(No Model.) 3 Sheets—Sheet 1.

# J. J. WOOD.

## ELECTRIC ARC LAMP.

No. 515,850. Patented Mar. 6, 1894.

FIG. 2.

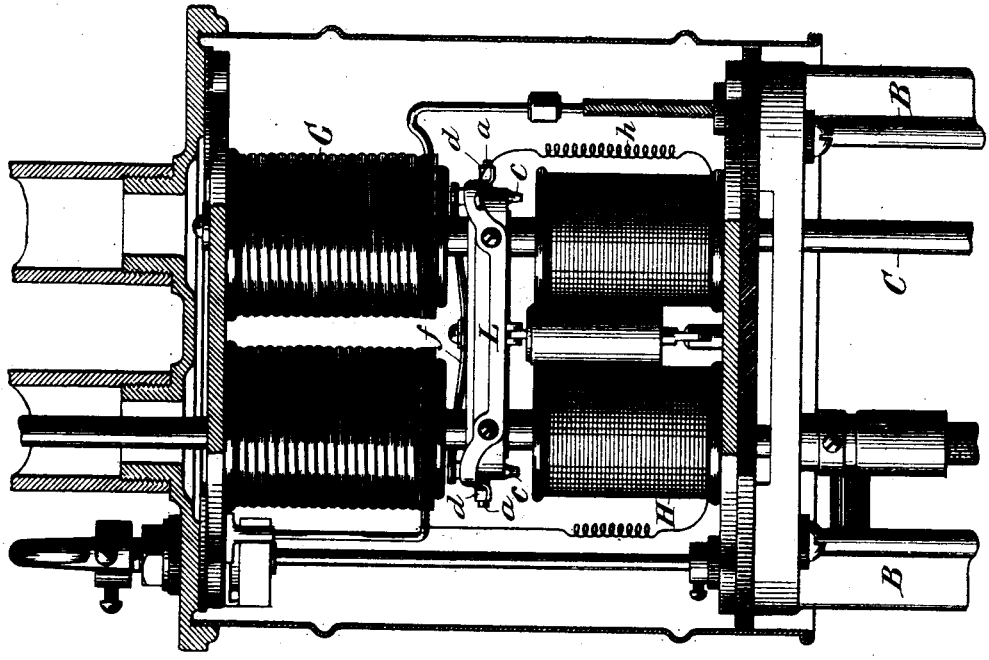
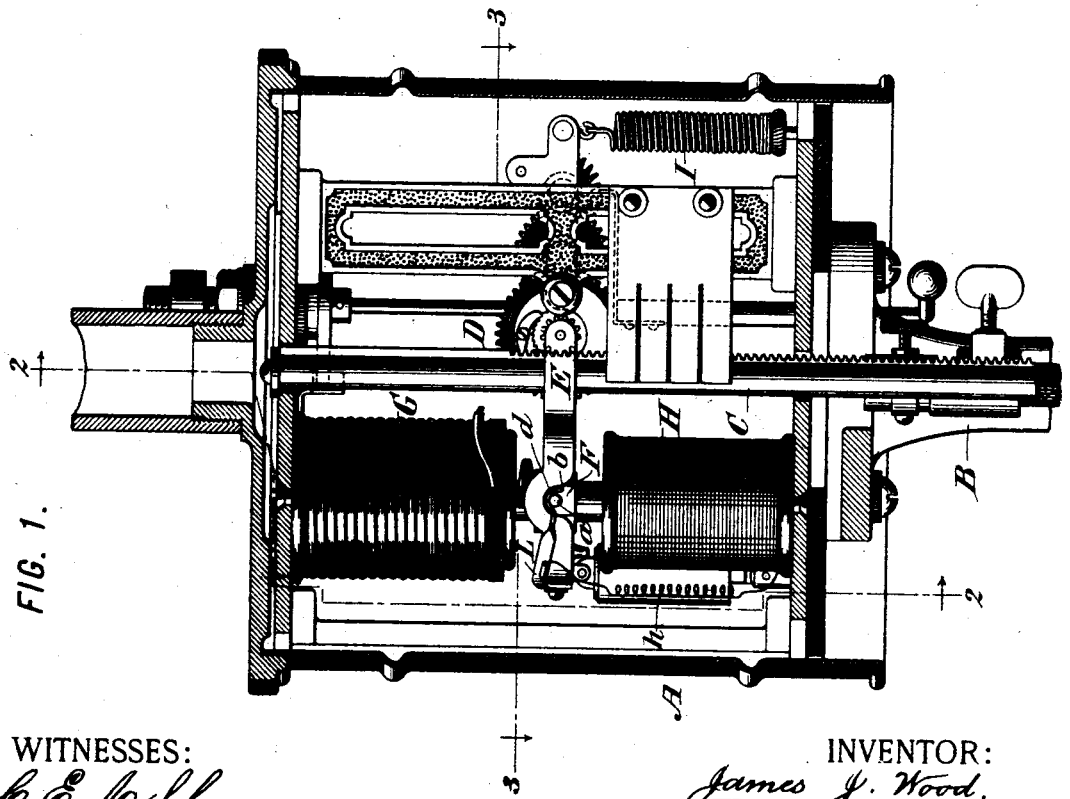



FIG. 1.

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(No Model.) 3 Sheets—Sheet 2.

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FIG. 7.

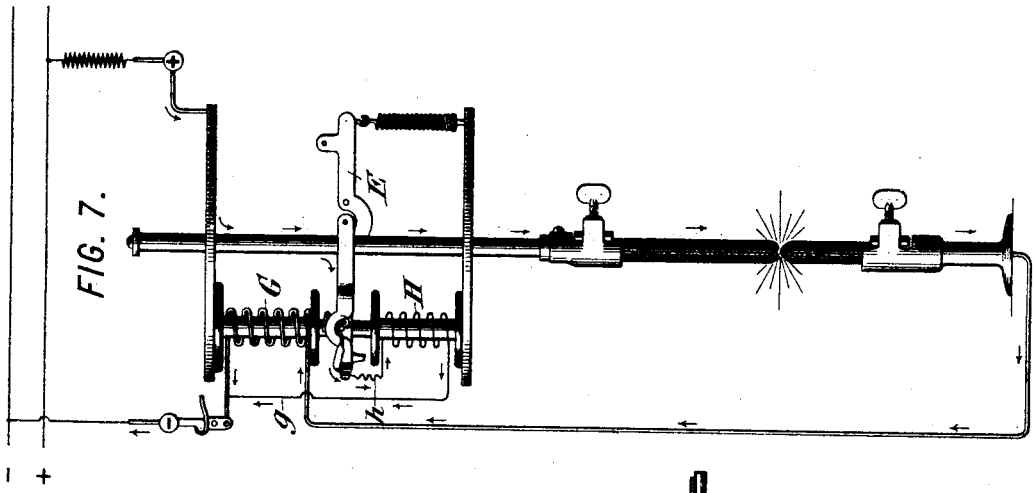



FIG. 5.

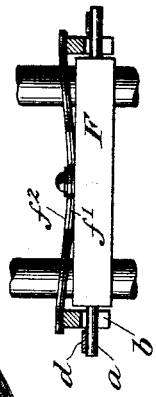



FIG. 6.

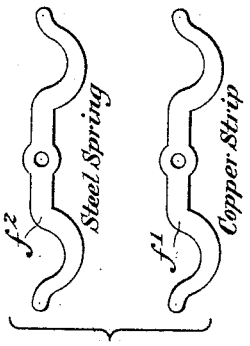



FIG. 3.

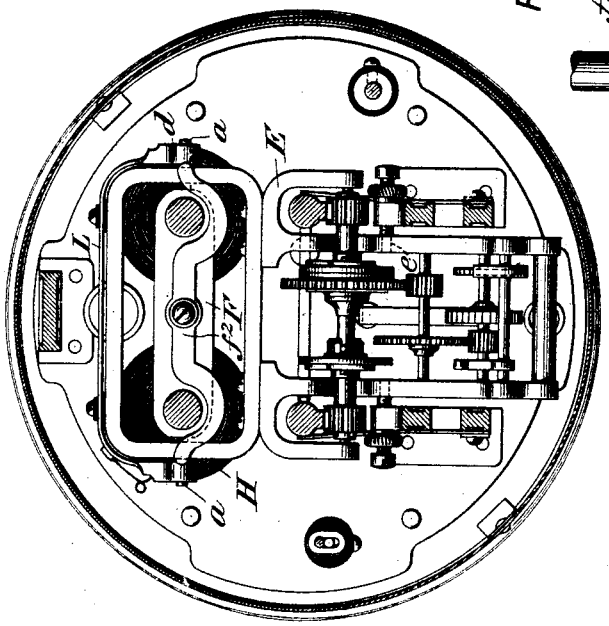
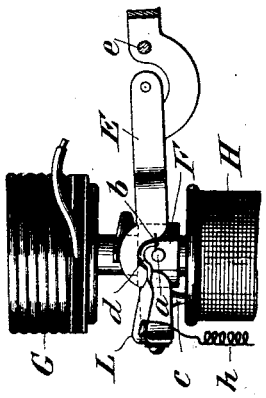



FIG. 4.

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(No Model.) 3 Sheets—Sheet 3.

# J. J. WOOD.

## ELECTRIC ARC LAMP.

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FIG. 9.

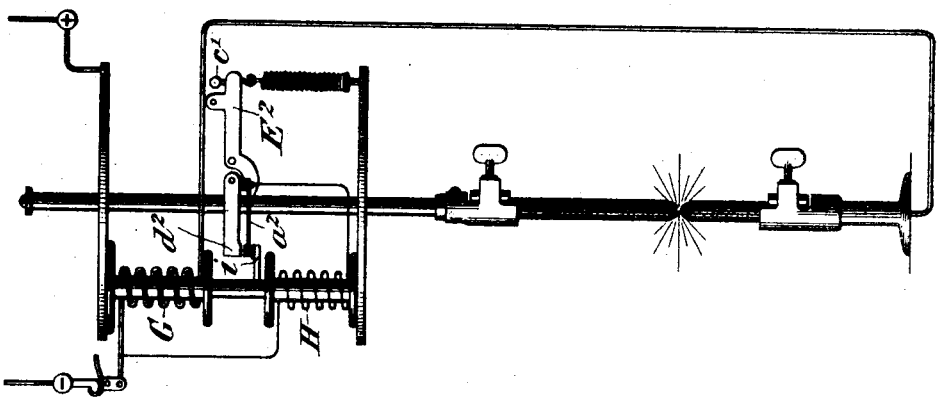
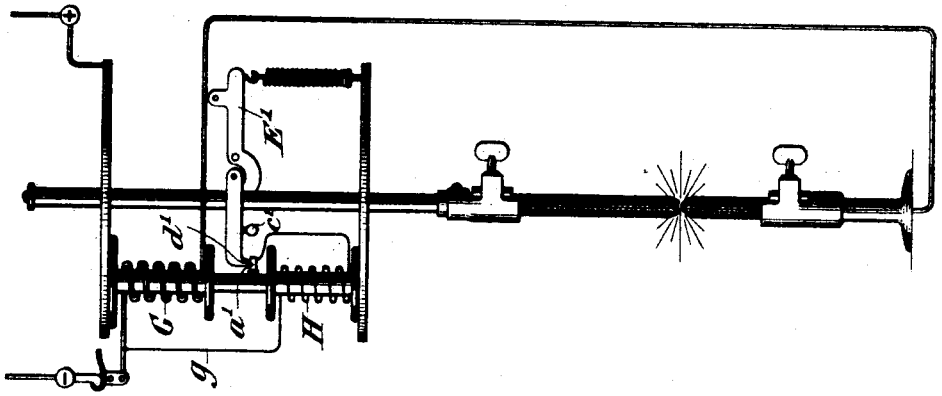



FIG. 8.

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# UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA.

## ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 515,850, dated March 6, 1894.

Application filed June 7, 1893. Serial No. 476,854. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

This invention relates to arc lamps for use on constant potential circuits carrying direct currents.

Arc lamps have been most commonly used on direct current high tension circuits wherein the lamps are installed in series and the current or number of ampères remains uniform, while the electro-motive force or number of volts is varied at the dynamo in direct proportion (aside from the line resistance) to the number of lamps in circuit. In lamps to be operated on this system the shunt magnet remains constantly in circuit between the terminals of the lamp, and in case of any failure of the lamp to operate whereby the main circuit through it would be broken, the lamp mechanism acts to throw into circuit a resistance shunt between the lamp terminals, by which the current is carried and the breaking of the circuit or the burning out of the lamp mechanism is avoided.

In arc lamps to be burned on constant potential circuits, the lamps are connected in multiple between the opposite leads or main conductors of the circuit, either singly or in pairs serially according to the difference of potential between the leads. The failure of any lamp to operate consequently does not affect the circuit, except the branch between the leads which feeds the lamp in question, but in order to prevent waste of electric energy by the passage of a current through the shunt coils whenever the lamp becomes extinguished while it remains still in circuit, it is desirable to provide means for automatically breaking the circuit of the shunt magnet whenever the lamp ceases to burn. My invention provides an improved construction of lamp adapted for this purpose.

According to my invention the lamp mechanism is adapted to cut the shunt magnet out of circuit automatically in case the current through the carbons is interrupted, extinguishing the arc. The operation of the main magnet is utilized for accomplishing this result without in any way interfering with the normal operation of this magnet and without complicating the mechanism, but on the contrary simplifying the construction of the lamp. To this end I arrange a pair of circuit-closing contacts in the shunt circuit, and connect them in such manner to the armature which receives the attraction of the main magnet, that when this armature is retracted the contacts shall be separated and the shunt-magnet consequently opencircuited, but upon the attraction of the armature by the main magnet, its initial movement shall close the contacts together and thereby bring the shunt magnet into operation. It results from this construction that whenever by the blowing out of the arc, the breaking of a carbon, the sticking fast of a feed-rod, or any other casualty whereby the lamp is extinguished, the cessation of the current traversing the main magnet releases the armature, and its retraction separates the circuit-closing contacts and consequently open-circuits the shunt magnet, so that no current is wasted by flowing through the latter.

Figure 1 of the accompanying drawings is a sectional side elevation of my improved lamp showing the mechanism case in vertical section in the plane of one of the feed-rods, and showing the inclosed mechanism in elevation. Fig. 2 is a sectional elevation looking from the left in Fig. 1, showing the mechanism case in section on the line 2—2, and showing the inclosed mechanism in front elevation. Fig. 3 is a horizontal section cut on the line 3—3 in Fig. 1. Fig. 4 is a fragmentary side elevation showing the parts in a different position. Fig. 5 is a fragmentary sectional rear elevation of the armature crossbar and its related parts. Fig. 6 shows in plan the armature spring and its conducting copper strip detached. Fig. 7 is a diagram showing the electric circuits. Figs. 8 and 9 are diagrams showing two modified constructions.

Before describing the mechanism of my present construction of lamp, I would remark that in its structural features it very closely resembles the well known construction of Wood arc lamp for high potential series cir-

cuits, for many years extensively in use, and which is illustrated in detail in my Patents No. 426,405, dated April 22, 1890, No. 430,722, dated June 24, 1890, and No. 487,315, dated November 6, 1892, the two former being rack-feed lamps, and the latter a clutch-feed lamp. In view of the full illustration and description of all the details of construction contained in my said patents, I do not deem it necessary herein to describe in detail any of the features shown in the accompanying drawings, which do not directly pertain to my present invention. I would also remark that my present invention although illustrated as applied to a duplex or double lamp, is equally applicable to either single or double lamps. Also that it is immaterial to my present invention whether the feeding mechanism for feeding down the carbon holding or feed rods is of the rack-feed type or the clutch-feed type.

Referring to the drawings, let A designate the mechanism case or box, B the looped frame extending thence downwardly for supporting the globe holder and lower or negative carbon pencil, and C C the vertically sliding carbon holding rods or feed-rods. The feed-rod is engaged by a feeding mechanism designated as a whole by the letter D in Fig. 1, and in the construction there shown consisting of a train of wheels meshing with rack-teeth on the rod, and freed or arrested in the manner common to rack-gear feeds. This feed mechanism is carried by the armature lever E, which is fulcrumed at *e*, and is connected to the armature F which plays between the main magnet G and the shunt magnet H. As in my previous constructions these magnets G, H, are arranged opposite each other, and the armature F is in the form of the letter **H** with its legs entering the cores of the opposite magnets, and its cross-bar playing between the magnets. Thus the two magnets act oppositely to each other, the main magnet striving to lift the armature, and the shunt magnet striving to pull it down. The armature-lever E is made in the form of an open frame, the feed-rod C and armature F being engaged on one side of its fulcrum *e*, while on the other side thereof in order to partially compensate for the weight of the feed-rod or rods, and also to provide a means for regulating the feed, a spring I is connected pulling down upon the lever.

The armature F is connected to the armature-lever E by a loose or free connection consisting in the preferred construction shown of two pivotal pins *a a* projecting from the opposite ends of the armature bar and entering into open notches *b b* indenting the open frame of the lever upon its lower side. When the magnets are inert, the weight of the feed-rod or rods C causes the armature-lever E to rock downward until stopped by a lug *c* striking the top of the spool of the shunt magnet H, as shown in Fig. 4, and the armature F descends sufficiently lower to bring its pins *a* out of direct engagement with the armature-lever, this descent of the armature being due to gravity in the construction shown, although with a different arrangement of the parts it may be necessary to apply a spring to the armature instead. To the armature-lever is fixed in the preferred construction a copper strip L, fastened to it by screws but insulated from it and extending across its front end as shown in Fig. 2, while the free ends are bent back around the sides of the armature-lever, and are formed at their ends into half eyes *d d* arranged to overlie the pins *a a* on the armature, and arranged to project somewhat lower than the top of the notches *b*, in order that when the armature is lifted by the attraction of the main magnet G the pins *a* shall encounter the curved ends *d* of the copper strip L, and lifting against these ends shall transmit the lifting pressure to the armature-lever E without actually coming into contact with the armature itself.

The pins *a* and the curved ends *d* of the copper strip constitute opposite circuit-breaking or closing contacts for closing or breaking the shunt circuit, including the magnet H. The connections of this shunt circuit are clearly shown in Fig. 7, from which it will be observed that the armature-lever is in connection with the positive terminal. The current passes from the positive terminal into the frame of the lamp mechanism, thence through the fulcrum pivots into the lever E, thence through a flat spring *f* the ends of which rest on the armature-lever and the middle of which is fastened to the armature, to the latter, and consequently to the pins *a*, and thence into the ends *d* of the copper strip L, and thence by a flexible wire *h* to one terminal of the coil of the shunt magnet, the other terminal of which is connected by a wire *g* to the negative terminal of the lamp. It follows that all the current traversing the coils of the shunt magnet must necessarily pass between one or both of the pairs of circuit-closing contacts *a d*. Consequently if from any cause the main current through the lamp is interrupted, the resulting demagnetization of the main magnet G frees the armature F, which quickly descends, thereby dropping the pins *a* out of contact with the ends *d* of the strip L, and thereby breaking the circuit to the shunt magnet. Whenever the main current is turned through the lamp, the excitation of the main magnet G attracts the armature F upward, and the initial upward movement of the armature brings the pins *a* against the ends *d* of the strip, and thereby closes the circuit to the shunt magnet, so that the lamp is rendered instantly operative.

The construction of circuit-closing device shown is very simple and easily applied. In detail it is substantially the same device that is claimed in my Patent No. 430,722, where it is applied to an arc lamp for series connection in order to close the resistance shunt between the lamp terminals upon the complete de-

scent of the armature. By inverting the copper strip L, I now apply the same construction for breaking the circuit to the shunt magnet upon the complete descent of the armature. This particular construction of circuit-closing contacts, however, is not essential to my invention, as such contacts might be variously otherwise provided. It is only necessary that there should be some freedom of motion or lost motion between the armature and armature-lever, or in other words, after the armature-lever has moved to the limit of its movement and is retracted the armature shall be capable of sufficient further movement to effect the breaking of contact between the circuit-closing contacts. Preferably one of the circuit-closing contacts is carried by the armature-lever and the other by the armature, but this is not essential.

Fig. 8 is a diagram similar to Fig. 7, but showing a modified construction to the extent that the armature carries an insulated pin $a'$ connected with one terminal of the shunt circuit, while the other terminal contact, lettered $d'$, is formed by the end of the armature-lever E', the lever being arrested at the end of its retractile movement by a stop $c'$. Here the contact carried by the armature is an insulated contact, whereas in the construction first described the insulated contact is the contact $d$ carried by the armature-lever.

Fig. 9 shows a further modification wherein neither of the contacts is carried by the armature, both being carried by the armature-lever $E^2$. The armature has a projecting pin or arm $i$ which acts against the end of a contact spring $a^2$ mounted on but insulated from the armature-lever, and which by the movement of the armature is pressed against the terminal contact $d^2$ consisting of the end of the armature-lever itself. In this construction the respective terminal contacts are simply interposed between the armature and armature-lever, so that the initial movement of the armature closes them together, and they constitute as in the other instances the intermedium through which the pressure of the armature is communicated to the armature-lever to displace the latter and effect the lifting of the feed-rod to strike the arc.

My invention also introduces an improvement in the detail of the lamp mechanism which I will now describe. Heretofore the flat plate or spring-plate $f$, the purpose of which has been in different constructions to partly or wholly sustain the weight of the armature F, has been made of brass or bronze, and has served both the purpose of a spring and the purpose of a conducting strip for carrying the current between the armature and armature-lever. It has been found that this strip has sometimes become so heated by the passage of the current as to impair its function as a spring. To overcome this difficulty my present invention substitutes for the single spring strip heretofore used, two strips or plates, as best shown in Fig. 5, the lower one of which is a simple strip of copper $f'$ having no necessary springiness, while the upper one of which $f^2$ is a steel spring which affords the requisite resiliency for properly acting upon the armature. The steel spring $f^2$ consequently serves not merely as a spring for more or less upholding the armature, but also serves to force the ends of the copper strip $f'$ into close and conductive contact with the armature-lever, while the copper strip affording a much greater conductivity, serves to carry the electric current without heating, and without any material portion of the current passing through the steel spring, so that the spring is protected from injury, and a better conductivity is secured, while permitting the spring to be made of a material which will preserve its elasticity indefinitely. In the lamp shown, the function of the spring is solely to keep the strip $f'$ pressed into conductive contact with the armature-lever and to carry a fraction of the weight of the armature, but not sufficient to permit the retraction of the armature from the armature-lever by gravity.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. In an arc lamp for constant potential circuits, the combination with the main and shunt magnets, the armature and the armature lever, loosely connected to the armature, so that the armature moves beyond the lever of circuit-closing contacts in the shunt circuit, arranged to be normally separated when the magnets are inert, and one of them connected to the armature to be closed against the other by the initial movement of the armature relatively to the armature lever under the attraction of the main-magnet, whereby so long as the main-magnet is excited the shunt magnet is retained in circuit, and upon the extinguishing of the arc the shunt magnet is open-circuited.

2. The combination with the main and shunt magnets, the armature and armature lever, loosely connected together of circuit-closing contacts in the shunt circuit, arranged to be normally separated when the magnets are inert, and mounted as the intermediary through which the armature when attracted by the main-magnet displaces the lever, whereby they are closed together and the shunt-magnet is retained in circuit so long as the main magnet is excited, and upon the extinguishing of the arc the shunt magnet is open-circuited.

3. The combination with the main and shunt magnets, the armature and armature lever, of circuit-closing contacts in the shunt circuit, mounted on the armature and lever respectively, arranged to be normally separated when the magnets are inert, and to be closed together by the initial movement of the armature under the attraction of the main-magnet, whereby so long as the main magnet is excited the shunt magnet is retained in cir-

cuit, and upon the extinguishing of the arc the shunt magnet is open-circuited.

4. The combination with the main and shunt magnets, the armature and armature-lever, of conducting pins *a a* carried by the armature, and a conducting strip L fastened to but insulated from the armature-lever and having contact ends *d* overlying said pins, the circuit-closing contacts *a d* thus constituted being connected in the shunt circuit and arranged to be normally separated by the retraction of the armature when the magnets are inert.

5. In an arc lamp, the combination with the armature and armature-lever, of a strip *f'* of conducting metal arranged to conduct the current between the armature and lever, and a spring-plate $f^2$ overlying said strip and serving to press it into conductive contact with the armature lever.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:

CHAS. C. MILLER,

R. F. HARDING.