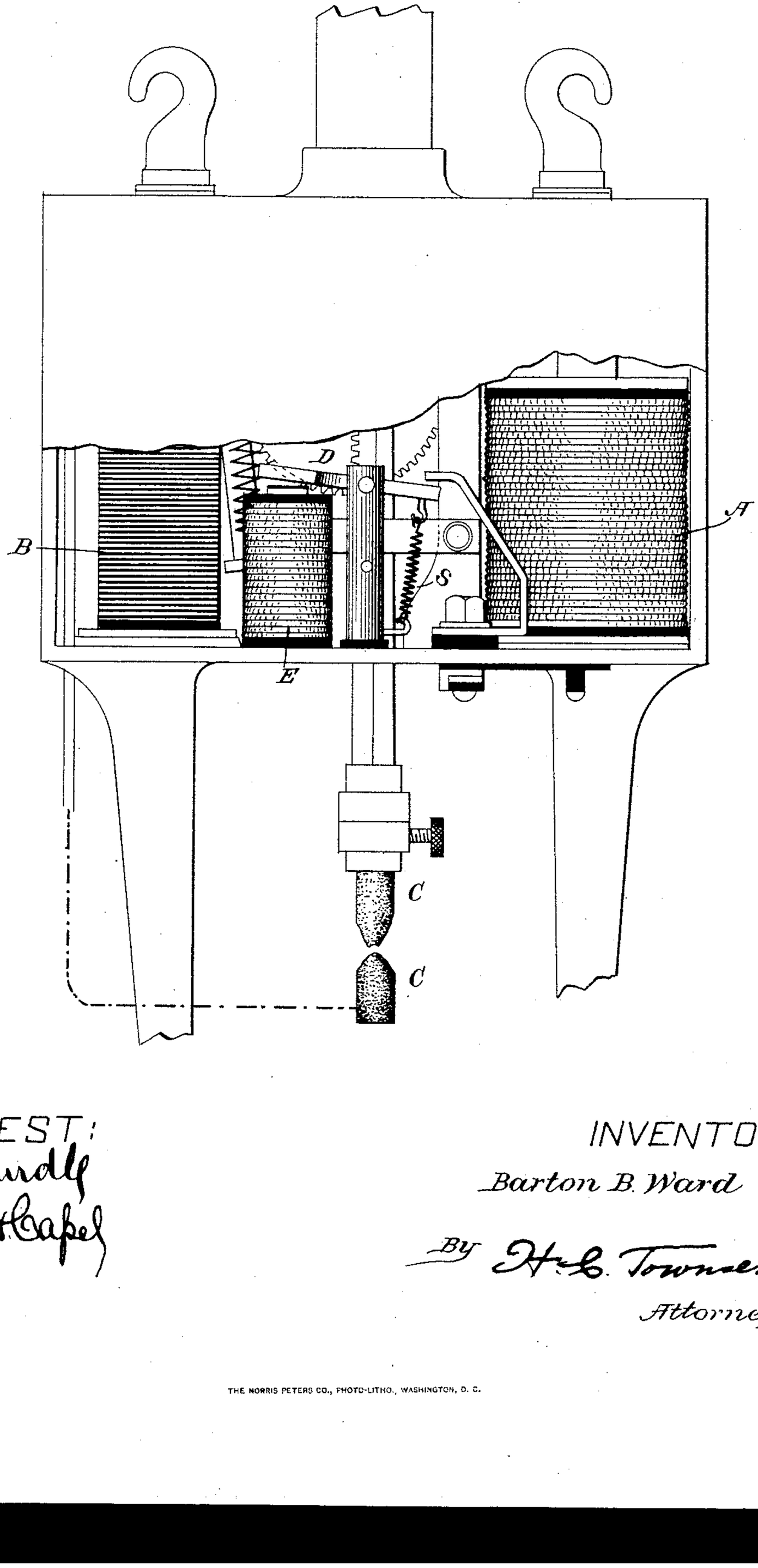
(No Model.) 2 Sheets—Sheet 1.

B. B. WARD.

ELECTRIC ARC LAMP.

No. 444,472. Patented Jan. 13, 1891.

Fig. 1.



ATTEST:

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

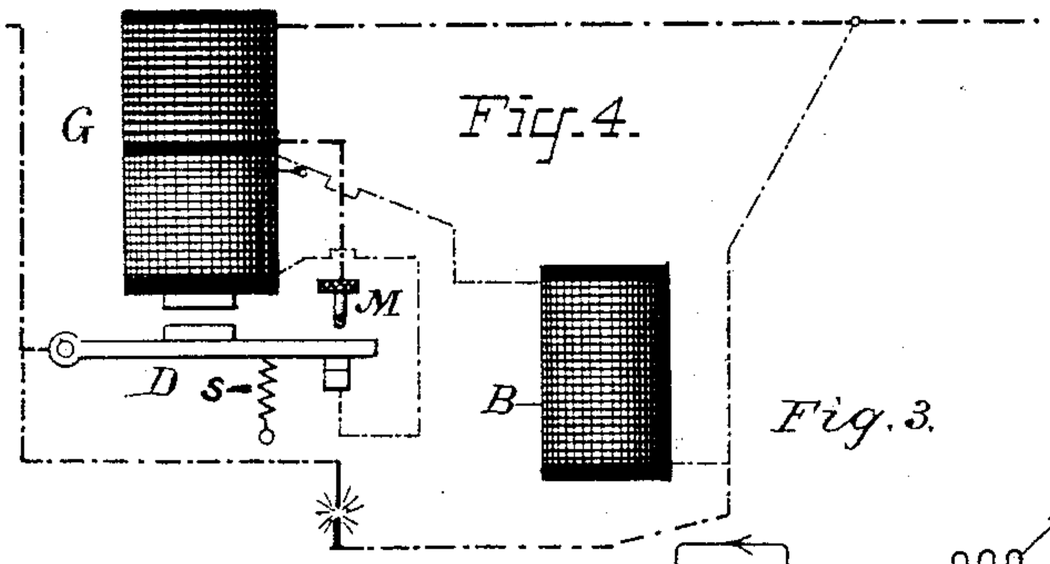


Fig. 3.

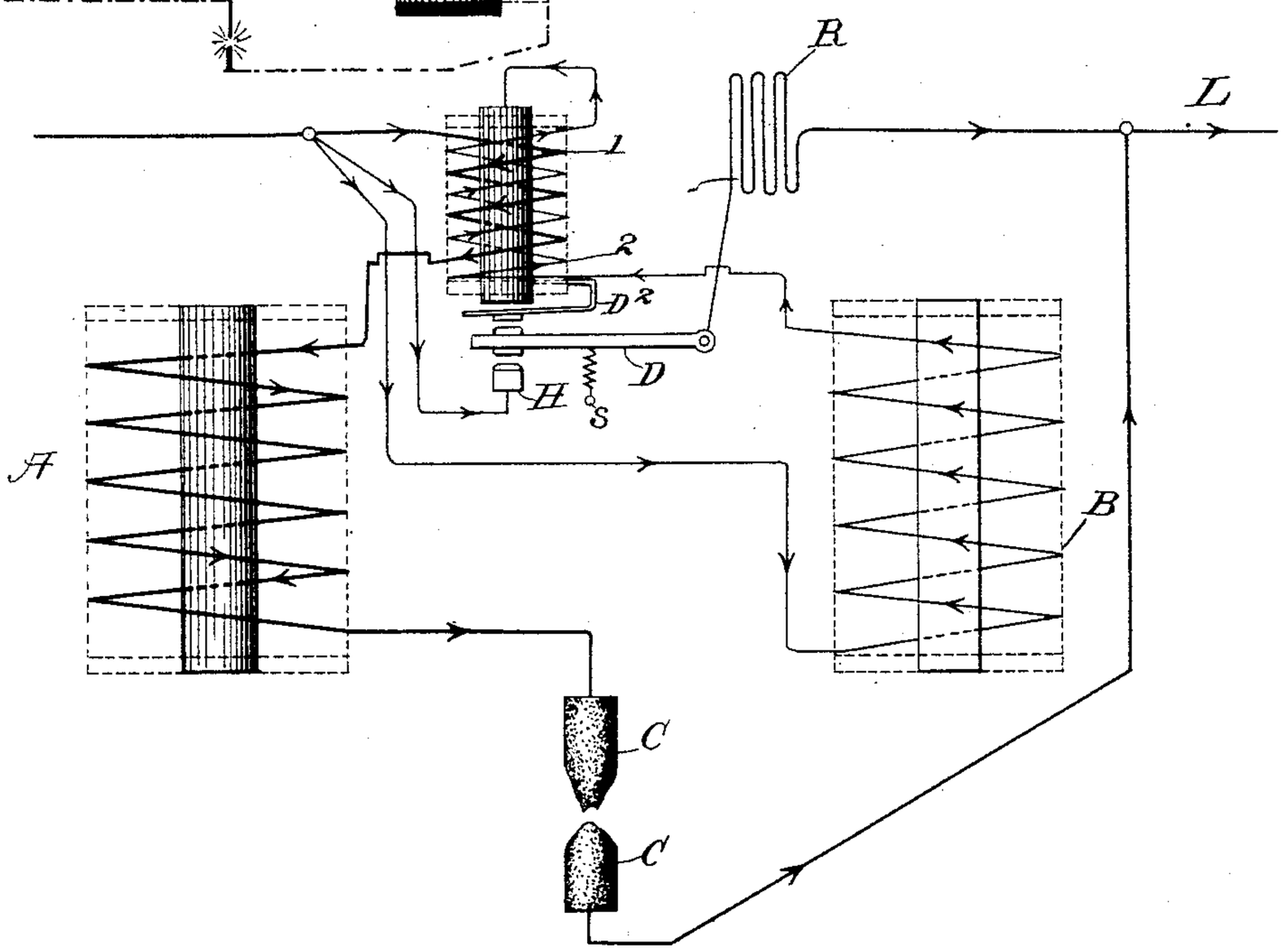
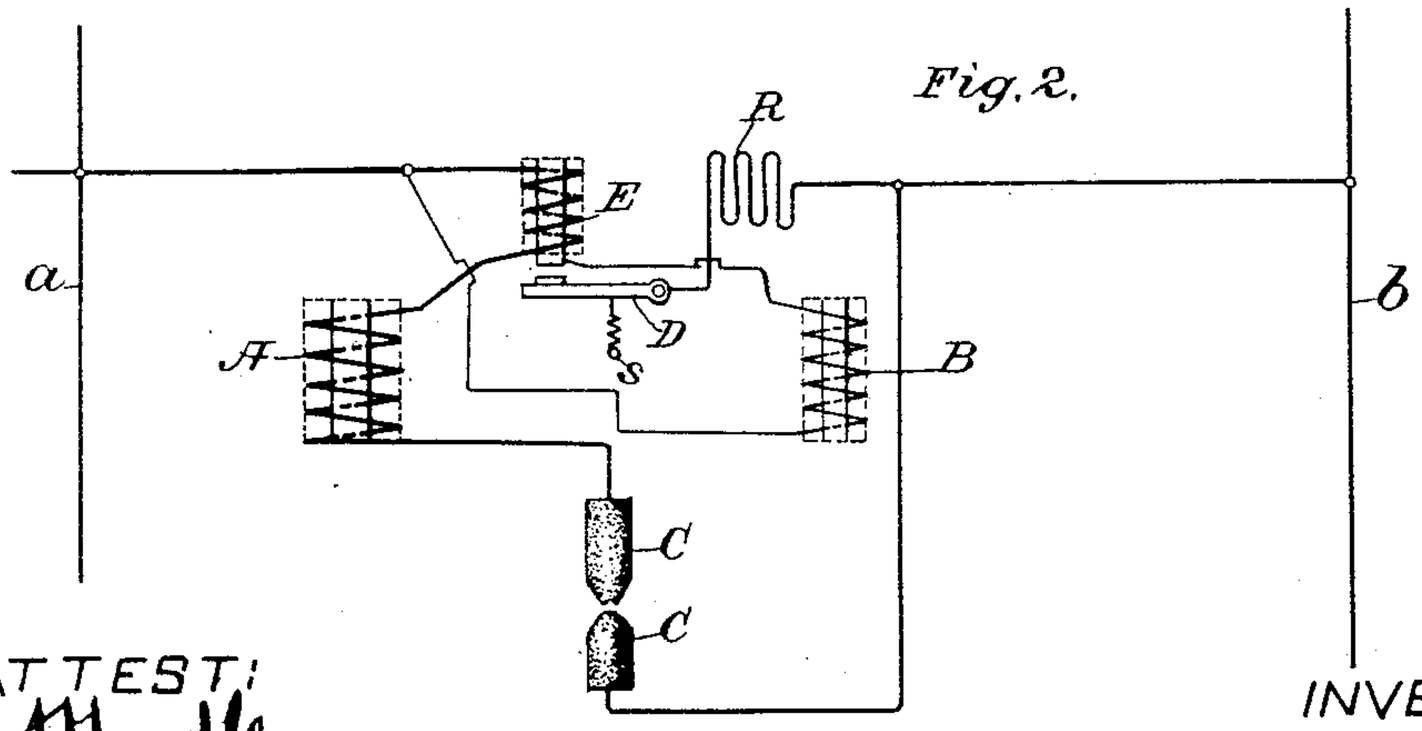


Fig. 2.



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INVENTOR:
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Attorney

UNITED STATES PATENT OFFICE.

BARTON B. WARD, OF NEW YORK, N. Y., ASSIGNOR TO THE ELECTRIC CONSTRUCTION AND SUPPLY COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 444,472, dated January 13, 1891.

Application filed April 11, 1890. Serial No. 347,519. (No model.)

To all whom it may concern:

Be it known that I, BARTON B. WARD, a citizen of the Dominion of Canada, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Safety Appliances for Electric-Arc Lamps, of which the following is a specification.

My invention relates to automatic safety appliances for electric-arc lamps.

The object of the invention is to prevent injury to the lamp in case the circuit through the carbons should become abnormally high.

A further object of my invention is to provide means whereby the current may be shunted around the lamp and at the same time the coils of the feed-regulating derived-circuit magnet may be effectually protected from injury.

The invention consists, essentially, in interposing a switch into the circuit of the derived-circuit feed-regulating magnet for opening and holding open the circuit of such coil, and in controlling or bringing such switch or circuit-opener into operation through the action of controlling devices adapted to respond to any abnormal increase in the resistance of the circuit through the arc.

I have herein shown my invention as applied to an electric-arc lamp in which the feed-regulating system embodies a main-circuit magnet operating in conjunction with the derived-circuit magnet, though it is applicable to any arc lamp wherein the feed is produced or controlled by a derived-circuit magnet acting alone or in conjunction with other magnets. The circuit-opening switch in the circuit of said derived-circuit magnet may be controlled by an electro-magnet or other responsive device which is energized solely by the current flowing to the arc, or by the current flowing in a derived circuit around the arc, or by a combination of such currents, the only condition being that it shall be responsive to an abnormal increase of resistance in the circuit to the arc and shall permit or cause the operation of the circuit-opening device which opens and holds open the circuit of the derived-circuit feed-regulating magnet.

Instead of an electro-magnet any other device known to electricians which will respond directly or indirectly to variations of an electric current may be used for the purposes of my invention.

In the accompanying drawings, Figure 1 is a side elevation of a lamp embodying my invention. Fig. 3 is a diagram of the circuits of such device. Fig. 2 is a diagram of a modification in the manner of controlling the circuit-opening switch. Fig. 4 illustrates another way of bringing such switch into operation and holding it in position to keep the circuit of the feed-regulating magnet open.

Referring to Fig. 1, A indicates the main-circuit magnet, and B the derived-circuit magnet, constituting the arc-forming and feed-regulating magnet system of an electric-arc lamp, the carbons of which are indicated at C C. The upper carbon C is connected with the feed-regulating mechanism and governed in its movement thereby in any ordinary or desired manner. As this mechanism may be indefinitely varied, it will not be further described, as its operation is well understood in the art.

D indicates a circuit-opening switch interposed in the circuit of the derived-circuit magnet B, as shown, and subjected to the influence of a spring S, which tends to open the switch and hold it down against the back contact-stop in position where the circuit of the magnet B will be opened.

E indicates an electro-magnet or other electro-responsive device which is in the circuit leading through the carbons, and which has an armature carried by the switch-lever D. When the magnet E is excited by the current flowing through the carbons in the usual manner or to the usual extent, the magnet E is of sufficient power to hold the circuit-opening switch D raised against the stress of spring S and in position where it will close the circuit of the magnet B. Should the resistance in the circuit through the arc become abnormally high or should the arc break, the magnet E will decrease in power to a sufficient extent to allow the retractor S to open the switch, thereby breaking the circuit of the magnet B. This device is designed especially for use on constant-potential circuits where arc lamps are fed in multiple between

two mains *a b*, as indicated. The effect of the device is to remove the derived-circuit magnet from connection with such mains and to prevent abnormal heating thereof in case the circuit through the arc should become broken for any reason. The switch D or other device responsive to such abnormal increase of current might also operate to close a shunt-circuit around the lamp containing a resistance which is the equivalent of the lamp resistance or which is a shunt of low resistance. Such shunt or branch circuit is to be used in those cases where two or more lamps are run in series.

Fig. 3 shows an arrangement of this description wherein the circuit-opening switch is provided with contacts that close the safety branch and is controlled by the joint action of current in a derived circuit around the arc and in the main circuit, the effect, however, being, as before, to bring such circuit-opening switch into operation on the occurrence of an abnormal increase in the arc circuit in the well-understood manner. Here the magnet E is wound with two coils, one of which (indicated by the numeral 1) is in the circuit with the main-circuit coil A, while the other (indicated by the numeral 2) is included in the derived circuit around the arc, and in this instance is shown in series with the coils of B. The two coils 1 2 are wound so as to oppose one another; but the coil 1 is made to be superior to the coil 2 when the arc is burning or when the resistance in the arc circuit is of normal amount. Under these conditions the magnet E holds up the armature-lever, consisting of the switch D, and thereby presses a supplemental spring-contact D^2 against the core of the magnet, thus completing the circuit from the terminal of coil 2 through the switch D to the main line L by way of the resistance R. The resistance R has no special function under this condition of the parts, and is only of benefit as constituting a resistance in the safety branch around the lamp formed when the lever D drops against the back contact H, which is connected to the opposite pole of the lamp, as shown. When the lamp is burning, the switch-lever D is held up; but should the arc get abnormally high the power of coil 1 decreases, while the power of coil 2, opposing 1, increases, until finally the magnet becomes so weak that the retractor S may operate the circuit-opening switch D, thereby breaking the circuit of the derived-circuit magnet B. This action is attained by the closure of a safety branch or shunt in obvious manner. The derived-circuit magnet B of the regulator system, being thus entirely removed from circuit and remaining so removed, cannot by any possibility become heated, even though the lamp should remain out of operation for a long time while connected to a line-circuit.

In Fig. 4 I have shown an equivalent way of controlling the circuit-opening switch through a change of resistance in the arc circuit. Here the circuit-opening switch is held in position to keep the circuit open through the magnet B by means of a supplemental magnet-coil G, that is put into circuit by the movement of the switch-lever to open the circuit of the magnet B. The switch D is here actuated by means of a derived-circuit magnet in a branch of high resistance around the arc. The power of this magnet is ordinarily insufficient to operate the circuit-opening switch, so that the latter may remain in position to keep the circuit through the magnet B closed. Here the normal circuit is through the back contact of the lever D. If the arc lengthens abnormally or breaks, or the resistance for any other reason becomes abnormally high in the arc branch, the circuit-opening switch D will be lifted and will open the circuit for the derived-circuit magnet B, and will retain its circuit-opening position through the action of the magnet-coil in the circuit closed against a front contact M in the well-known manner.

It will be understood that in all cases before described, where the switch is held closed by a main-circuit coil, such coil should be of sufficient power at starting the lamp to operate the switch when the current is first turned on and passes through the carbon, so as to complete the circuit for the derived-circuit feed-regulating magnet. In the case illustrated in Fig. 4 the switch will assume the proper position when the current is turned off of the circuit, and when the current is turned on it will find the switch in position where the circuit of the derived-circuit feed-regulating magnet is closed, which position it will retain until the conditions before described may exist.

The supplemental spring D^2, through which the circuit is closed in Fig. 2, serves simply to preserve the circuit for an instant after the lever D begins to move away from the magnet, so that when finally in its downward movement it opens the derived circuit the momentary increase of power in the magnet E in the arc circuit cannot again attract the armature and raise the switch.

What I claim as my invention is—

1. The combination, in an electric-arc lamp, of a derived-circuit feed-regulating magnet B, a circuit-opening switch which normally or while the arc is of normal length maintains the connection of such derived-circuit magnet-coil with the main or supply circuit closed, but which is adapted on operation to hold such connection open, and devices responsive to abnormal resistance in the circuit of the arc for bringing said switch into operation, as and for the purpose described.

2. The combination, in an electric-arc lamp, of a feed-regulating magnet in a derived circuit around the arc, a circuit breaker and closer of such derived circuit which normally or while the arc is of normal length maintains a position to keep such derived circuit closed, and a controlling-magnet for such switch con-

nected to the circuits of the lamp and responsive to abnormal increase in the circuit of the arc for bringing such switch into operation to open and hold open the circuit of the feed-regulating magnet.

3. The combination, in an electric-arc lamp, of a switch D, normally completing the circuit through the feed-regulating derived-circuit magnet for the lamp, a magnet-coil in the circuit of the arc adapted when excited to hold such switch in circuit-closing position, and a retractor operating on such switch for opening the circuit of the feed-regulating magnet when the current through the arc decreases to an abnormal extent.

4. The combination, in an electric-arc lamp, of a switch having back and front contacts, the front one of which is included in the circuit of the derived-circuit feed-regulating magnet, while the back contact is in a shunt or branch circuit around the lamp, and a controller-magnet for such switch having a coil in a circuit through the arc, as and for the purpose described.

Signed at New York, in the county of New York and State of New York, this 3d day of April, A. D. 1890.

BARTON B. WARD.

Witnesses:
WM. H. CAPEL,
HUGO KOELKER.