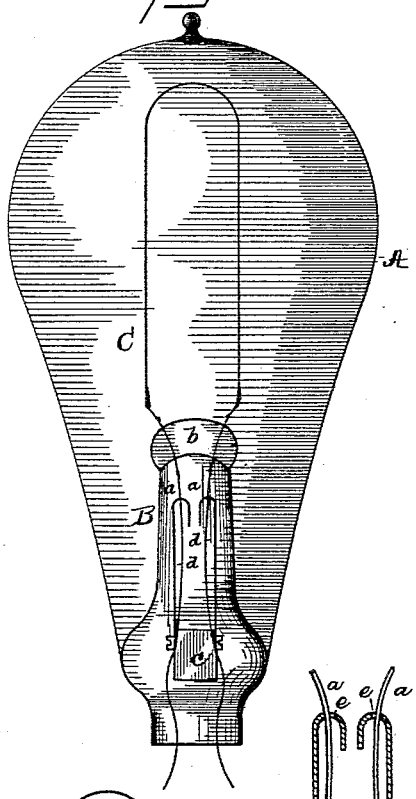
(No Model.)

T. A. EDISON.

INCANDESCENT ELECTRIC LAMP.

No. 476,530. Patented June 7, 1892.

Fig. 1.



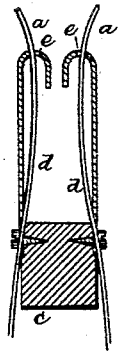
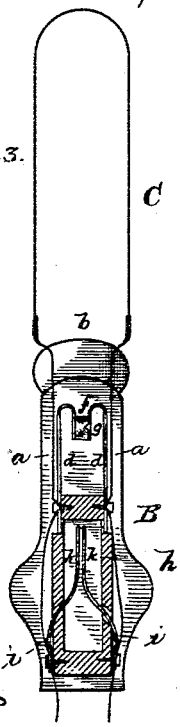


Fig. 2.

Fig. 3.



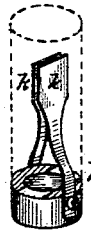


Fig. 4.

ATTEST:

E. C. Goodwin.

William Pfyer

INVENTOR:

Thomas A. Edison

By Dyer & Tibbey

Attys.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

INCANDESCENT ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 476,530, dated June 7, 1892.

Application filed June 4, 1887. Serial No. 240,200. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Incandescent Electric Lamps, (Case No. 722,) 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 electro-motive force. When lamps are so used, difficulty has arisen from the breaking of the carbon filament of a lamp and the consequent opening of the series circuit and extinguishing of all the other lamps. Ordinary electro-magnetic cut-out devices are of no avail to prevent this, because when the filament breaks a powerful arc usually forms across its terminals, which follows down the leading-in wires to the lamp-socket, and finally destroys the socket and the cut-out devices and breaks the circuit. Various cut-out devices have been proposed to obviate this difficulty, which would be operated by the breaking of the filament or by the effect of the arc. One such device is set forth in the joint application of myself and John F. Ott, filed October 27, 1886, Serial No. 217,314, in which a spring adapted to bridge the wires in the lamp-neck was normally held out of contact by a conducting-thread of high resistance, which when the arc reached it would be consumed and would permit the spring to bridge the wires, and so break the arc and cut out the lamp. This cut-out was also designed to act in the contingency, which sometimes arises, of the breaking of the filament without the formation of the arc, in which case the thread, which was of such high resistance that normally practically no current would be conveyed by it, would receive current due to the rise of potential, consequent on the breaking of the filament, and such current would destroy the thread and permit the spring to bridge the wires. This construction has sometimes been found ineffective on account of there being always an electrical connection through the conducting-thread between the lamp-wires, which it is very difficult to make of just the right resistance to convey no current when the lamp is in operation and to convey enough to destroy it when the filament breaks.

To remedy this is the object of my present invention, and to this end I employ in the stem of the lamp spring parts normally entirely insulated from each other and held mechanically apart by a destructible fastening, which will be so affected by the arc as to release such parts and permit them to make a contact, short-circuiting the lamp. Such device, however, being arranged to be affected by the arc, will not act when the arc does not form upon the breaking of the filament. It is therefore preferable to employ an additional cut-out device operating to short-circuit the lamp by the breaking of the circuit within the lamp. Any suitable electro-magnetic or other cut-out such as are well known may be used for this purpose. I have, however, devised a simple and convenient form, which is placed within the stem of the lamp and which forms a feature of my present invention. This consists generally of two metal plates placed very close together, but not touching each other, in the lamp-stem, and each connected with one of the wires therein. These plates thus become charged with electricity; but in the normal operation of the lamp the difference of potential between the plates is not sufficient to cause such an attraction between them as to make them approach each other. When, however, the circuit through the lamp is opened by the breaking of the filament, the rise in potential upon the wires causes the plates to be attracted together, so as to come in contact and short-circuit the lamp.

My invention is illustrated in the accompanying drawings.

Figure 1 is a view in elevation of an incandescent electric lamp containing the cut-out actuated by the arc; Fig. 2, a section of said cut-out; Fig. 3, a view of the stem of a lamp containing the two cut-outs, the arc cut-out being a modification of that in Figs. 1 and 2; Fig. 4, a perspective view of the plates of the second cut-out and of a section of their supporting-block.

Referring first to Figs. 1 and 2, A is the glass inclosing globe of an incandescent electric lamp.

B is the glass stem or wire-support through which the wires *a a'* pass, which are sealed in the glass of the end of the stem at *b* and are joined within the globe to the ends of the carbon filament C.

Within the neck or stem B is placed a block *c*, of insulating material, supported by the wires *a a'*.

Attached to the sides of the block *c* are two springs *d d*, which extend up toward the top of the stem and are bent over toward each other, but so as to be well insulated from each other by the air-space between them. These springs have small apertures at *e e*, through which the wires *a a* pass. The wires thus hold the springs apart. When the filament breaks and the arc forms across it, the arc proceeds down the wires and through the glass at *b*, and as soon as the wires are released by being consumed below the glass the springs come together and complete a short circuit across the wires, whereby the arc is stopped and the series circuit is completed through the remaining lamps therein.

Instead of having the springs insulated from each other by the air-space only, I may place between them a material which will be so affected by the arc that it will permit them to come together. This is illustrated in Fig. 3, where *f* is a small block of asphalt or other suitable material, which will be melted or softened by the heat as the arc approaches it. This block is placed between the springs *d d*, and thus forms another form of destructible fastening which holds them apart. It is therefore unnecessary to pass the wires through the springs as in the other form, and the wires are therefore brought up outside, the springs being connected to them at the supporting-block. I may provide one of the springs with a sharp projecting point *g*, penetrating the asphalt block. When the arc forms and proceeds down the wires, the softening and melting of the asphalt or similar material by the arc's heat permits the springs to come together. When the point *g* is used, the springs will begin to come together as soon as the asphalt begins to soften, for the point will gradually force its way through the softening material.

The cut-out, which acts when the filament breaks and the arc does not form, is shown in Figs. 3 and 4. Instead of the small block *c* a hollow cylindrical block of insulating material *h* is placed in the lamp-stem. To the outside of this block, at its lower end, are attached two springs *i i*, which pass through the sides of the block and terminate in flat plates *k k*, situated close together, but not in contact within the block. The wires *a a* are connected with the springs, respectively, at the lower end of the block. The plates *k k* thus become electrically charged; but with the comparatively low difference of potential which exists across the wires when the filament is in circuit the charge is not sufficient to cause the plates to move toward each other. If, however, the filament breaks and the arc does not form across it, so that no effect is produced upon the upper cut-out, the difference of potential between the plates is so greatly increased that they attract each other sufficiently to be drawn together and so produce a short circuit of the lamp. The two plates will remain in contact, because any tendency to separate will cause an arc across their surfaces, which will fuse them together. When the arc forms across the filament upon its breaking, the lower cut-out is not affected. It will be seen that I thus provide for both the contingencies which occur in the operation of lamps in series and that I do so by simple and compact devices, all located in the stem of the lamp.

What I claim is—

1. In an incandescent electric lamp, the combination of contacts in co-operative relation, one being a spring, situated in the stem of the lamp, connected with one wire and having an opening through which said wire passes and substantially parallel with said wire, whereby the spring is normally held away from the other contact, which is connected to the other side of the circuit, whereby upon destruction of said wire the spring is allowed to make contact with the other side of the circuit, substantially as described.

2. In an incandescent electric lamp, two springs situated in the stem of the lamp and each connected with one of the wires therein, being substantially parallel thereto and having openings through which said wires pass, the wires normally holding said springs out of contact with each other, whereby upon the destruction of said wires the springs will make contact with each other, substantially as described.

3. The combination, in an incandescent lamp, of two cut-out springs in the neck of the lamp, connected to opposite leading-in wires, said springs being bent toward each other at one end to form adjacent contact-surfaces and being perforated, the wires passing through said perforations and holding the springs apart, substantially as described.

4. In an incandescent electric lamp, the combination, with the wires leading to the filament, of two metal plates, each connected with one of said wires and situated with their surfaces near together, whereby such plates are mutually attracted by their electrification, substantially as set forth.

5. In an incandescent electric lamp, the combination, with the leading-in wires, of a spring cut-out situated in the neck or stem of the lamp, composed of parts normally insulated from each other and constructed to be released and come into contact with each other to bridge said wires by the passage of

an arc down said wires, and two metal plates, each connected with one of said wires and situated with their surfaces near together, so as to be mutually attracted by their electrification, whereby the lamp is cut out when the arc does not form upon the breaking of the filament, substantially as set forth.

This specification signed and witnessed this 1st day of June, 1887.

THOS. A. EDISON.

Witnesses:
WILLIAM PELZER,
E. C. ROWLAND.