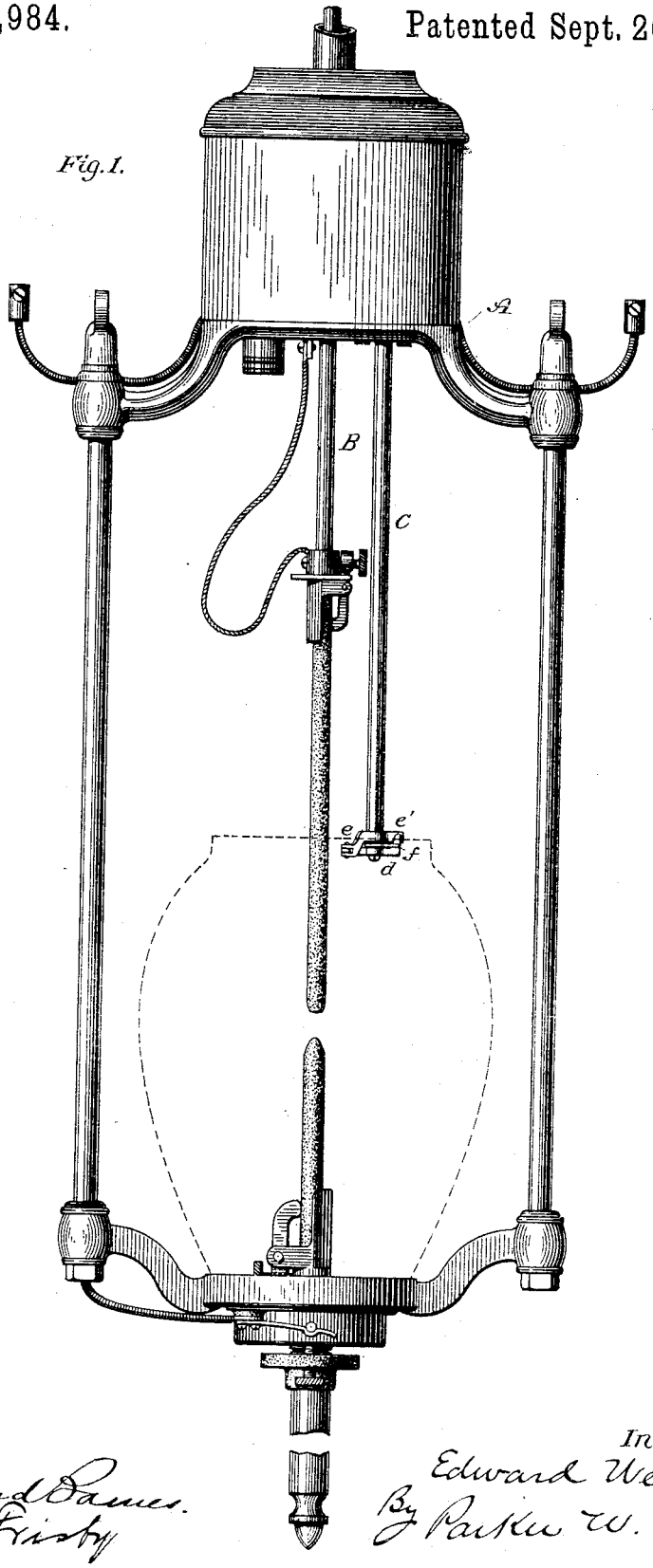
(No Model.) 4 Sheets—Sheet 1.

# E. WESTON.

## SHUNTING ATTACHMENT FOR ELECTRIC ARC LAMPS.

No. 264,984. Patented Sept. 26, 1882.

*Fig. 1.*

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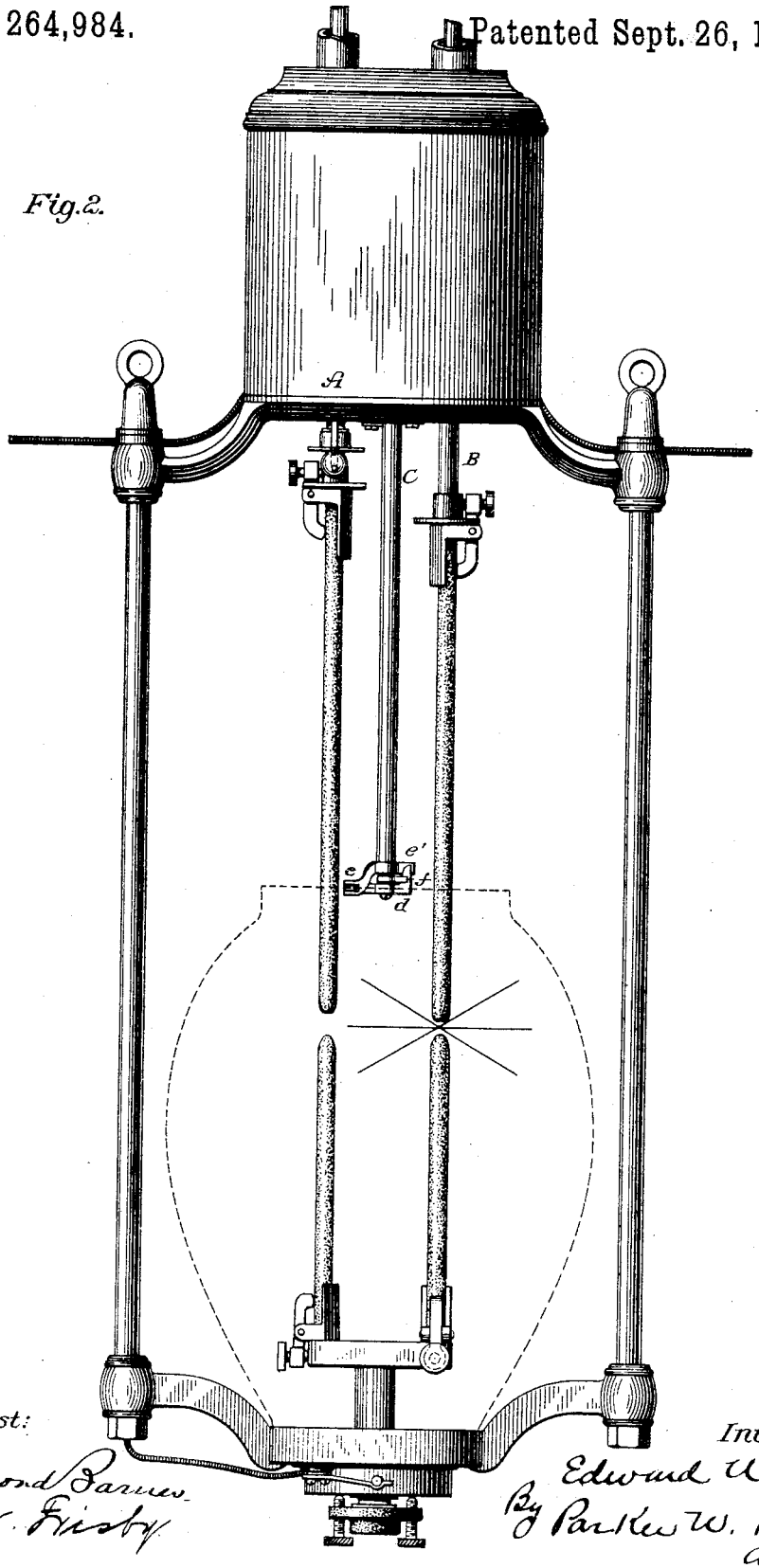
(No Model.) 4 Sheets—Sheet 2.

# E. WESTON.

## SHUNTING ATTACHMENT FOR ELECTRIC ARC LAMPS.

No. 264,984. Patented Sept. 26, 1882.

*Fig. 2.*

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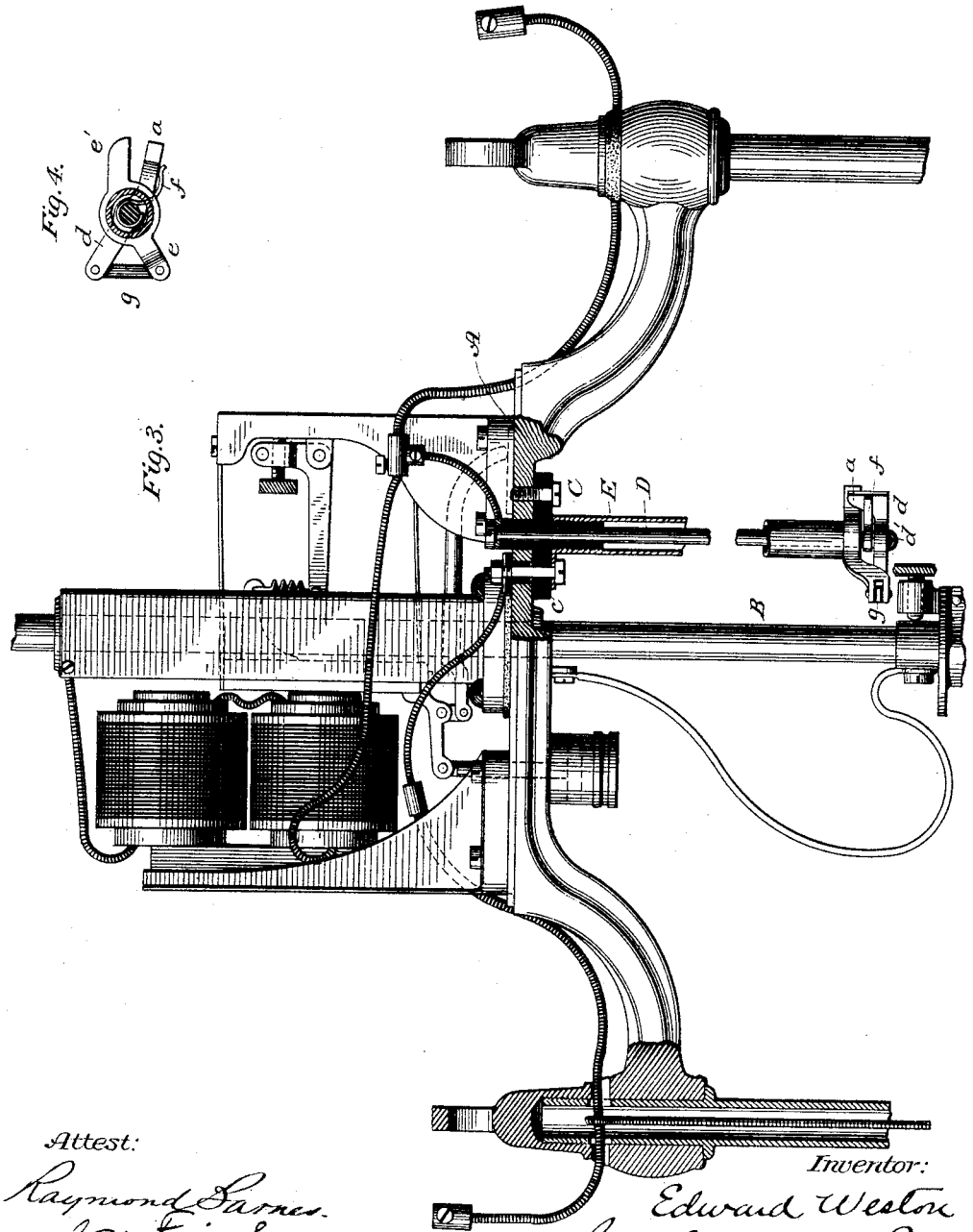
(No Model.) 4 Sheets—Sheet 3.

# E. WESTON.

## SHUNTING ATTACHMENT FOR ELECTRIC ARC LAMPS.

No. 264,984. Patented Sept. 26, 1882.

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(No Model.) 4 Sheets—Sheet 4.

# E. WESTON.

## SHUNTING ATTACHMENT FOR ELECTRIC ARC LAMPS.

No. 264,984. Patented Sept. 26, 1882.

*Fig. 5.*

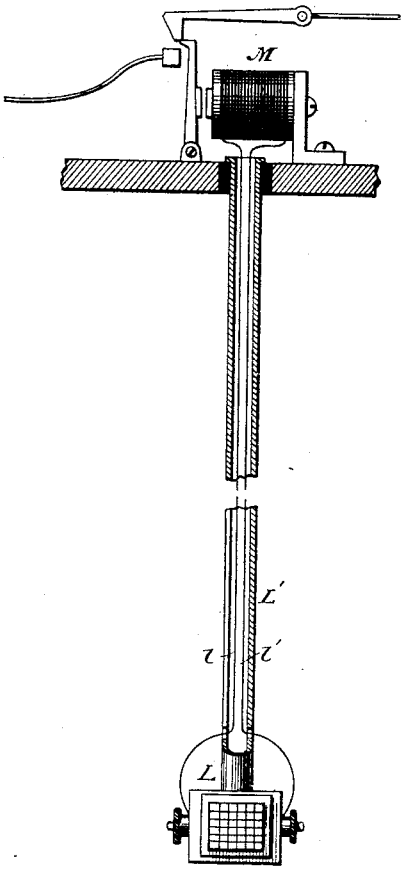
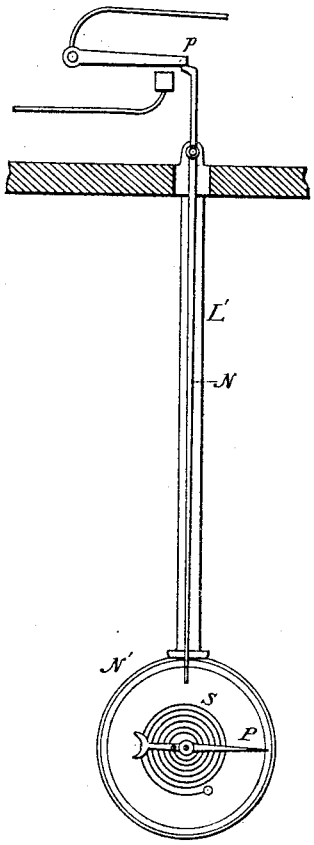



*Fig. 6.*

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# UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE UNITED STATES ELECTRIC LIGHTING COMPANY, OF NEW YORK, N. Y.

## SHUNTING ATTACHMENT FOR ELECTRIC-ARC LAMPS.

SPECIFICATION forming part of Letters Patent No. 264,984, dated September 26, 1882.

Application filed April 27, 1882. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD WESTON, of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Shunting Attachments for Electric-Arc Lamps, of which the following is a specification, reference being had to the accompanying drawings, forming a part of the same.

In electric-arc lamps it may occur, through derangement of the feed-controlling mechanism or through the failure of some of the parts to perform their allotted functions, that the upper or movable carbon is not properly fed toward the other. As a result, an arc of abnormal length is formed between the two carbon points, which in a comparatively short time may assume such proportions as to endanger the lamp. Such occurrences, although extremely rare, even in circuits containing large numbers of lamps, where currents of very high tension are required, are nevertheless possible, and to guard against any possible injury to the lamps from this source I design employing in connection with each lamp an attachment in the nature of a safety device, which shall operate on the elongation of the arc beyond the limits of safety to shunt the current around the lamp. Heretofore this object has been accomplished by the employment of electro-magnetic devices or their equivalents in shunt or derived circuits around the lamps; but inasmuch as the diversion of current from the main or lamp circuit through the shunts often results in the burning of the coils of fine wire contained therein, I have devised an apparatus the operation of which is made to depend on causes in a certain sense independent of the electrical conditions of the circuit. Under normal conditions the arc is practically confined to the space between the two carbons. When the arc, on the other hand, becomes unduly elongated, it leaves this space and branches out and up at the same time, exhibiting a tendency to travel around the carbons. In my present invention I take advantage of this phenomenon of displacement to operate a cut-out. To this end I employ a normally-open branch circuit around the arc, containing or not, as may be determined by preference or the necessities of the case, a resistance. To close this circuit when the arc has become so distorted and has reached such a length as to endanger the lamp, I use a safety-switch of proper character, which will be brought into operation by the heat developed by such an arc.

The special character of the safety device may be greatly varied, and among the many ways in which the desired end is attained are the following: The contact-surfaces of a mechanical circuit-closer may be held apart by a strip of combustible or easily-fused substance, and this arranged at a point in the vicinity of the arc where, upon an undue elongation of the same, the heat developed will ignite or fuse the substance which keeps the circuit open and permit the points of contact to come together. The point at which the above device is placed should, however, be sufficiently remote from the arc to prevent the heat under normal conditions from affecting it. Another means of accomplishing this result is by the employment of an independent circuit containing a thermal pile and an electro-magnet. The pile is placed where only the heat of a very long arc will cause it to generate sufficient current to energize its magnet. With the magnet is arranged a circuit-closer in a severed branch about the arc. Still another device for the same purpose consists of a switch in the open branch circuit, arranged to be closed by the movement of a metallic thermometer or pyrometer placed with reference to the arc in a manner which will be understood from the above. These several forms of switch, being all operated by force due to the application of heat, I term "thermo-dynamic" switches or "safety devices."

The first of the above-described means of carrying out the invention I have illustrated in detail, and the nature of the invention and manner of applying the same will be described more particularly with reference to it.

In the drawings, Figure 1 represents a single lamp complete with a safety-switch applied. Fig. 2 is a double lamp represented in a similar manner with a safety-switch. Fig. 3 is an interior view, partly in section, showing the arrangement of parts and circuits required in applying the invention. Fig. 4 is a detail of the safety-switch shown in the previous fig-

ures. Fig. 5 is a view of a modified form of safety-switch involving a thermal pile. Fig. 6 is another modification, showing a pyrometer.

Referring to Figs. 1 to 4, inclusive, the cross-bar A of the lamp is perforated at a point, say, an inch and a half from the point through which passes the carbon-holder B. In this perforation is inserted a tube or sleeve of insulating substance, C, having a wide flange, *c*. Through the tube C is passed a metal rod, D. Over the end of tube C is secured by screw-thread or otherwise a metal tube, E, somewhat shorter than rod D. To the end of tube C is fixed a ring having ears *e e'*, the former bent, as shown in Fig. 3, and split. On the end of rod D, projecting beyond the tube E, is a bar, *d*, held in place by a screw, *d'*, and capable of turning freely on the rod. One end of bar *d* is split, the other bent up, or provided with a stop, *a*. A light spring, *f*, is fixed to rod D and bears on the stop *a*, imparting to the bar *d* a tendency to turn and bring stop *a* in contact with ear *e'*. This movement is prevented by a strip of easily-fused substance *g*, which is to be properly secured to the split ends of ear *e* and bar *d*. Rod D is to be connected with the wire which introduces the current to the lamp, and the tube E is electrically connected by an insulated wire to the negative terminal of the lamp. The length of rod D and tube E is determined by experiment, and will of course differ according to such circumstances as the limit which it is desired to fix for the length of arc or the degree of fusibility of the strip *g*.

The fusible substance which I prefer to employ in this device is an alloy composed of tin, four parts; lead, two parts; cadmium, two parts; bismuth, one part—the above proportions by weight. When a metallic strip is used care must be taken to insulate one end at least from the part to which it is attached, as otherwise it would form a path for the current around the lamp.

If with a device constructed as above set forth the rod D be extended to a point, say, two or three inches from the arc at the outset, the desired results will be obtained, for as the negative carbon burns but little the change of position of the arc in a vertical line will not affect the working of the safety device, for by the displacement of the arc when it becomes elongated the strip *d* is either enveloped in flame or heated sufficiently to be fused. In either event the stop *a* and ear *e'* are brought into contact and the lamp short-circuited, even though these parts be placed at a distance of several inches from the end of the positive carbon. The fact that the fusible strip is only on one side of the carbons does not materially, if at all, render its fusion less certain, inasmuch as the arc does not remain in the same place, but exhibits a continual tendency to revolve around the carbon points.

It may be stated that the fusible metal may be supplanted by a strip of some combustible and non-conducting material, if so desired; but in practice I prefer the use of the metal.

The above device may be applied to any ordinary lamp, whether a single lamp or one containing two or more sets of carbons, the manner of applying the same being shown in Figs. 1 and 2. As to the safety-switch itself, no specific plan of construction is prescribed, though the form shown is believed to be the most practicable. It is evident that many variations of this special form are possible, two insulated springs, forming the terminals of a severed branch circuit, and a suitable strip or block of fusible substance holding them apart, forming one means of accomplishing the object desired.

In Fig. 5 is shown a small thermal pile, L, in place of the safety device previously described. This pile is sustained by a tube, L', containing the conductors, at a point with reference to the arc which is determined by experiment, and has wires *l l'* leading from its poles to a small electro-magnet, M, contained in the casing of the lamp. With this magnet is arranged a circuit-closer, (represented by the conventional levers and stops in the drawings,) which circuit-closer is so adjusted as to be affected and tripped only by a current of predetermined strength, and then to permanently close the previously-open branch circuit. In Fig. 6 a tube, L', corresponding to that shown in the former figure, contains a pivoted rod or trigger, N, which holds up a contact-lever, *p*, and maintains the branch circuit with which it is connected open. A circular metallic case, N', is carried by the tube L', in which case is arranged a spiral spring, S, composed of two or three different metals, and arranged, in the manner of the well-known metallic thermometers, with a pointer, P. By the heat of a long arc the pointer is brought around against the end of trigger N, and, imparting to it a slight movement, trips the lever *p* and completes the branch circuit.

Many other modifications of this device are possible, but those described are thought sufficient to illustrate the principle of the invention.

In conjunction with a safety device of this kind other devices not forming part of the lamp proper, but acting as cut-outs or shunting devices, may be employed; but no description of such is here given, as they form the subject-matter of other applications.

It may be stated that the details of the lamp herein shown do not form part of the present invention, and as they have been fully described elsewhere, as in patents granted to me, further description is not here given.

I am aware that it has been heretofore proposed to employ, in combination with a continuous incandescent conductor, thermal regulators of various kinds, the function of which was to momentarily shunt a portion or the whole of the current away from the incandescent conductor when the temperature of the

same exceeded a certain limit. My invention, however, differs from this mainly in the fact that its operation is due primarily to the lengthening of the arc, rather than to a rise of temperature in a normal arc, and, secondly, in that the devices which I have described as constituting my invention act to permanently close the circuit about the carbons when an abnormal arc has formed.

Having now described my invention, what I claim is—

1. In an electric lamp, the combination, with the carbon pencils or electrodes, of a normally-open derived circuit around the lamp, and a thermo-dynamic safety-switch or shunting device connected therewith, said device being constructed and arranged to be operated upon the displacement of the arc, due to the abnormal elongation of the same by the heat developed by the arc, and thereby close the derived circuit, as and for the purpose set forth.

2. In an electric lamp, the combination, with the electrodes, of a normally-open derived circuit, a circuit-closer contained therein, and a safety device such as a fusible strip or its equivalent for holding apart the contact-points of the circuit-closer, the said safety device being constructed and so arranged with reference to the position of the arc that upon an undue elongation of the same it may cause the contact-points to come together, thereby permanently closing the derived circuit, as set forth.

3. In an electric lamp, the combination, with the electrodes, of a normally-open derived circuit, a spring circuit-closer connected therewith, and a strip or piece of fusible or combustible substance for holding the contact-points of said circuit-closer apart, these parts being so constructed and arranged with reference to the position of the arc that upon an undue elongation and displacement of the same the heat will melt or destroy the fusible strip, and thereby close the derived circuit, as described.

In testimony whereof I have hereunto set my hand this 21st day of April, 1882.

EDWARD WESTON.

Witnesses:
PARKER W. PAGE,
W. FRISBY.