(No Model.) 2 Sheets—Sheet 1.

# W. B. LUCE.

## ELECTRIC ARC LAMP.

No. 474,091. Patented May 3, 1892.

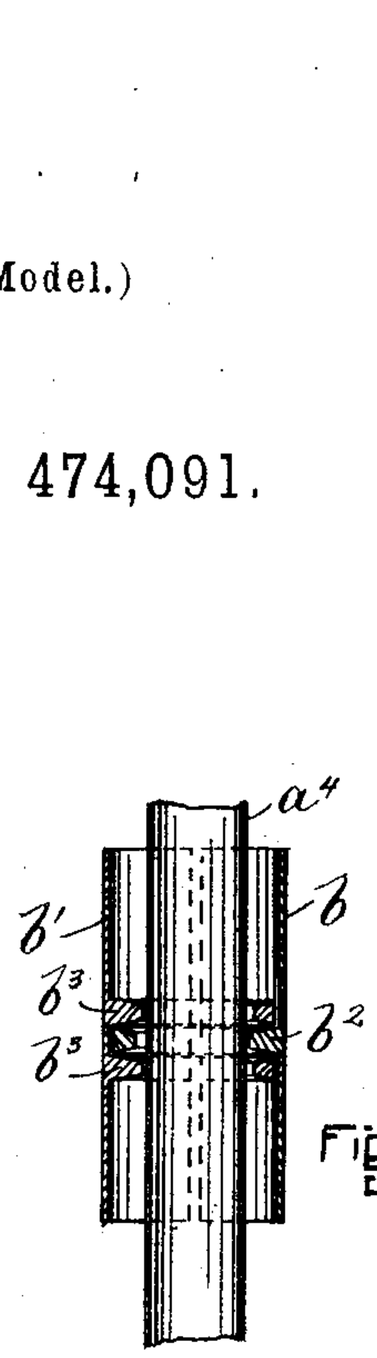


Fig. 4.

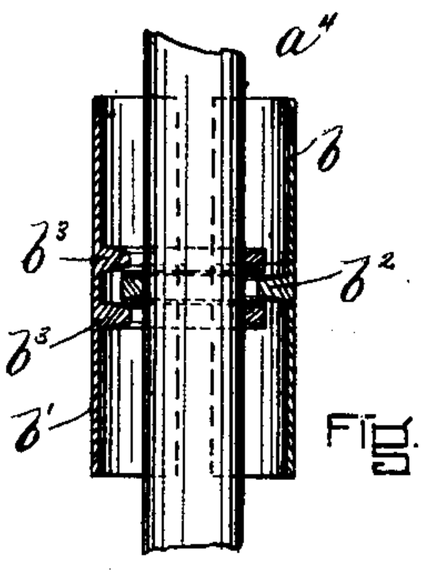


Fig. 5.




Fig. 6

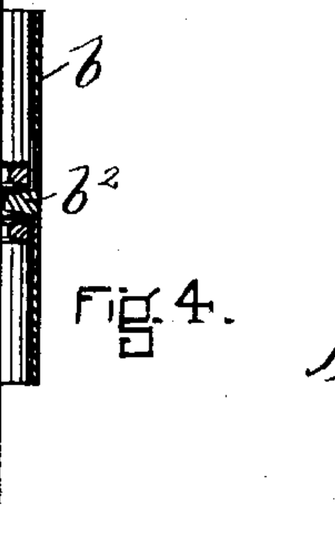


Fig. 7

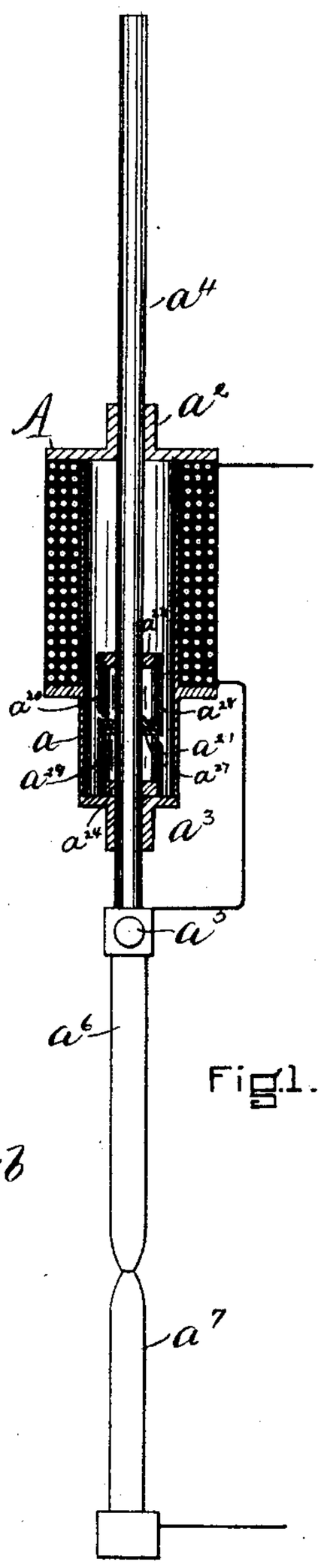


Fig. 1.

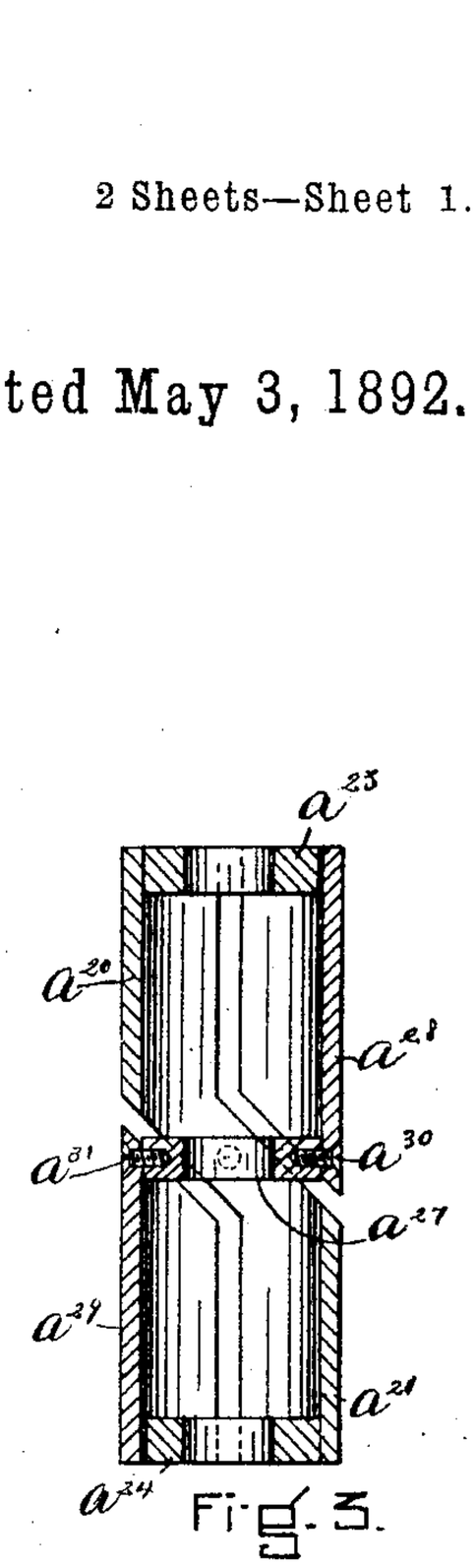


Fig. 3.

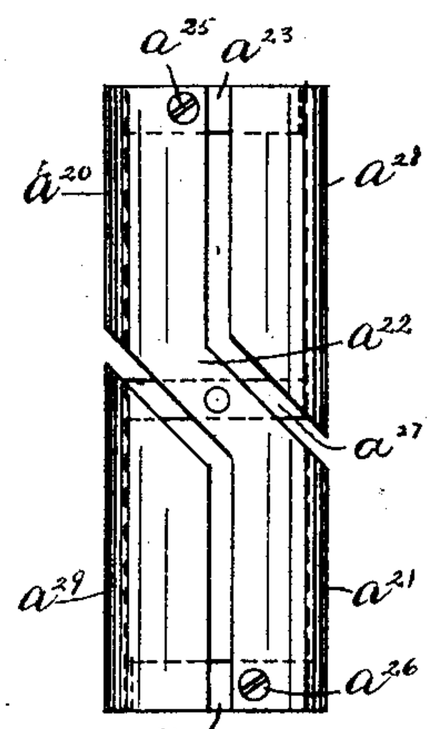


Fig. 2.

WITNESSES.
A. D. Harrison.
B. G. Underwood.

INVENTOR.
W. B. Luce
by Wright Brown Quinby
Attys.

(No Model.) 2 Sheets—Sheet 2.

# W. B. LUCE.

## ELECTRIC ARC LAMP.

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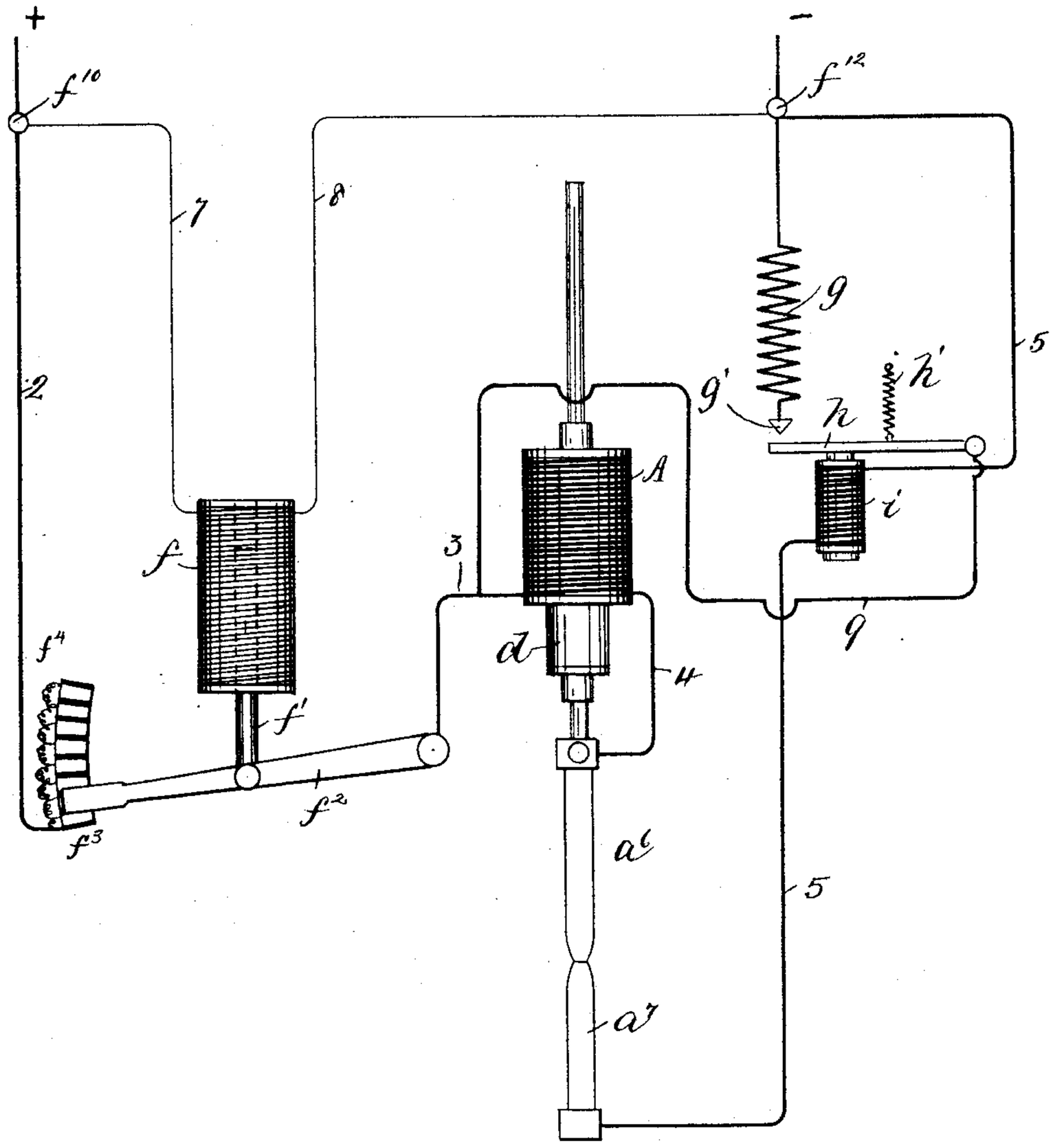


Fig. 2.

WITNESSES.
A. D. Harrison.
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INVENTOR.
W. B. Luce
by Wright Brown Quinby & Otts.
Attys.

# UNITED STATES PATENT OFFICE.

WILLIAM B. LUCE, OF BROOKLINE, MASSACHUSETTS.

## ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 474,091, dated May 3, 1892.

Application filed August 8, 1891. Serial No. 402,080. (No model.)

*To all whom it may concern.*

Be it known that I, WILLIAM B. LUCE, of Brookline, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

This invention relates to electric-arc lamps, and has for its object to improve and simplify the construction of the same. In electric-arc lamps as now commonly constructed and known to me two magnets are employed, one serving to lift the movable carbon to establish the arc and the other serving to control the action of a clutch mechanism by which one carbon, usually the positive carbon, is fed toward the other or negative carbon when the arc between the carbons becomes of abnormal size or length.

My invention has for its object to provide an electric-arc lamp in which a single magnet serves the double purpose of a lifting-magnet and a feed-magnet, and I accomplish my object by means of a solenoid provided with a magnetic core, having secured to or forming part of it a clutch, preferably constructed as will be described.

The particular features of the invention will be pointed out in the claims at the end of this specification.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents in section and elevation a sufficient portion of of the arc lamp embodying my invention to enable it to be understood. Fig. 2 is an elevation of a detail showing the clutch shown in Fig. 1 in its normal or inoperative position. Fig. 3 represents a longitudinal section of the clutch shown in Fig. 2. Figs. 4 and 5 represent details in section of a modified form of clutch. Figs. 6 and 7 represent details hereinafter referred to. Fig. 8 represents a diagrammatic view of the lamp, a regulator, and a cut-out therefor.

Referring to Fig. 1, a solenoid A of any well-known or usual construction is shown as provided with a tubular extension $a$. The solenoid A is provided at its opposite ends with suitable guides $a^2$ $a^3$, through which is extended the usual carbon-holding tube $a^4$, having secured to it, as by set-screw $a^5$, one carbon electrode or pencil $a^6$, which may be the positive carbon, and which co-operates with the negative-carbon electrode or pencil $a^7$, secured in the lamp in any usual or well-known manner.

The solenoid A is provided with a magnetic core, which may be made in the form shown in Figs. 1, 2, and 3, or as shown in Figs. 3 to 7. Referring to Figs. 2 and 3, the magnetic core is made tubular in form, and consists of an upper semi-cylindrical portion $a^{20}$, lower semi-cylindrical portion $a^{21}$, cross or connecting pieces or portions $a^{22}$, rings $a^{23}$ $a^{24}$, rigidly fastened, as by screws $a^{25}$ $a^{26}$, to the said upper and lower portions, a movable ring $a^{27}$, pivoted to the cross-pieces $a^{22}$, and an upper piece $a^{28}$ and lower piece $a^{29}$, fastened to the movable ring as by screws $a^{30}$ $a^{31}$.

In practice, the carbon-holding rod $a^4$ is extended through the rings $a^{23}$ $a^{24}$ $a^{27}$, and when the current is cut off from the lamp the said rings are in line with each other and occupy the normal position shown in Figs. 1, 2, and 3, the said rings at such time loosely encircling the carbon-holder $a^4$.

When the current is supplied to the lamp, the solenoid A attracts the magnetic core within it, and the parts or portions $a^{28}$ $a^{29}$ of the magnetic core, being pivotally connected through the ring $a^{27}$, are free to move under magnetic influence toward the walls of the solenoid, thereby turning the ring $a^{27}$ on its pivot and causing the carbon-holding tube $a^4$ to be forced against the diametrically-opposite side of the cutch-rings $a^{23}$ $a^{24}$ and thus securely clamp it (the said tube) to the magnetic core, so that as the magnetic core is moved within its solenoid the carbon $a^6$ is drawn away from the carbon $a^7$ and the arc established. The current passing through the solenoid A acts to polarize the parts $a^{20}$ $a^{28}$ $a^{21}$ $a^{29}$ of the core, and like poles in the two parts being adjacent the parts are repelled, which action moves the parts $a^{28}$ $a^{29}$ in opposite directions.

The magnetic core is drawn up within its solenoid until the strength of the current passing through the solenoid is diminished by the formation of the arc to such extent as to attract the said magnetic core with less force, thus maintaining the arc between the carbons at the desired or normal size or length.

As the arc between the carbons becomes ab-

normal by the consumption of the same, the strength of the current passing through the lamp is diminished by the resistance interposed in the line by the abnormal arc and the weight of the carbon and its holder overcomes the attractive force of the solenoid for its magnetic core, and the force with which the carbon-holder is gripped by the clutch-rings is weakened sufficiently to permit the carbon $a^6$ to feed toward the negative carbon $a^7$ and restore the arc to its normal size or length. It will thus be seen that the feed of the carbon $a^6$ toward its co-operating carbon $a^7$ is controlled by the strength of the current passing through the solenoid A, and in practice the magnetic clutch is so sensitive to the strength of the current that the carbon $a^6$ is almost continuously being fed toward its lower carbon $a^7$, and as a result the arc between the carbons is maintained at a substantially constant size, thereby giving a steadier and more brilliant light.

I may prefer to employ a magnetic core constructed as shown in Figs. 1, 2, and 3; but I do not desire to limit myself in this respect, as the said magnetic core and clutch may be made in other forms—for instance, as shown in Figs. 4 to 7, inclusive, wherein the magnetic core is shown as composed of two semi-cylindrical pieces or shells $b$ $b'$, having secured to or forming part of them clutch-rings $b^2$ $b^3$. Two rings $b^3$ are shown as secured to the shell $b'$ and one ring $b^2$ to the shell $b$, the ring $b^2$ being extended between the rings when in operative position.

Fig. 4 shows the magnetic core and clutch in the normal position, and Fig. 5 shows the said core and clutch in operative position.

My improved lamp may be provided with any usual or well-known form of regulator and cut-out. The regulator, as represented in Fig. 8, consists of a high-resistance solenoid $f$, having its core $f'$ attached to a lever $f^2$, forming part of the main circuit through the lamp, the said lever being connected by wire 3 to the solenoid A, the other wire 4 of the solenoid being joined to the positive electrode $a^6$. The lever $f'$ co-operates with a series of contacts $f^3$, to which resistances $f^4$ are connected, the main-line wire 2 being joined to the lowest contact-plate $f^3$, as herein shown. The lamp is provided with the usual binding-posts, (represented by $f^{10}$ $f^{12}$,) and the wires 7 8 of this high-resistance magnet or solenoid $f$ are connected to the said binding-posts. The negative carbon $a^7$ is connected by wire 5 to the negative binding-post $f^{12}$, and the said wire includes in it a cut-out magnet $i$, controlling a normally-open shunt for the solenoid A, the said magnet having an armature $h$, connected by wire 9 to the wire 3, and co-operating with a contact or terminal $g'$, to which is connected one end of a resistance $g'$, having its other end connected to the negative binding-post $f^{12}$.

When the lamp is in operation, the magnet $i$ attracts its armature $h$ and opens the shunt containing the resistance $g$; but if the lamp should become inoperative, as by reason of a broken carbon, the spring $h'$ would withdraw the said armature into contact with the terminal $g'$ and close the shunt-circuit around the solenoid A. The current coming in over the wire to the binding-post $f^{10}$ flows over the wire 2, through one of the contact-pieces $f^2$, arm $f'$, wire 3, to the solenoid A, thence by wire 4 to the carbon $a^6$, thence to the carbon $a^7$, wire 5, through the magnet $i$, and to the negative post $f^{12}$, and out over the line-wire. A derived current, acting through the solenoid $f$ on the regulator-arm $f'$, regulates the current passing through said arm to the lamp in the usual well-known manner.

The frame-work of the lamp is not herein shown, as it forms no part of my invention, and it may be of any desired or usual construction.

I claim—

1. In an electric-arc lamp, the combination, with a movable carbon, of a solenoid and a magnetic core composed of two or more parts, and a clutch consisting of clamping-rings secured to said parts and embracing the movable carbon, the said clamping-rings normally encircling the said carbon loosely and acting upon opposite sides of the said carbon to grip the same when the magnetic core is attracted by the solenoid, substantially as described.

2. In an electric-arc lamp, the combination, with a movable carbon, of a solenoid, a magnetic core composed of two semi-cylindrical parts or halves, and one or more clamping-rings secured to the inner side of each of the said parts or halves, and through which the movable carbon is extended, substantially as described.

3. In an electric-arc lamp, the combination, with a movable carbon, of a solenoid, a magnetic core composed of two semi-cylindrical parts $a^{20}$ $a^{21}$ and cross-piece $a^{22}$, clamping-rings $a^{23}$ $a^{24}$, attached to the said parts, a clamping-ring $a^{27}$, pivoted to the cross-piece $a^{22}$, and pieces $a^{28}$ $a^{29}$, attached to said pivoted ring, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 5th day of August, A. D. 1891.

WILLIAM B. LUCE.

Witnesses:
C. F. BROWN,
EWING W. HAMLEN.