(No Model.)

2 Sheets—Sheet 1.

W. R. WHITE.

THERMAL CUT-OUT.

No. 438,394. Patented Oct. 14, 1890.

Fig: 1.

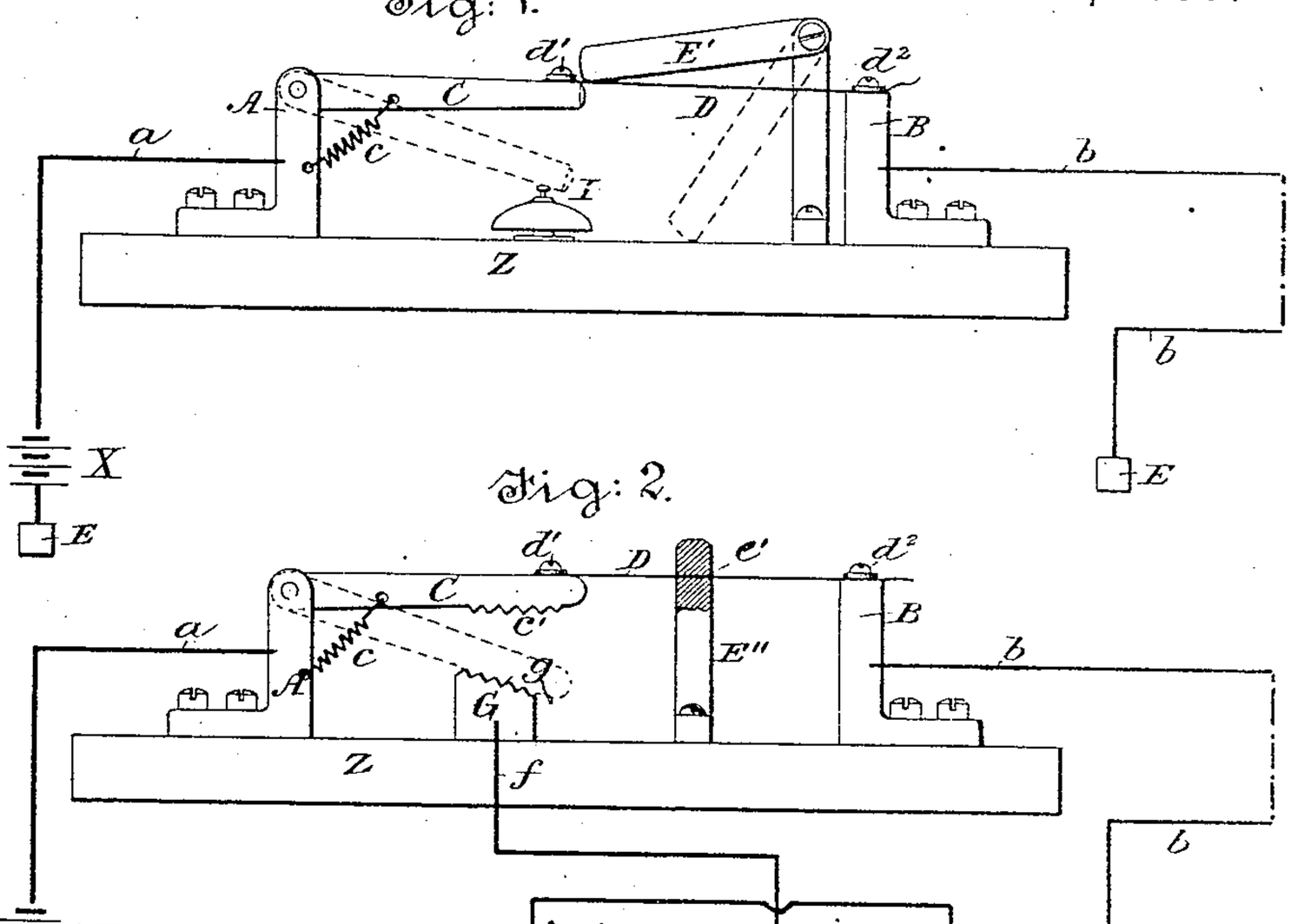
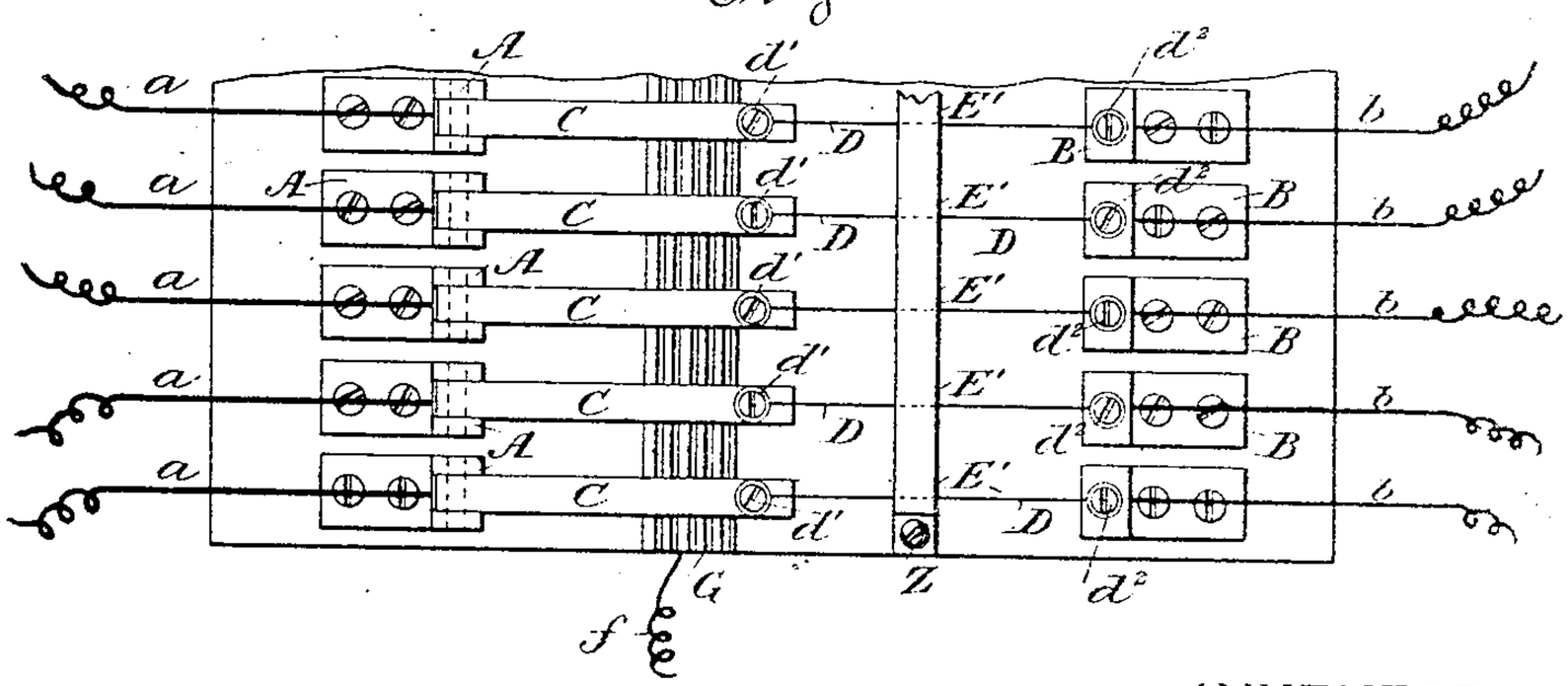


Fig: 2.

Fig: 3.



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No Model.)

2 Sheets—Sheet 2.

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THERMAL CUT-OUT.

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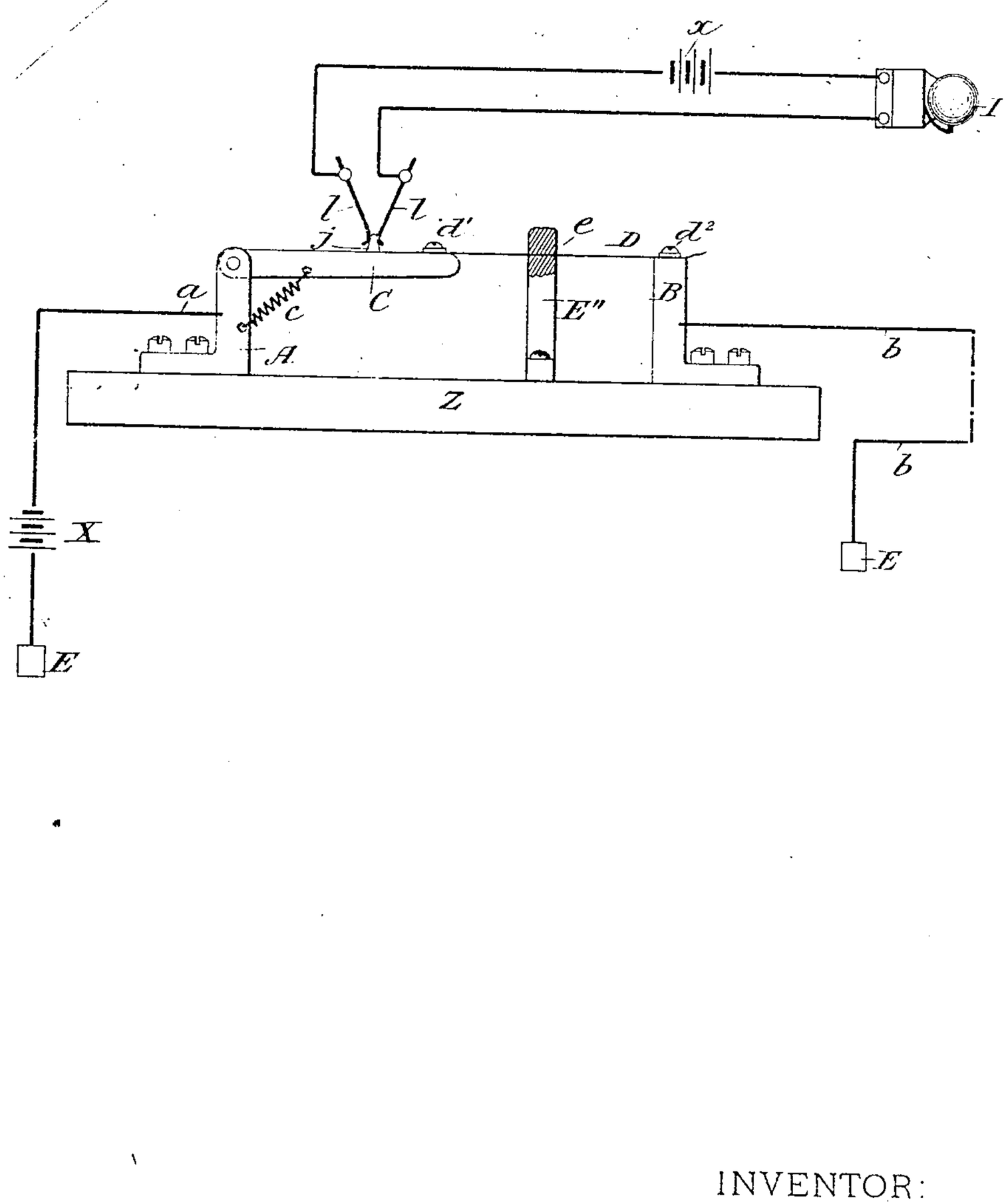
Fig: 4.



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UNITED STATES PATENT OFFICE.

WILLIAM R. WHITE, OF HARTFORD, CONNECTICUT.

THERMAL CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 438,394, dated October 14, 1890.

Application filed January 10, 1890. Serial No. 336,593. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM R. WHITE, a citizen of the United States, residing at Hartford, Hartford county, Connecticut, have invented certain Improvements in Automatic Cut-Outs for Grounded or Defective Low-Tension Electrical Conductors, of which the following is a specification.

My invention relates to that class of devices designed to detect so-called "groundings" in electric low-tension circuits—such as telegraph or telephone wires—caused by the crossing of the conductors of such circuits by conductors carrying high-tension currents of electricity, such as electric lighting and motor currents.

The object of my invention is, in part, to provide a simple and effective device whereby when such grounding or crossing occurs the high-tension current will instantly cut out or break the telephone or other low-tension circuit, and in part, also, to sound an alarm simultaneously, so that the attendant or operator may be immediately warned, and thus enabled to repair the circuit at once. Such grounding or crossing often gives rise to serious accidents to telegraph-operators and linemen, as well as to persons using the telephone, especially in large cities where the various wires become netted and massed together, and the insulation of the high-tension conductors becomes impaired and worn away by the chafing and swaying of the wires. Many serious accidents have been caused by this crossing of wires, and destructive fires are sometimes caused by the heating of a low-tension conductor by a high-tension current.

In order that my invention may be the better understood, I have illustrated in the accompanying drawings several embodiments thereof, which I will now describe.

In the drawings, Figure 1 is a side elevation of the more approved form of my device. Fig. 2 is a side elevation, similar to Fig. 1, illustrating another embodiment of my invention, which will be hereinafter described. Fig. 3 is a plan of the device shown in Fig. 2. Fig. 4 is a side elevation, similar to Figs. 1 and 2, illustrating another embodiment of my invention.

All of these views are of a somewhat diagraphic character.

In the drawings, A and B are two metallic posts or brackets, preferably mounted on a base Z of wood and connected, respectively, with the line-conductors *a* and *b* of a low-tension circuit, such as a telephone or telegraph circuit, the conductor *a*, in the case of a telephone-circuit, leading through a generator located at the instrument indicated by X to a ground-plate E, and the conductor *b* leading to the street-line and onto the central, where it also terminates in a ground-plate E, the earth between these plates E forming the return-conductor in the usual manner.

In the head of the post A is pivoted a lever C, preferably connected thereto by a coiled copper wire *c* in the nature of a spring, which serves to provide a positive electrical connection between post A and lever C, shunting the current around the joint or pivot, where it might otherwise be broken.

Between the free end of the lever C and the head of the post B is stretched a fine strip or wire D of copper or other easily-fusible metal, secured at its ends by means of screws d' d^2, set, respectively, in the free end of lever C and the head of post B.

In order to assure the breaking of the circuit immediately on the crossing of the line-conductor by an electric-light or other high-tension conductor, and to break the arc formed between the terminals C and B at the instant the circuit is broken, and to prevent sparking between said terminals, I mount in the casing inclosing the device a pivoted partition or shutter E′ of some suitable non-conducting material, as glass, porcelain, &c., preferably equal in width and height to these dimensions of the inclosing-case, said shutter being so arranged that its free end bears on the conductor D, and in case this conductor should soften under the influence of the high-tension current and not be actually broken by fusion the weight of the shutter E′ bearing thereon will serve to break it, thus opening the circuit. Lever C, being now released, falls by its weight, and the shutter, now unsupported, falls, assuming the vertical position seen in dotted lines in Fig. 1, thus

breaking the arc formed and effectually preventing sparking between the lever C and post B. Now in case the line-wire becomes crossed by a grounded high-tension conductor the current will flow along wire *b*, for example, through post B, wire D, lever C, wire *c*, and post A to wire *a*, and thence to the earth, heating the alternated conductor D, which will be fused by the heat generated by the passage of the current or by the weight of shutter E', as before described. The conductor being thus broken and the terminals of the circuit insulated from one another, no current can pass through the line, and hence there can be no shock received by a person at the telephone or other instrument, and in case the device is within a "loop" or short circuit of a high-tension by a low-tension conductor the lineman repairing the circuit cannot receive a shock, as the short circuit will be broken at once.

In order that the subscriber or attendant may be warned immediately of the break in the circuit, I prefer to provide an audible signal of any kind, that the fault may be detected and the circuit repaired, and in the accompanying drawings I have shown two of these audible signals—namely, that of Fig. 1, adapted for a device to be mounted within the casing of a telephone-instrument at the subscriber's end, and the device of Fig. 2, adapted for a central telephone-station or large telegraph-line station.

In Fig. 1 I have shown a gong I, of any suitable kind, mounted on the base Z under the end of the pivoted lever C, whereby when the conductor D is broken the said lever C, falling on the gong, will sound the same and warn the subscriber.

In Fig. 2 I have shown an arrangement in all respects similar to that shown in Fig. 1 but varying slightly in the form of some of the parts. For instance, in the arrangement shown in Fig. 2 the pivoted shutter E' of the device of Fig. 1 is replaced by a stationary or non-falling shutter E'', fixed to the base Z and provided with apertures *e'* for the passage of the conductor D. This shutter performs the same function as the pivoted shutter of Fig. 1, except that it exerts no strain on the conductor D. However, this pressure of the shutter on the conductor is not of great importance, as a very moderate increase in tension of the passing current will suffice to fuse the fine wire that will be usually employed. The shutter E'' of Fig. 2 prevents sparking between the terminals of the broken circuit, inasmuch as the aperture *e'* is very small and does not permit of the passage of a current of air sufficient to admit of such sparking.

In Fig. 2 I have shown an arrangement wherein an electric bell I' is substituted for the mechanical gong I. (Shown in Fig. 1.) In this view the lever C is provided with a series of teeth or serrations *c'* on its under side, which when the lever falls, wire D being severed, engage with a series of serrations *g* on a contact-piece G, arranged directly under said lever. From the contact-piece G a wire *f* leads to the coil of an electro-magnet F. In one of the arms of this magnet at F' is pivoted an armature-lever H, bearing an armature H'. A small leaf-spring *h*, secured to the magnet, holds the armature raised just above the other arm or pole F^2 of magnet F. On the upper face of the armature-lever H' is a small pin or cone *j* of insulating material, which, when the armature is upheld by the spring *h*, presses apart two spring-fingers *l l* which latter form the terminals of an electric bell-circuit, also including a generator *x*. Now when lever C falls to the position seen in dotted lines in Fig. 2 the current will flow from wire *a* through post A, lever C, contact-piece G, wire *f*, and coil of magnet F to wire *i*, leading to the ground or to the other terminal of generator X. The passage of this current through the coil of magnet F will draw down the armature H', thus withdrawing the insulating finger or pin *j* from between the spring arms or fingers *l l*, which immediately close together, thus completing the bell-circuit of which they are terminals. By lifting the lever H and throwing it back the bell-circuit may be broken and the bell stopped.

In Fig. 3, which is a plan of the device shown in Fig. 2, I have shown the arrangement preferred for use in a central telephone-station or large telegraph-station, where many lines of conductors center. This consists of a series of levers C, mounted in posts A and provided with conductors D, stretched to posts B, each set of parts being insulated from the others. Each lever and set of posts corresponds to a circuit, and are in the same, so that the fusing or breaking of the alternated conductor D in either circuit breaks that particular circuit, as will be readily understood from the preceding description. In this arrangement, however, only one contact-piece G is employed, so that when either of the levers C falls the circuit through the coils of the magnet F will be made and the bell sounded. This will warn the attendant of the defect, and by looking over the several levers C he will be able to determine just what circuit is open and to make repairs at once. In this construction but one shutter or partition E'' is used, which is in the nature of a long strip provided with apertures *e'*—one for each conductor D—and secured to the base Z between the lever C and post B.

In Fig. 4 I have shown yet another arrangement of the bell-circuit, which I will now describe. In this arrangement the construction is the same as that seen in Fig. 2, except that the contact-piece G, the magnet F, and the connecting-wires are dispensed with, and the insulating finger or pin *j* is mounted directly on the lever C, and when the lever falls is withdrawn from between the spring-arms *l l* in the same manner as the pin on the armature-lever H in the arrangement shown in

Fig. 2. The arrangement is the same, except that the electro-magnet and its circuit are omitted.

It will be observed that in all these constructions the lever C is held extended by the mechanical tension of the attenuated conductor D, and the strain imposed by this conductor is resisted in some degree by the coiled wire *c*. Hence the forces tending to rupture the conductor D when it is weakened by the heat generated are the spring *c*, weight of lever C, and the auxiliary weight of the shutter E′ when employed. It may happen in some cases that the heat generated in the conductor D by the high-tension current will not suffice to actually fuse it instantly, in which case it will still be too much weakened to resist the forces tending to rupture it.

It will be obvious that my invention may be considerably modified without materially departing from the principles involved, and I do not wish to be limited to the precise constructions and arrangements shown for accomplishing the results specified. Nor do I wish to limit myself to the use of an audible signal, as it is obvious that the device will be perfectly operative without such an element; but I prefer to employ such a signal.

Having thus described my invention, I claim—

1. In a cut-out for electric circuits, the combination, with the terminals of a low-tension circuit, of an attenuated fusible conductor completing the circuit between said terminals and a shutter of non-conducting material sustained by said fusible conductor, whereby when the latter is weakened by heat said shutter tends to insure its rupture and to insulate the circuit-terminals from one another, substantially as set forth.

2. In a cut-out for electric circuits, the combination, with the posts A and B, forming the terminals of a low-tension circuit, of a lever pivotally attached to one of said posts, an attenuated fusible conductor extending from the free end of said lever to the other post, whereby the lever is upheld and a pivoted shutter of non-conducting material above said conductor, the free end of same supported by said conductor, substantially as set forth.

3. In a cut-out for electric circuits, the combination, with the terminals of the line-conductors of a low-tension circuit, of the pivoted lever C in said circuit, the attenuated fusible conductor D, completing the circuit between the lever C and one of said terminals, and an audible signal sounded by the fall of said lever, substantially as set forth.

4. In a cut-out for electric circuits, the combination, with the terminal posts of a low-tension circuit, the lever C, pivotally attached to one of said posts, and the attenuated fusible conductor D, extending from the free end of said lever to the other terminal post, of the contact-piece G, arranged under said lever C, an electric circuit including a generator and an electro-magnet F, of which circuit lever C and contact-piece G form the terminals, the armature and armature-lever of said magnet provided with a pin of insulating material, and the electric bell and its circuit including a generator, the terminals of the bell-circuit being normally separated by said pin and adapted to contact upon its withdrawal, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM R. WHITE.

Witnesses:
CLARKSON N. FOWLER,
PHILIP SMYTH.