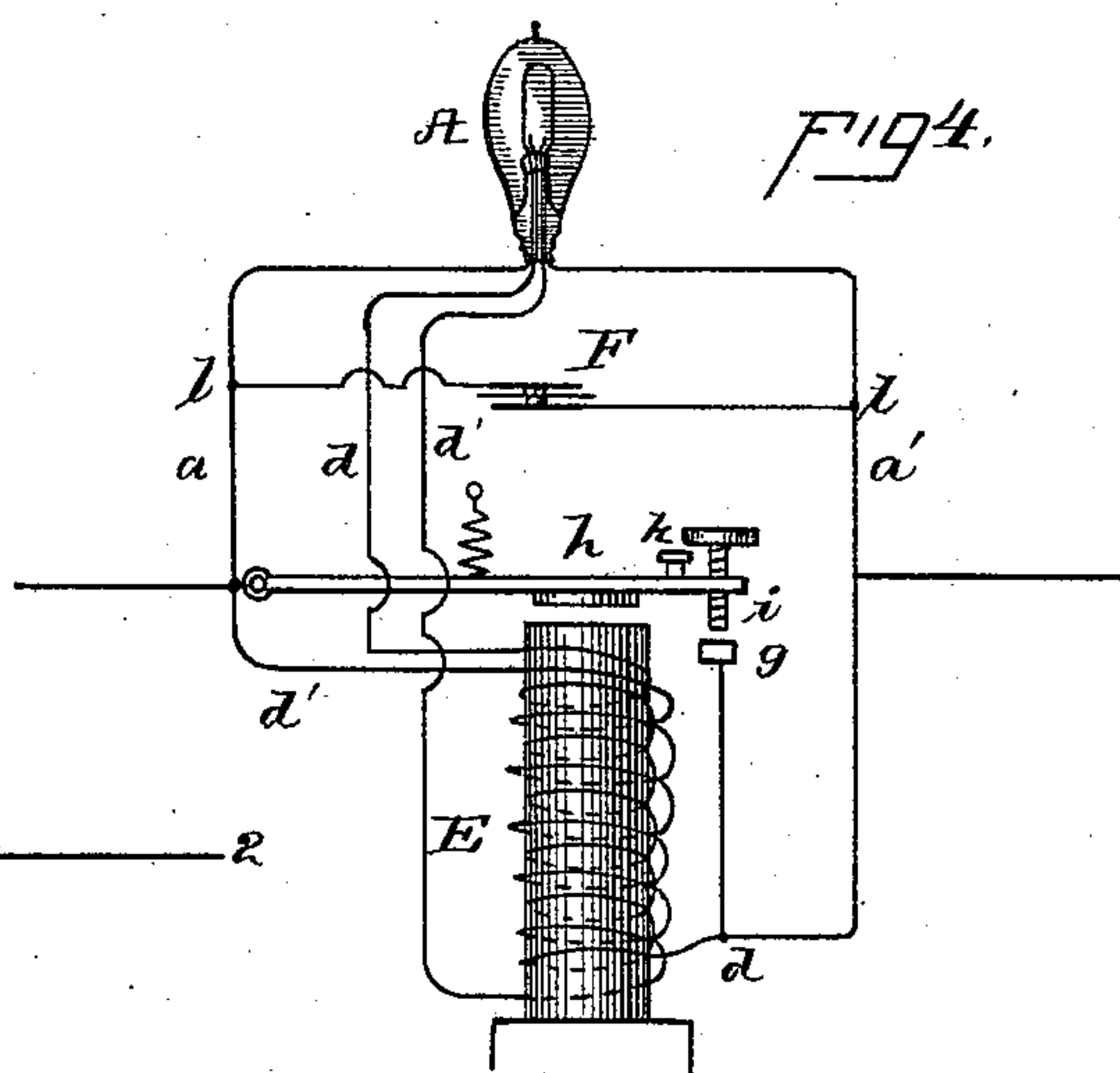
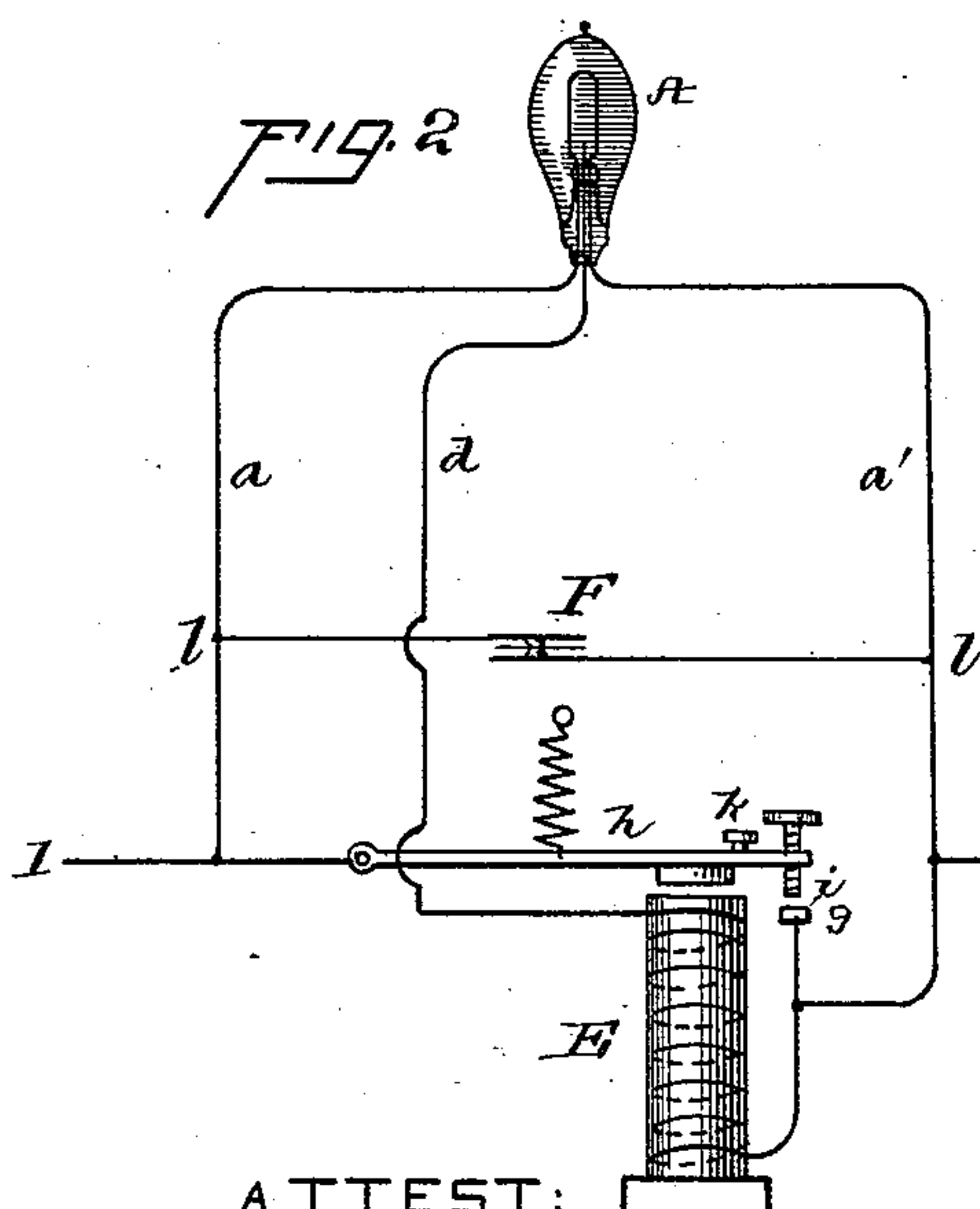
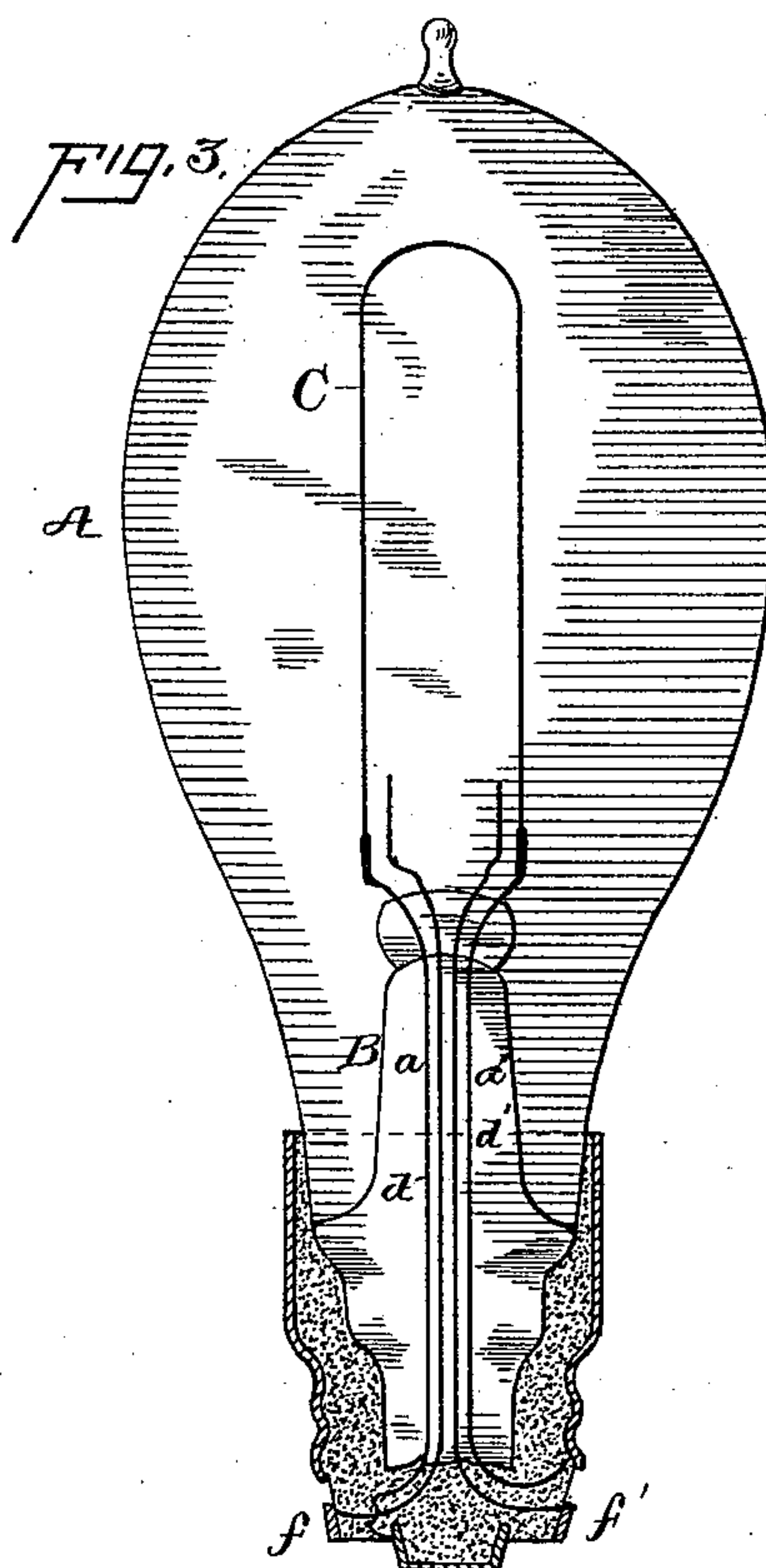
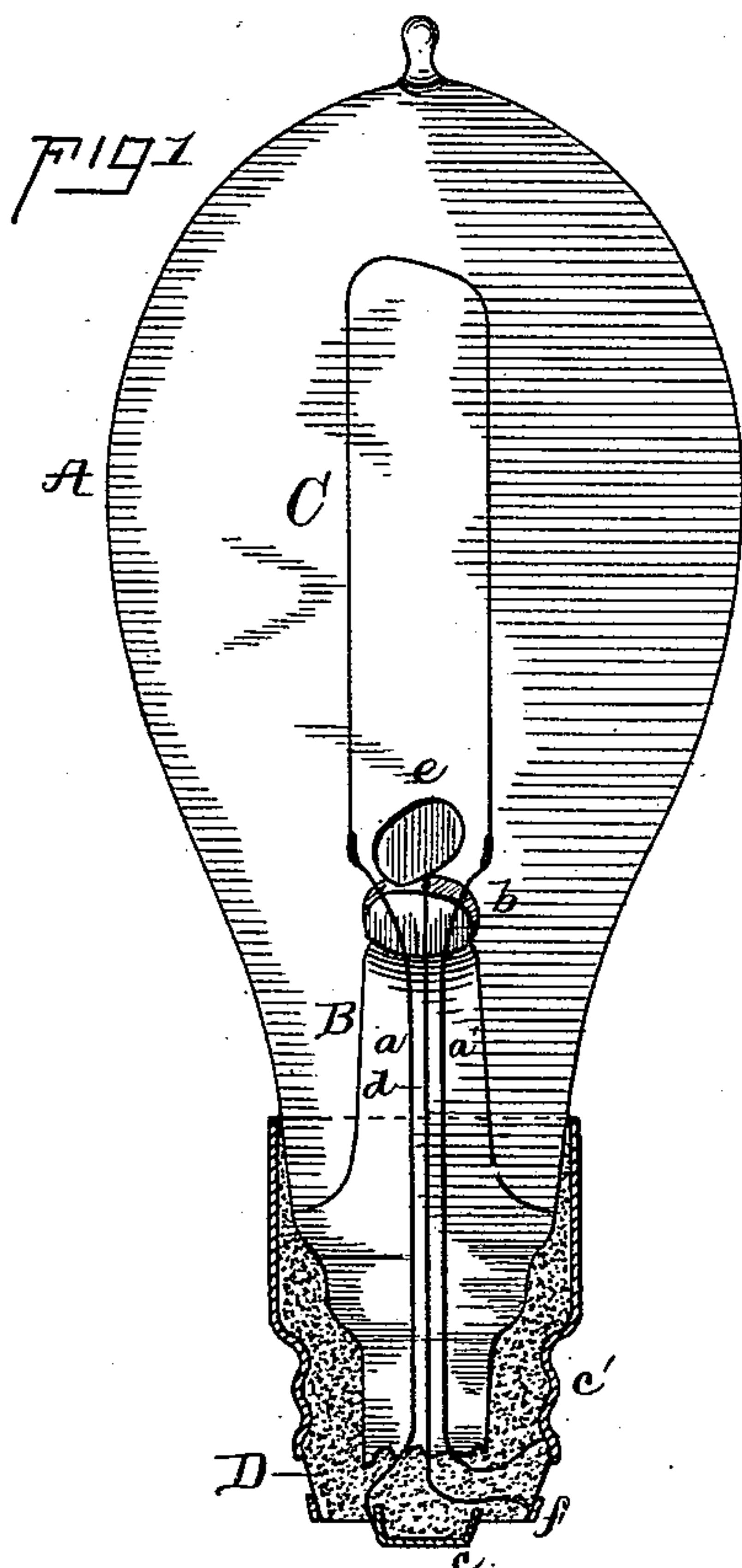


M. WADDELL.  
AUTOMATIC ELECTRIC CUT-OUT.

No. 430,096.

Patented June 10, 1890.



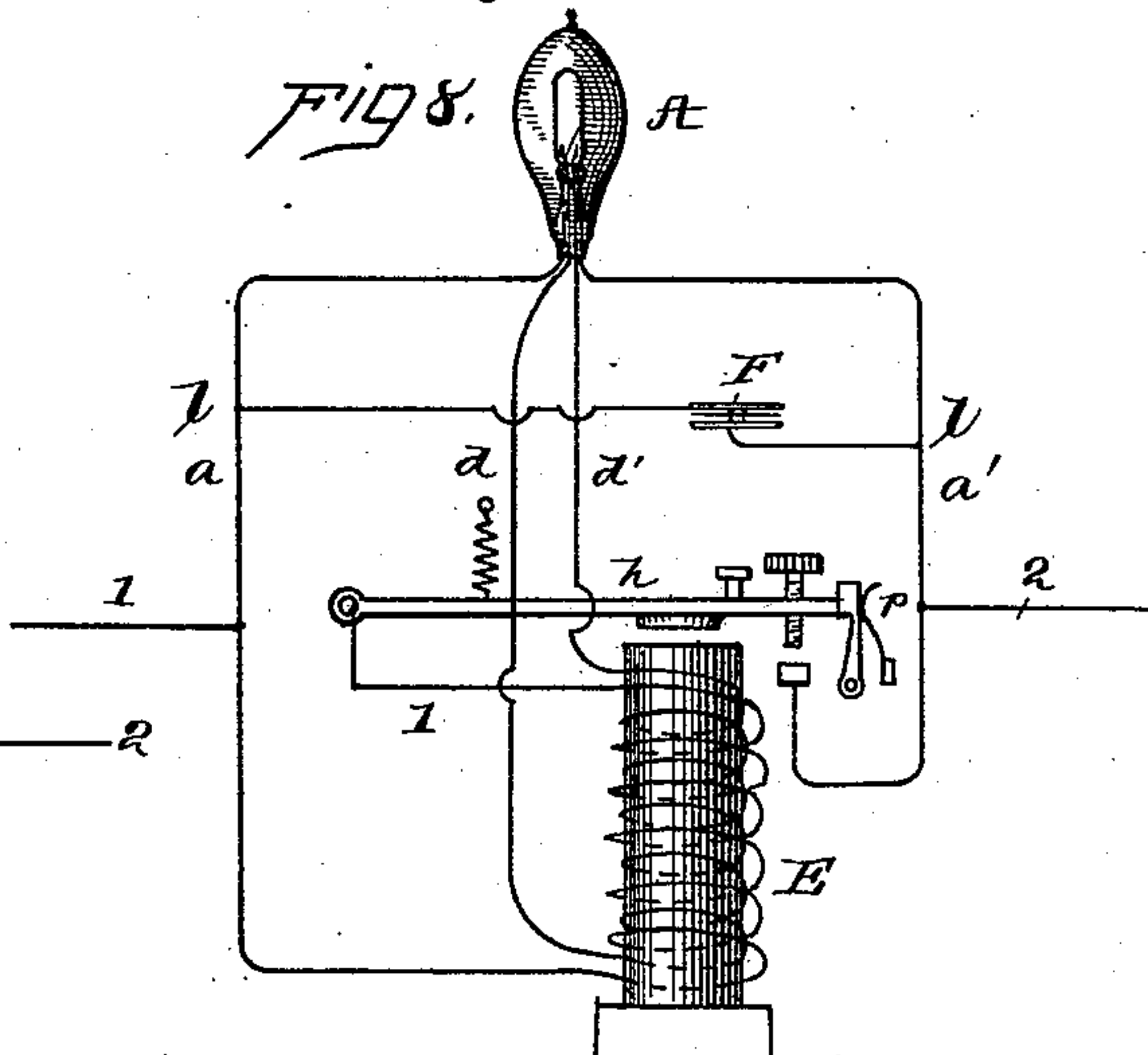
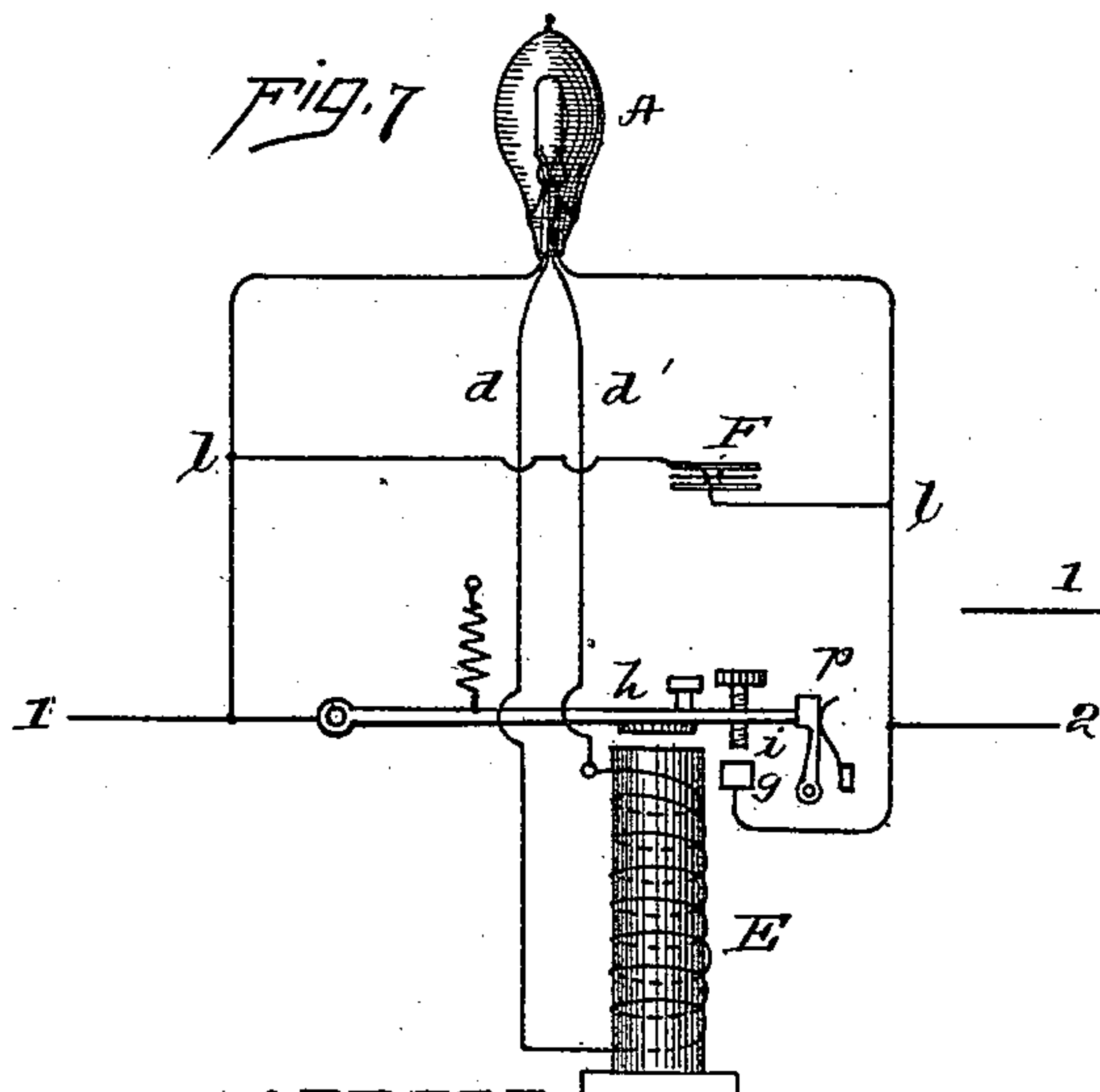
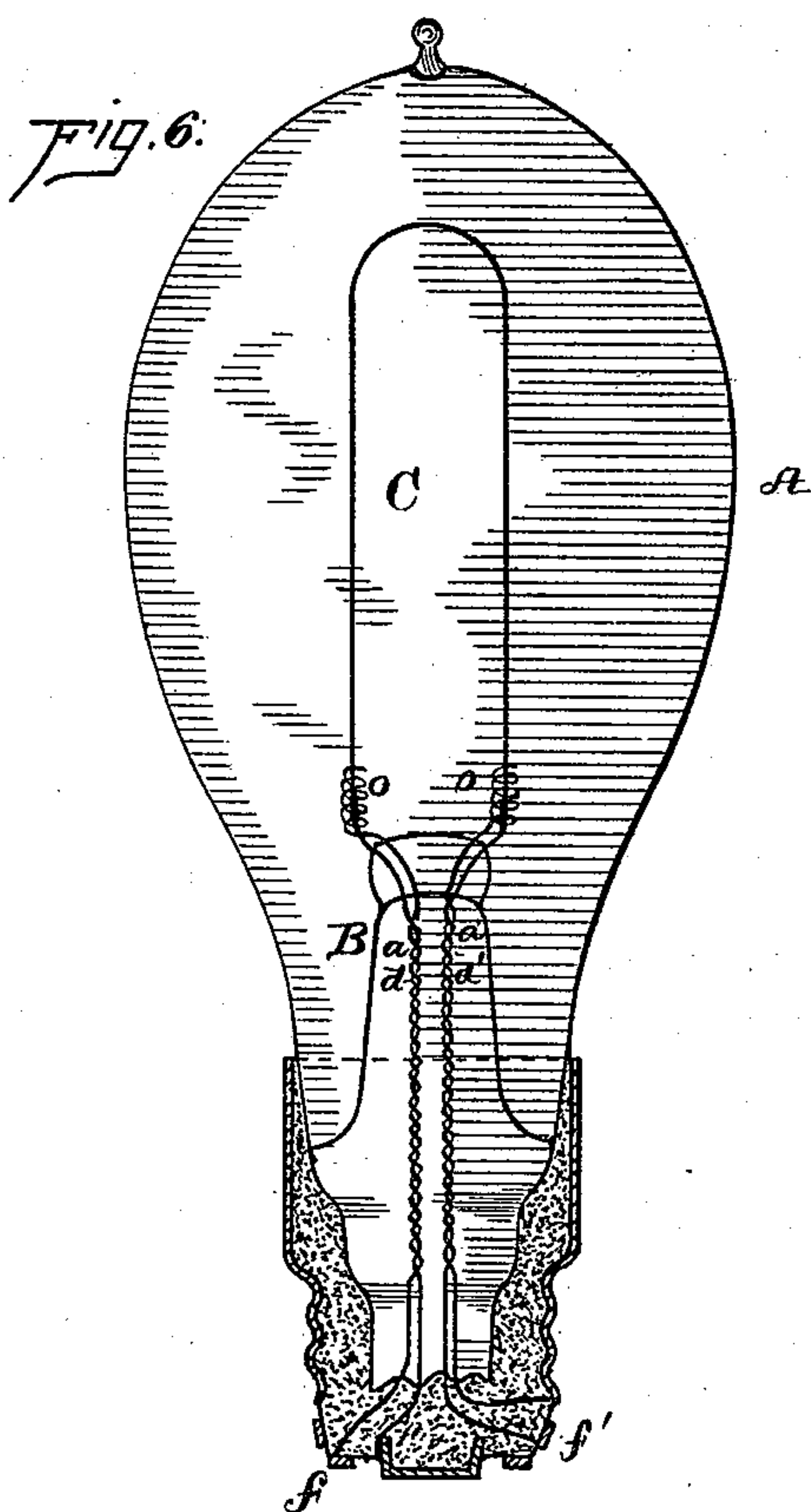
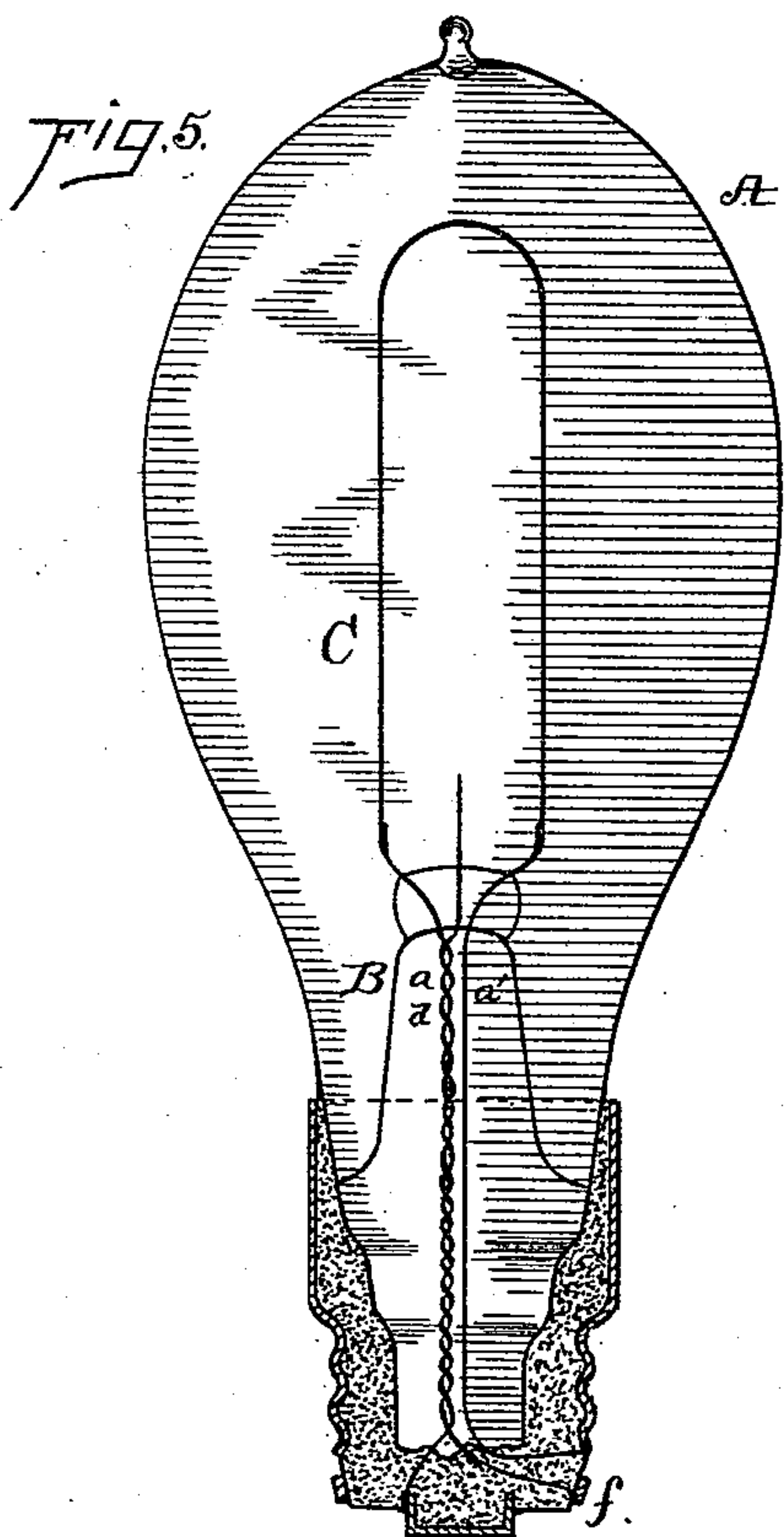
ATTEST:  
*E. C. Powell.*  
*Notary Public*

INVENTOR  
*Montgomery Waddell*  
*By [Signature]*

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*att.*



# UNITED STATES PATENT OFFICE.

MONTGOMERY WADDELL, OF NEW YORK, N. Y., ASSIGNOR TO THE WADDELL-ENTZ ELECTRIC COMPANY, OF SAME PLACE.

## AUTOMATIC ELECTRIC CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 430,096, dated June 10, 1890.

Application filed April 21, 1887. Serial No. 235,621. (No model.)

*To all whom it may concern:*

Be it known that I, MONTGOMERY WADDELL, of New York city, in the county and State of New York, have invented a certain new and useful Improvement in Incandescent Electric-Lamp Cut-Outs, of which the following is a specification.

My invention relates to incandescent electric lamps designed to be used in series with one another with currents of high electromotive force. In such a system if the carbon filament of a lamp breaks an arc forms across the filament, and if no means for stopping it is provided such arc will continue down the leading-in wires to the lamp-socket, and so will destroy the socket and the line-connections. Ordinary cut-out devices actuated by cessation of the current through the lamp are of no avail in this case, because the circuit through the lamp is of course maintained by the arc, and so the cut-out devices cannot act.

The object of my invention is to provide means which will break the arc immediately upon its formation, and so permit the action of devices to cut out or short-circuit the lamp.

My invention consists in the novel devices and combinations of devices employed by me in accomplishing the above-named object, as hereinafter set forth and claimed.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view, with the base in section, of an incandescent lamp, which may be employed in connection with my invention, and having a single normally idle wire; Fig. 2, a diagram of the circuits and cut-out devices used with said lamp; Fig. 3, an elevation, with the base in section, of a form of my invention in which two idle wires are used in the lamp; Fig. 4, a diagram of the connections and cut-out devices for this lamp. Figs. 5 and 6 are views of lamps with modified arrangements of the idle wires, and Figs. 7 and 8 diagrams of other forms of cut-outs.

A is the glass inclosing-globe, B the stem or inside part, and C the carbon filament, of an incandescent electric lamp. Said filament is attached to the leading-in wires *a* and *a'*, which are sealed in the glass of the stem at *b*

and extend to terminals *c c'*, attached to the base D, of insulating material. Referring now more particularly to Figs. 1 and 2, *d* is an extra or idle wire, also sealed at *b*, extending up into the lamp between the filament terminals, being preferably enlarged or flattened into a fan shape, as at *e*. The wire *d* is preferably connected to an extra terminal *f* on the lamp-base, which base is designed to be screwed into a suitable socket. (Not shown.)

1 2 is the main-line or series circuit, with which the leading-in wires *a a'* are connected, as is well understood, so that the filament is included in the circuit.

The idle wire *d* includes the coils of an electro-magnet E, and is then connected with the negative side of the lamp-circuit. Wire 2 of the main circuit is joined to a contact *g*. Wire 1 is joined to the pivoted spring-retracted armature-lever *h*, controlled by magnet E, and adapted to make and break circuit at *g* by means of a contact-point *i*, which it carries. *k* is a stop, limiting the upward movement of the lever.

The circuit in the normal operation of the lamp is from wire 1 to wire 2, by leading-in wires *a* and *a'*, and through the filament. If, however, the carbon filament breaks and an arc starts across from the positive to the negative side of the filament, such arc is intercepted by the end of the idle wire *d* and another circuit is formed, being by wire *d* through the magnet-coils E and to the negative terminal of the lamp, whereby the magnet draws down the armature-lever *h*, and the main circuit is closed at *g i*. This short-circuits the arc at once by providing a path of lower resistance for the lamp-current, and the moment the arc is short-circuited it is discontinued and will not start again. The arc being broken, the circuit through *d* is discontinued, and the lever will be withdrawn by its spring, breaking the main circuit; but now the cut-out F, placed in the additional shunt *l l*, will act. This is what is known as the "paper" cut-out, consisting of two buttons or terminals separated by a thin piece of paper, which normally permits no current to pass; but on the whole of the current being



thrown upon the shunt the paper is pierced by such current and the two contact-buttons are brought together, so that the main circuit is completed around the lamp and the other devices. This paper cut-out is an efficient one for the purpose; but any suitable electro-magnetic or other automatic cut-out may be substituted for it. However, by employing suitable locking devices for the armature-line the additional cut-out may be dispensed with, as will be presently explained. Said cut-out is, however, useful in the contingency which sometimes occurs, that the arc does not form when the filament breaks, in which case, the circuit being broken in the lamp, the paper or other automatic cut-out will act at once and short-circuit the lamp without affecting the idle wire cut-out devices.

The arrangement shown in Figs. 3 and 4 may effect the breaking of the arc with greater certainty, though the construction already described is a very efficient one. This consists of two idle wires  $d$  and  $d'$ , terminating between the filament terminals and in proximity, respectively, to the positive and negative sides thereof. Wire  $d$  extends to a terminal  $f$  and wire  $d'$  to terminal  $f'$  on the lamp-base.

The circuits outside the lamp are as follows: Wire  $d$ , which is near the positive-filament terminal, includes one set of coils on magnet E, and is connected with the negative side of the lamp-circuit. Wire  $d'$  from near the negative side of the filament includes another set of similarly-acting coils of the magnet and goes to the positive side of the lamp-circuit.

The spring-retracted armature-lever and the main-circuit contacts controlled thereby are as in Fig. 2. The same paper cut-out is also shown.

When the arc forms in the lamp, current will flow either on the extra wire  $d$  or on  $d'$ , or on both, so that the magnet E will be certainly energized, no matter in which way the arc goes, or if one wire should fail to intercept the arc the other will receive it. It will be seen that the use of two wires thus increases the certainty of action of the cut-out. When the magnet is energized, the effect is as before stated. The armature-lever is drawn down and the arc is short-circuited and ceases to pass, and then when the main circuit is broken by the spring the paper cut-out acts to shunt the lamp permanently.

In Fig. 5 the idle wire  $d$  is supported by twisting it around the positive wire  $a$ , one or both of the wires being covered with suitable insulation. In this case if the end of the idle wire within the lamp should fail to intercept the arc and the arc continues down to where the wires are twisted together it cannot fail to burn the insulation and give current to the wire  $d$ . Any one of the forms of cut-out for one idle wire therein described may be used with this form of lamp.

If two idle-wires are used, they may each be twisted around one of the lamp-wires  $a$   $a'$ , as shown in Fig. 6. In this figure the ends of the idle wires are formed into coils or spirals  $o$   $o$ , which encircle without touching the ends of the filament, so that the arc is sure to reach them. It is evident that when one idle wire is used it may be coiled around one end of the filament in the same manner. It is also evident that any one of the forms of cut-out devices described herein for two idle wires may be used with the lamp of Fig. 6.

In the form of cut-out illustrated in Fig. 7 the coils of the magnet E are in a circuit joining the two idle wires  $d$   $d'$ , such wires not being connected to the lamp-wire terminals. The effect is that when the arc passes across the filament it will also pass from the end of  $d$  to the end of  $d'$ , and current will therefore flow through these wires and energize the magnet, so as to close the main circuit around the lamp and short-circuit both the arc and the lamp. A locking device  $p$  is here shown for locking the lever down and keeping the main circuit closed, and the paper cut-out F may therefore be dispensed with. I may, however, provide it, as shown, so that, as before explained, the contingency of the non-formation of the arc when the filament breaks is guarded against.

The cut-out of Fig. 8 is the same as that of Fig. 7, except that an additional coil, forming part of the main circuit 1 2, is placed on the magnet E. This coil after the arc is broken keeps the main circuit closed, so that the locking device  $p$  might be dispensed with. I prefer to use it, however, so that when the line is broken at any other point or the supplying-generators are stopped the circuit is still closed here. When the broken lamp is replaced by a new one, the locking device is released by hand and the parts resume their original positions. The main-line coils around the magnet may evidently be used with the other arrangements of circuits from the idle wires hereinbefore described.

I do not claim as my invention, broadly, an incandescent electric lamp provided with a normally idle wire extending between the sides of the looped filament, in combination with cut-out devices operated by the passage of an abnormal current in said idle wire.

What I claim is—

1. An incandescent electric lamp provided with two normally idle wires extending between the sides of the looped filament, in combination with cut-out devices operated by the passage of an abnormal current in either or both of said wires, substantially as set forth.

2. An incandescent electric lamp provided with a normally idle wire situated between the terminals of the filament and connected outside the lamp with one of the terminals, in combination with an electro-magnet in the circuit thus formed, a cut-out switch in the main or supplying circuit controlled by said



magnet, and an additional shunt around the lamp containing an automatic cut-out, substantially as set forth.

3. An incandescent electric lamp provided with a normally idle wire situated between the sides of the looped filament, cut-out devices operated by the passage of an abnormal current in said wire, and an additional shunt around the lamp containing an automatic cut-out, substantially as set forth.

4. An incandescent electric lamp provided with two normally idle wires, both extending between the sides of the looped filament and

each connected outside the lamp with one of the lamp-wires, in combination with an electro-magnet having two sets of coils, one in the circuit of each of said idle wires, and a cut-out switch in the main circuit controlled by said magnet, substantially as set forth.

This specification signed and witnessed this 19th day of April, 1887.

MONTGOMERY WADDELL.

Witnesses:

JOS. F. WITMER,  
J. M. ESTEP, Jr.