(No Model.) 2 Sheets—Sheet 1.

W. J. JENKS.

ELECTRICAL CUT-OUT.

No. 428,564. Patented May 20, 1890.

Fig. 1.

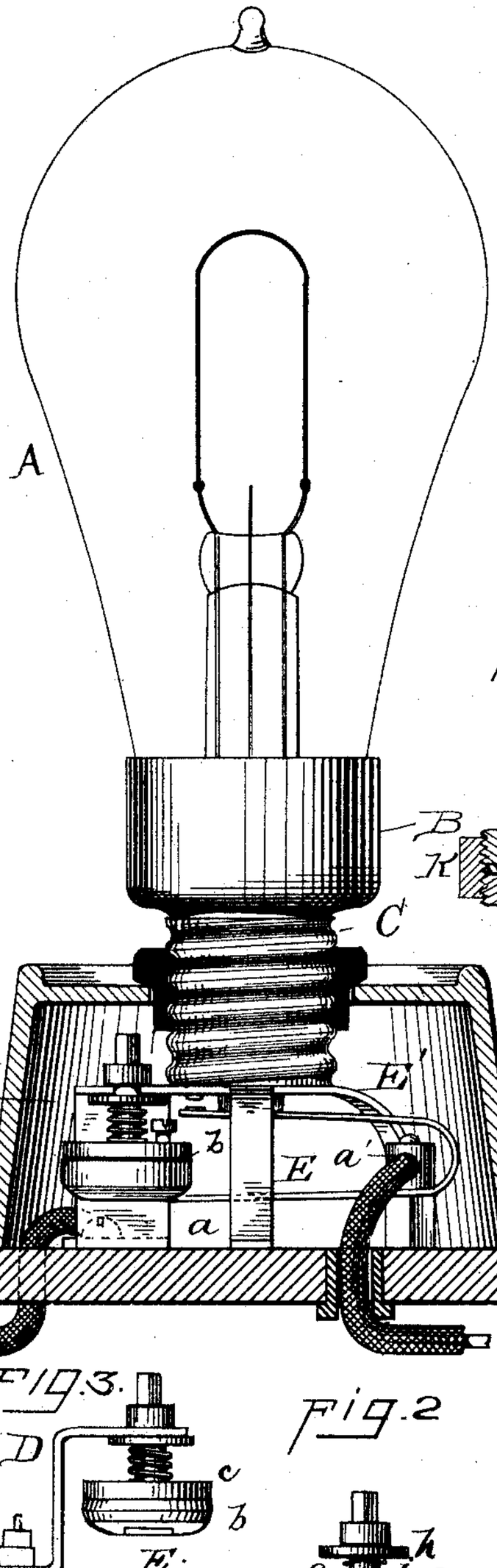

Fig. 8.

Fig. 4.

Fig. 5.

Fig. 7.

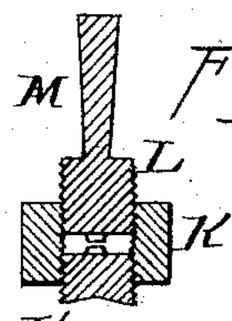

Fig. 6

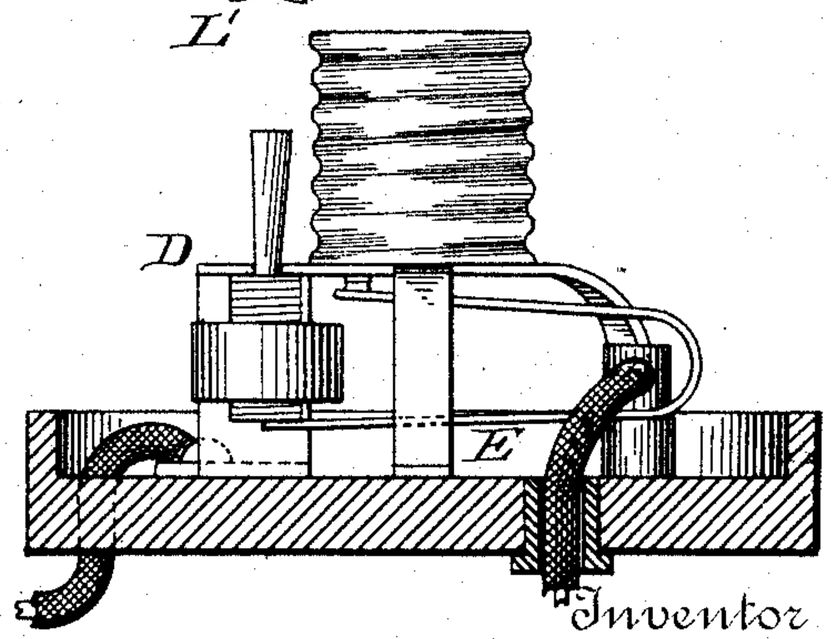

Fig. 3.

Fig. 2

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 9

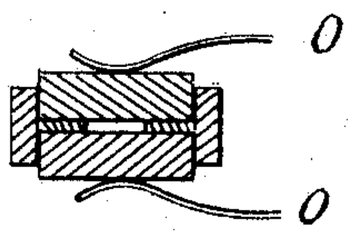


FIG 10.

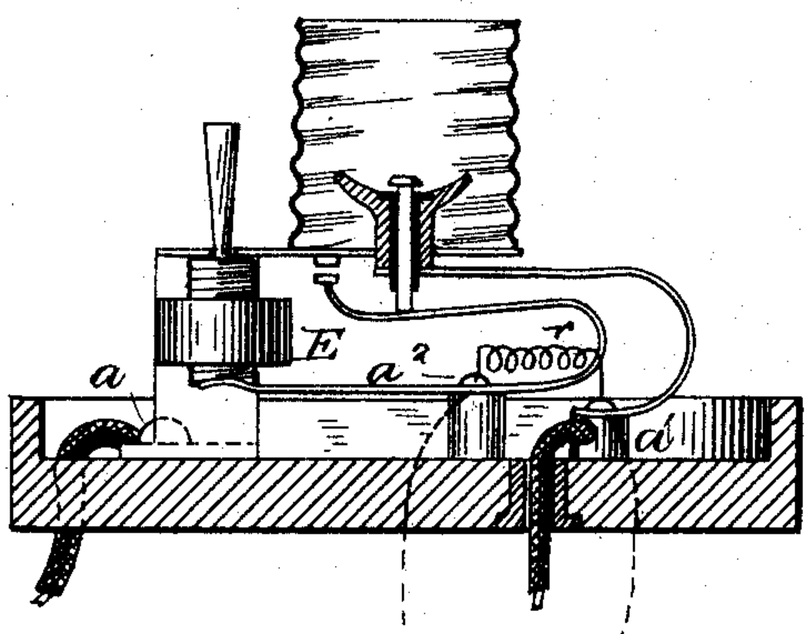


FIG 11

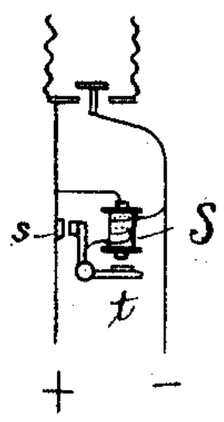
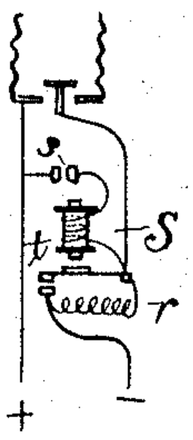


FIG. 12.



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UNITED STATES PATENT OFFICE.

WILLIAM J. JENKS, OF NEW YORK, N. Y.

ELECTRICAL CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 428,564, dated May 20, 1890.

Application filed December 10, 1888. Serial No. 293,193. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. JENKS, a citizen of the United States, residing at New York city, in the county and State of New York, have invented a certain new and useful Improvement in Electrical Cut-Out Devices, of which the following is a specification.

My invention relates to cut-out devices whose object is to close a shunt-circuit around an electrical device of any character—such as an incandescent electric lamp—upon the occurrence of an abnormal increase of resistance in such electrical device or of difference of potential between the terminals thereof.

More especially my invention relates to that character of cut-outs in which two electrical conducting-surfaces are employed, which are separated by a slight air-space, across which the current passes as a disruptive discharge when the resistance of the electrical device to be protected or the difference of potential between its terminals is abnormally increased, whereby, as I have found, when the said surfaces are placed at the right distance apart, a sufficient metallic connection is formed between such surfaces to affect the closing of the shunt around such device in which such surfaces are placed. With incandescent electric lamps the cut-out comes into use usually upon the rupture of the filament, and sometimes in the case of a lightning-discharge on the line. In arc lamps the breaking of a carbon or any abnormal lengthening of the arc will bring the cut-out into use; or, with instruments like telephones and telegraphic instruments, the cut-out may be used as a protection for such instruments under the rise of potential due to discharges of atmospheric electricity or to contact with circuits carrying high potential currents. I believe the electrical joining of the surfaces when an abnormal difference of potential occurs between them to be due to the carrying of metallic particles between them, which form a bridge of metal connecting them together. At any rate the result of the operation of the cut-out is that a bridge of metal is formed between the two surfaces sufficient to produce a short circuit of the lamp or other device. The cut-out may be employed to merely close a low-resistance shunt around the lamp; or the shunt may include another lamp or a resistance equivalent to that of a lamp.

The main object of my invention is to protect the air-space of the cut-out from the entrance of moisture and of dust or other foreign substances which might cause a circuit to be formed between the cut-out terminals or might form an insulating layer between them, and by thus altering the electrical conditions may change the potential at which the cut-out will act, for by lowering the resistance of the air-space the discharge may be made to occur at a less difference of potential than that previously determined upon, and so the lamp may be prematurely short-circuited; or by increasing the resistance of the space the action of the cut-out at the required time may be prevented. For these reasons it is exceedingly desirable in this class of cut-outs to protect the air-space from the entrance of any foreign material, and I accomplish this by placing the air-space within a moisture-proof inclosure, the inclosing-wall being also preferably of a non-combustible and non-carbonizable material.

Another object is to cause the cut-out surfaces to be positively held at the distance apart to which they are adjusted, and I accomplish this by placing between such contact-surfaces insulating material which holds such surfaces positively apart at the required distance, but which is not continuous between the cut-out surfaces, an air-space being left between them at some point or points at which the connection is made when the cut-out operates. In some cases this separating insulation forms also the wall inclosing the air-space. I prefer, however, to employ in addition a closely-inclosing wall of material around the space between the contact-surfaces. This prevents any arc which may be formed between the surfaces from leaving such surfaces, so that such arc is confined to the inclosed space, and no damage can occur from it. Furthermore, if fusion of the metal occurs, the molten metal is not allowed to escape from the space where it is formed. The inclosing-wall is usually a sleeve or ring of non-combustible material in which the two

metal plates are inserted, and which serves to maintain said plates in the position in which they are placed.

In addition to these features my invention consists in other novel devices and combinations of devices employed by me to produce a simple and effective cut-out of the character referred to, as hereinafter described and claimed.

My invention is illustrated in the accompanying drawings.

Figure 1 illustrates an incandescent electric lamp provided with a form of cut-out embodying my invention. Fig. 2 is a vertical section of the cut-out of Fig. 1; Fig. 3, a side elevation of the same. Fig. 4 is a top view, and Fig. 5 a side elevation, of a lamp-socket of a different character provided with another form of cut-out. Fig. 6 shows a lamp-socket like that of Fig. 1, but with still a different form of cut-out. Fig. 7 is a vertical section of this form of cut-out, and Fig. 8 is a vertical section of still another modification of the cut-out. Fig. 9 shows a cut-out in which the parts are held by spring-pressure. Fig. 10 illustrates an arrangement for throwing into circuit an equivalent resistance or another lamp, and Figs. 11 and 12 are diagrams illustrating further modifications of the invention.

Referring first to Figs. 1 and 2, A is an incandescent electric lamp of the kind now commonly used in series with others, and this lamp is set in a socket B. The socket B has a screw-threaded metal sleeve C, in which the lamp is screwed. The wire 1 entering the socket is connected to a binding-post *a*, inserted in the base of a metal standard D, the upper end of which is bent over and connected with the base of the sleeve C. The opposite wire 2, which enters the socket, is connected to a binding-post *a'*. From this binding-post there extends a bent spring, the lower portion E of which forms the lower support for the cut-out, while the upper portion E' extends beneath the sleeve C, and is connected in the usual manner with a plate inside of said sleeve and insulated from said sleeve, with which the bottom plate of the lamp-base makes contact when the lamp is inserted. The normal circuit through the lamp, therefore, is from wire 1 and binding-post *a* through standard D to sleeve C, which is joined to one terminal of the lamp, and from the other terminal through spring E' to binding-post *a'* and wire 2.

The cut-out device consists of a metal plate *b*, having a slot in its bottom, in which the spring E rests. Above the plate *b* is another metal plate *c*, having an internal recess or chamber and separated from the plate *b* at its edges by a thin annular or perforated washer *d*, made of mica or any other suitable insulating material, preferably one which is impervious to moisture, non-combustible, and non-carbonizable. A small screw *e* sets through the plate *c* nearly into contact with the plate *b*. The two plates *b c* are connected positively together mechanically by a screw *f*, insulated from the plate *b*, and entering a stem *g*, secured in the plate *c*. The stem *g* has a flange *h*, and between this flange and the plate *c* a light spiral spring *i* is coiled on the stem. The flange *h* is loose on the stem, and above this flange the stem passes through an aperture in the standard D, so that the spring holds the cut-out in position between the standard D and the spring E. Thus, except for the air-space between the point of the screw *e* and the surface of the plate *b*, there would be a shunt-circuit around the lamp from binding-post *a*, through standard D, the cut-out, and spring E, to binding-post *a'*. If the circuit within the lamp is broken by the rupture of the filament of the lamp, the increased difference of potential between the lamp-terminals causes current to pass between the screw *e* and the plate *b*, and this current I find produces a building up of metallic particles between the screw and the filament, which makes a connection between them sufficient to carry the whole current and short-circuit the lamp. I prefer to adjust the screw *e* to a distance of about three one-thousandths of an inch from the plate *b*, when the cut-out is to be used with the current employed with series lamps in the Edison series system, where the normal potential is about twelve hundred volts and the current about three to four ampères; but with other potentials and other ampères the distance may be made greater or less, as may be required. When the short circuit has been formed and it is required to use the cut-out again, the plate *c* may be turned on the screw end of stem *g* so as to bring the screw *e* opposite another point on the surface of the plate *b*. It will be seen that the air-space of the cut-out is within a moisture-proof and dust-proof inclosure, so that no moisture or other foreign substances which would interfere with the working of the cut-out can enter the space. The moisture-proof inclosing of the cut-out also removes or lessens to a great degree the danger of the opposing surfaces becoming oxidized, and in that way insulated to a greater or less extent from each other. There is also no danger of any arc which may form between the terminals of the cut-out setting fire to any part of the apparatus, since such arc would be completely inclosed by the washer placed between such terminals.

The socket shown in Fig. 1 is one intended for outdoor use, its parts being joined together by tight joints, which prevent moisture from entering it.

The form of socket shown in Figs. 4 and 5 is a socket for indoor use, and I have also shown in these figures a different form of cut-out from that in Fig. 1. In this socket one side of the circuit to the lamp is through the spring F, with which the bottom terminal of the lamp engages, and the other side is through a metal plate G, connected with the screw-threaded sleeve C of the socket. A

metal plate H, electrically connected with the spring F, is secured to the bottom of the socket, and such plate has a free end I, which is raised from the bottom of the socket and overlaps the end of plate G at some distance above it.

Upon the plate G is set a washer *k*, made of mica or other suitable insulating material, which has a hole through its center, and upon the top of the washer *k* is set a metal plate *l*, held by a screw *m*, passing through the raised end I of the plate H. The plate *l* is thus set down firmly against the washer *k*, there being left between plates *l* and plate G an inclosed air-space where the washer *k* is perforated. The operation of this cut-out is as already explained, the increased difference of potential between the lamp-terminals caused by the rupture of the filament causing current to pass between the plate G and the plate *l* and short-circuiting the lamp at this point. The distance between the plates is gaged or adjusted, according to the different conditions under which the cut-out may be used, by the thickness of the washer between them.

The cut-out shown in Figs. 6 and 7 is held in the same way as that in Fig. 1—between spring E and standard D. It consists, simply, as shown in Fig. 7, of a sleeve K, made preferably of moisture-proof, non-combustible, and non-carbonizable insulating material and screw-threaded on its inner surface, into which sleeve are screwed two metal plugs L and L′, which have platinum contact-points, which are adjusted so as to almost but not quite meet. The plug L has a handle M for turning it, so as to screw it into sleeve K the right distance. This cut-out, being arranged and connected as illustrated in Fig. 6, operates as before described, the current passing across the inclosed air-space between the platinum points to short-circuit the lamp.

In the form of cut-out just described there is no positive insulating body for holding the contact-surfaces apart. While this construction may be employed, I prefer to employ such interposed insulating material, and a cut-out of similar form containing this feature is illustrated in Fig. 8. The plugs L and L′ are screwed into the sleeve K against a washer *n* of insulating material, which has an aperture. In this case the contact-surfaces have no projecting points, but the operation is the same as before, the current passing across the air-space formed by the aperture in the washer *n*. The washer *n* is preferably of mica, although in this case, as well as in others where the washer is completely inclosed, it may be made of paper or of silk or other fabric.

In this cut-out, as well as in that shown in Fig. 5, instead of a washer with a hole formed in it, I may employ as material for the washer a fabric—such as silk bolting-cloth—which has an open mesh, the meshes of the fabric being sufficient to form the air-space for the passage of the current, while the material itself holds the metal surfaces positively apart.

In the arrangement shown in Fig. 9, instead of the parts being screwed together, they are held by the pressure of springs O O.

It will be seen that in all the forms of cut-outs shown the air-space is entirely inclosed, as already stated, and that in nearly all the forms the surfaces are held positively apart by interposed insulating material, which material is, however, not continuous between such surfaces, but is perforated or partially removed in any way, so that an opening forming an air-space is always left at some point between them.

In the form shown in Fig. 10 an additional binding-post a^2 is provided, and a resistance-coil *r* (or, as shown in dotted lines, an auxiliary lamp) is connected between binding-posts a^2 and a'. Spring E is connected with binding-post a^2, and a separate spring extends from binding-post a' to the bottom terminal of the lamp. It will be seen that when the cut-out operates the resistance-coil or the lamp will be thrown into the shunt-circuit.

In Fig. 11 the air-space cut-out *s* is shown as controlling the circuit of an electro-magnet S, which when energized closes at *t* another shunt around the lamp, which includes the coils of the magnet, and remains closed without relation to the air-space cut-out.

In Fig. 12 the magnet S throws the resistance-coil *r* into shunt-circuit.

In some cases—as in telegraphy—the surfaces of the air-space cut-out may be adjusted to such a distance apart that no metal is carried across and no bridging occurs, so that there is still an open circuit when the lightning-discharge is past.

What I claim is—

1. The combination, with an incandescent electric lamp, of a cut-out therefor consisting of two conducting-surfaces separated by an air-space, each electrically connected with one side of the lamp-circuit and held rigidly at such a slight distance apart that such air-space will be bridged by a metallic connection upon the occurrence of a disruptive discharge upon the rupture of the lamp-filament, and an inclosing-wall of material surrounding such air-space and limiting the same to the space between said surfaces, substantially as set forth.

2. In an electrical cut-out, the combination, with two opposed conducting-surfaces situated in close proximity to each other, of interposed insulating material maintaining said surfaces positively apart and having an opening through it, substantially as set forth.

3. In an electrical cut-out, the combination of two opposed conducting-surfaces placed in close proximity to each other, and a washer of insulating material between them having an opening through it, substantially as set forth.

4. In an electrical cut-out, the combination

of two conducting-plates in close proximity to each other, a layer of insulating material between them having an opening through it, and a screw passing through one plate nearly into contact with the other plate, substantially as set forth.

5. The combination, with an incandescent electric lamp, of a cut-out consisting of two conducting-surfaces rigidly held a determined distance apart, one connected with each side of the lamp-circuit and having an air-space between them, an electro-magnet in the circuit of said cut-out, and a shunt-circuit containing a resistance controlled by said magnet, substantially as set forth.

6. In an electrical cut-out, the combination of two bodies having conducting-surfaces in close proximity to each other, but with an air-space between them, of a wall of insulating material surrounding the air-space between said bodies and in contact with said bodies, so that a confined space limited to said surfaces is formed.

7. In an electrical cut-out, the combination of a ring or sleeve and two bodies having conducting-surfaces inserted in said ring or sleeve at opposite ends thereof, with their surfaces facing and in close proximity with each other, but with an air-space between them, substantially as set forth.

8. In an electrical cut-out, the combination of two screw-threaded bodies having opposed conducting-surfaces in close proximity to each other, but with an air-space between them, and a screw-threaded ring or sleeve in which both said bodies are inserted, substantially as set forth.

9. In an electrical cut-out, the combination of two conducting-surfaces in close proximity to each other, a washer of insulating material between said surfaces having an opening through it, whereby the space between said surfaces is determined, and means for holding said surfaces in position, substantially as set forth.

10. In an electrical cut-out, the combination of two bodies having conducting-surfaces situated in close proximity to each other, a washer of insulating material between said surfaces having an opening through it, and a ring or sleeve around said bodies for holding them in position, substantially as set forth.

11. In an electrical cut-out, the combination of two metal plates placed close together, an insulating-washer between them having an opening through it, and an insulating ring or sleeve around said plates for holding them in position, substantially as set forth.

This specification signed and witnessed this 27th day of November, 1888.

WILLIAM J. JENKS.

Witnesses:

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