization and demagnetization, an electromagnetic winding for effecting feed of the movable carbon-containing coils in shunt and series relation to the arc and an independent lifting-magnet for striking the arc.

5. A clutch for an arc-lamp comprising an electromagnet containing a coil in series with the arc, mechanically engaging an armature movable with the carbon when feeding, a demagnetizing-circuit for said magnet controlled by the arc at a determinate length to permit feed without arc rupture, and an independent lifting-magnet for striking the arc.

6. An arc-lamp having a rack-feed, an armature geared to the rack, a feed-regulating magnet to which the armature presents a continuous face and by whose field of force it is attracted, said magnet containing a winding demagnetized when the arc attains a determinate length and an independent lifting-magnet for striking the arc.

7. An arc-lamp having a rack-feed, an armature having an unbroken face geared to the rack, a feed-regulating magnet engaging the armature forming a quick-acting magnet, a magnetizing-circuit for said magnet controlled by the arc length to reduce the force of engagement as the arc lengthens and an independent sluggish lifting-magnet for striking the arc.

8. An arc-lamp having a rack-feed, an armature geared to the rack, a feed-regulating coil establishing a magnetic field between the armature and a pole engaging the same, said armature and pole forming a quick-acting magnetic system, connections for demagnetizing the coil when the arc attains a determinate length and an independent sluggish arc-striking magnet.

9. An arc-lamp comprising a sluggish arc-striking magnet, and an independent feed-regulating magnet having its pole in frictional engagement with a movable armature connected to the movable carbon, said feed-regulating magnet forming a quick-acting magnetic system, and a demagnetizing-coil on the magnet destroying its field when the arc attains a determinate length.

10. An arc-lamp having a rack-feed, a disk-armature geared to the rack, a lifting-magnet for the rack, an independent quick-acting electromagnet having a pole-piece engaging the armature, and a demagnetizing-coil for the magnet controlled by the arc.

11. An arc-lamp having a rack-feed, a disk-armature geared to the rack, a crank on an arbor of the gearing, a lifting-magnet connected thereto, an independent quick-acting electromagnet having a pole-piece engaging the disk armature, and coils therefor in shunt and series relation to the arc.

12. An arc-lamp having a sluggish lifting-coil and a magnetic clutch, comprising an independent quick-acting magnet, an iron armature movable with the carbon engaged by the magnet, and a demagnetizing-coil for the latter magnet controlled by the arc.

In witness whereof I have hereunto set my hand this 22d day of December, 1899.

ELIHU THOMSON.

Witnesses:
DUGALD MCKILLOP,
HENRY O. WESTENDARP.