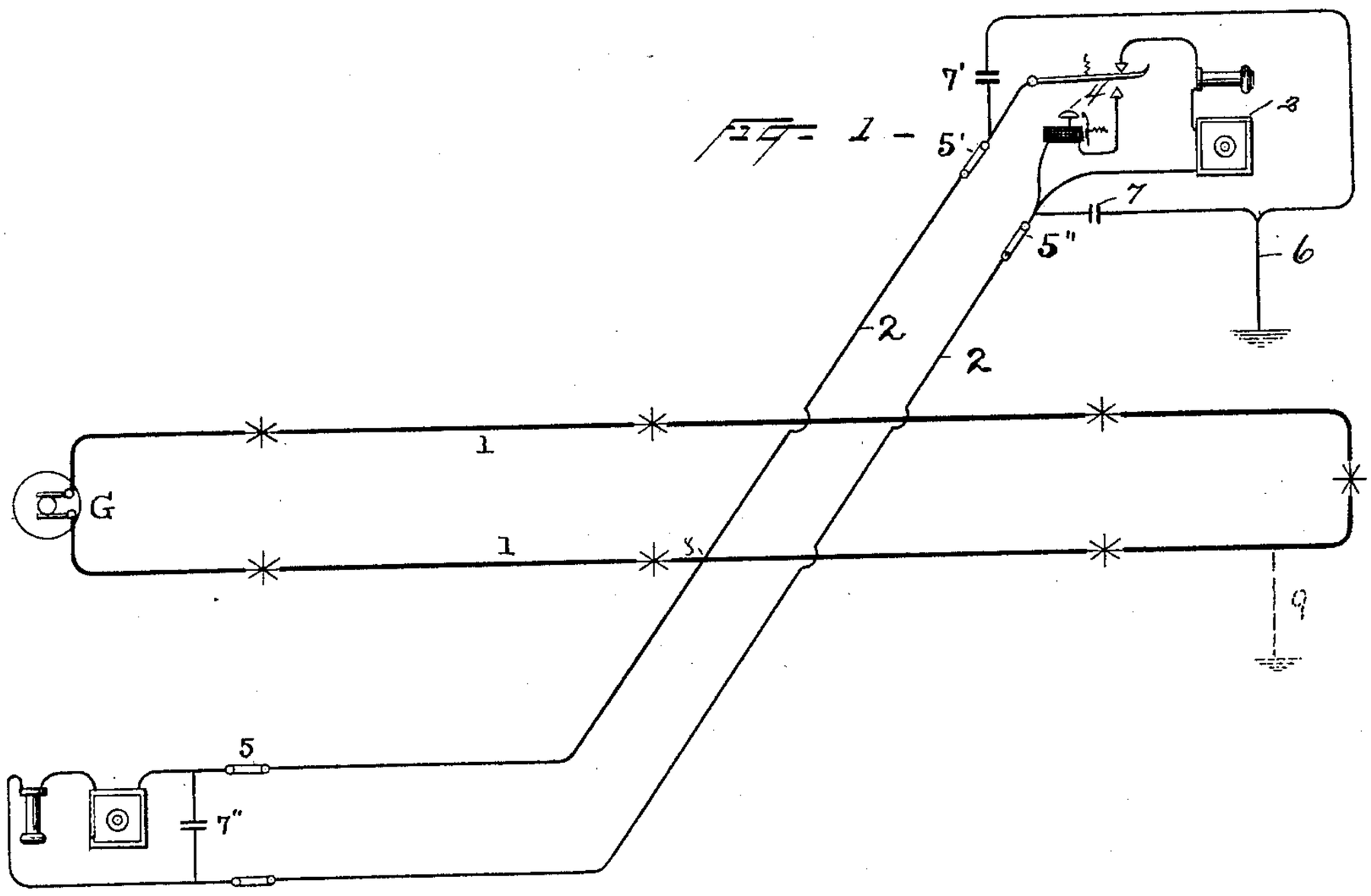
(No Model.)

2 Sheets—Sheet 1.

W. J. JENKS.

FUSIBLE CUT-OUT.

No. 433,682. Patented Aug. 5, 1890.



WITNESSES:

Norris A. Clark

Charles M. Cattin

INVENTOR

W. J. Jenks.

BY Dyer & Seely.

ATTORNEYS.

(No Model.) 2 Sheets—Sheet 2.

W. J. JENKS.

FUSIBLE CUT-OUT.

No. 433,682. Patented Aug. 5, 1890.

Fig. 4.

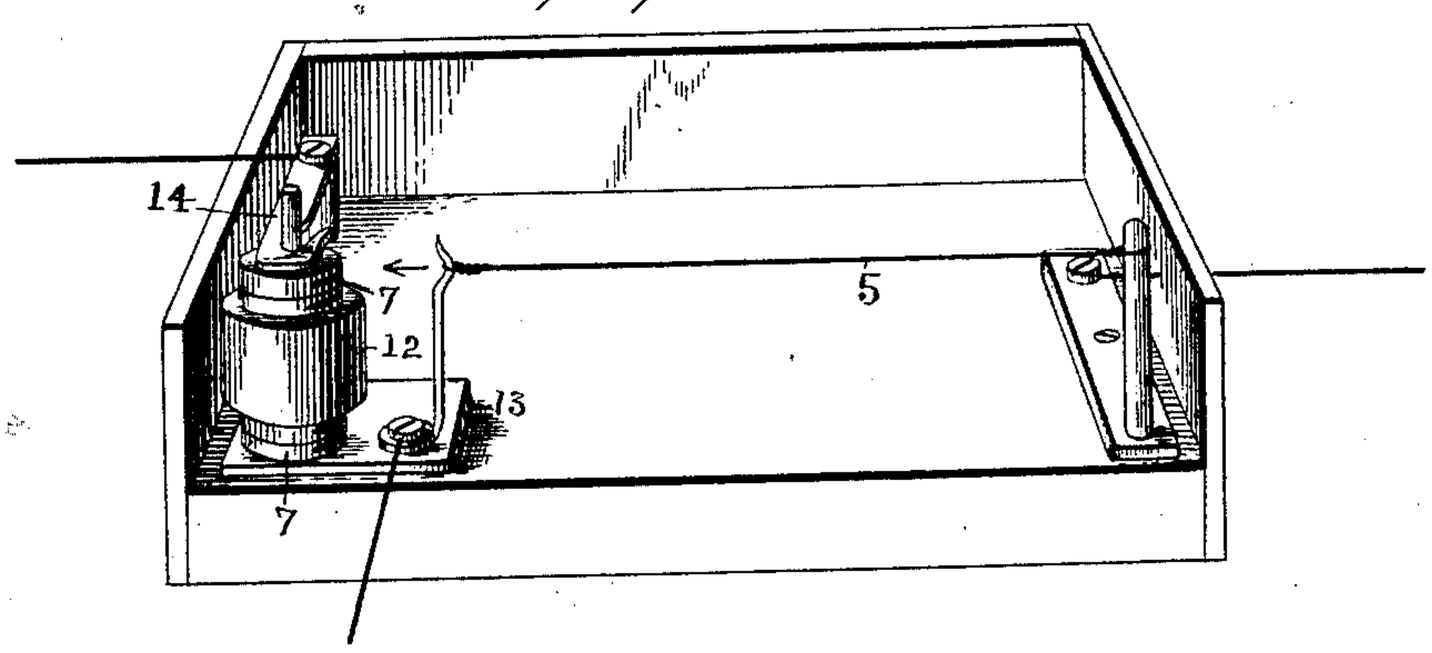


Fig. 3.

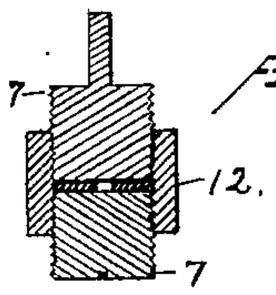
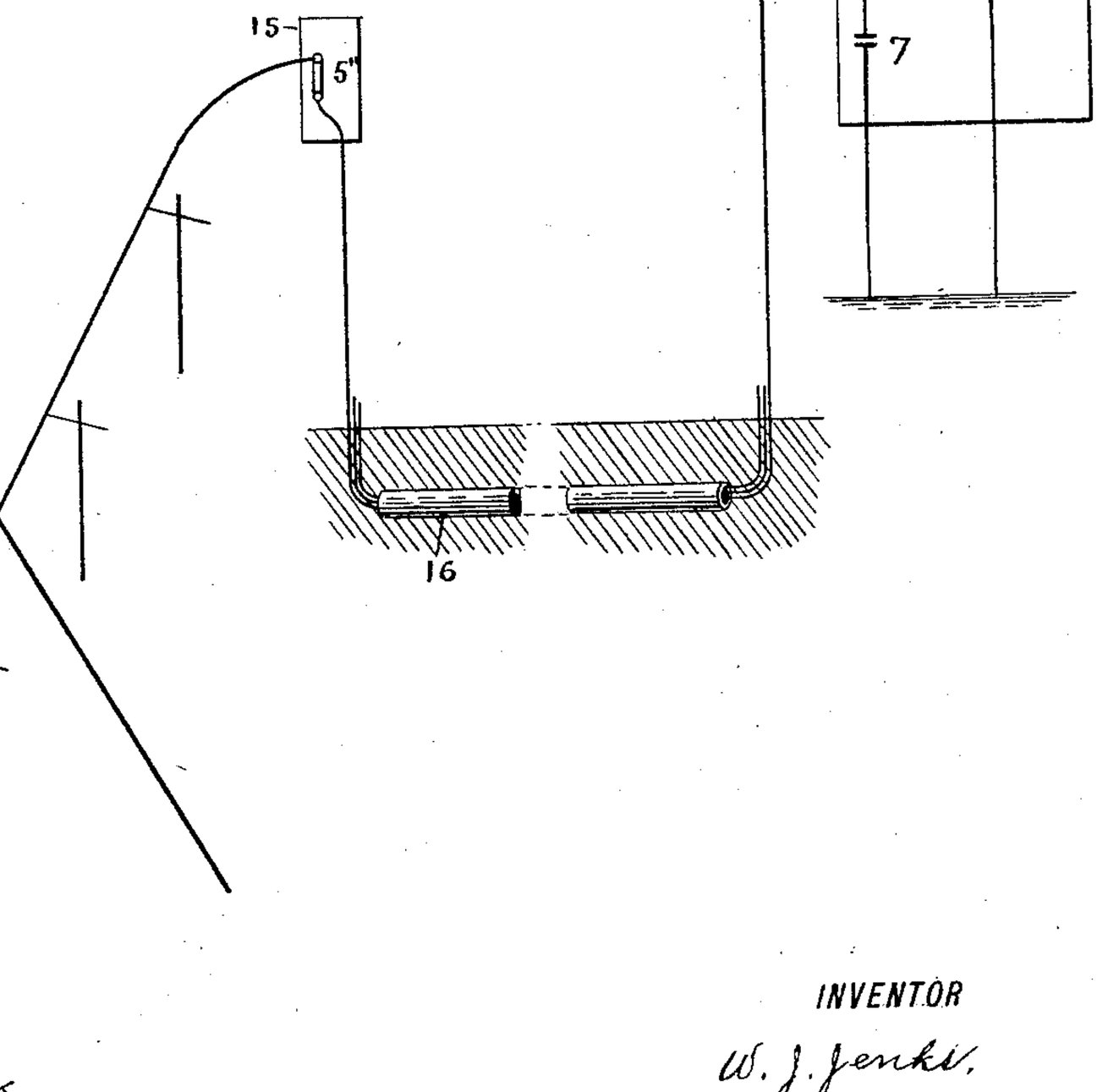


Fig. 2.



WITNESSES:

Norris A. Clark.

Charles M. Catlin.

INVENTOR

W. J. Jenks.

BY Dyer & Seely

ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM J. JENKS, OF NYACK, NEW YORK.

FUSIBLE CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 433,682, dated August 5, 1890.

Application filed February 17, 1890. Serial No. 340,703. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. JENKS, a citizen of the United States, residing at Nyack, in the county of Rockland and State of New York, have invented an Improved Cut-Out for Electrical Instruments, of which the following is a specification.

My invention relates to devices designed to protect electrical instruments—such as telephone-instruments, telegraph-instruments, fire-alarm instruments, burglar-alarms, &c.—and the users thereof from the harmful effects of high-potential or other currents due to cross-connection with arc-light or other circuits or to other causes.

The object of my invention is to produce a cut-out which shall sever the connection between line and instrument to which it is connected more promptly and certainly than in the devices heretofore used, thus largely reducing the danger of burning out the instruments or giving dangerous shocks to the user or of setting fire to the building into which the circuit may extend.

It has been found that various devices, more especially when applied to grounded circuits, have to a certain extent protected the circuits and instruments of the kinds mentioned against the heating effects of currents of abnormal ampères; but serious difficulties have been realized in their application. In the effort to secure this protection by means of fusible strips, for example, it has been found necessary to make this strip so sensitive that it has become liable to accidental rupture from mechanical or electrical causes. It also often happens, especially in metallic circuits normally insulated from the earth and used for fire-alarm, telephone, and similar purposes, that owing to a cross with an electric light or power conductor such metallic circuit is raised to a high potential relative to the earth or to some other conductor or point of a conductor with which there may be danger of a contact or to which an escape may at any time occur. A circuit thus charged to a high potential may become a source of danger by its tendency to destroy the instruments connected with it, to set fire to surrounding materials, or to give shocks to the user. In such a case there may be no flow of current along the insulated metallic circuit, and therefore no device depending solely upon the flow of current has proved efficient under such conditions.

My invention consists in providing a disrupting device, such as an inclosed air-space, film of rigid insulating material, or chemical compound, each of which, though normally an insulator, is capable of being bridged, punctured, or broken down by a certain rise of potential across its terminals, and by or in consequence of its action so changing the electrical condition of the circuit to be protected as to insure a sufficient flow of current to operate a circuit-opening device, such as a fusible strip or link. The results of the application of this combination are to automatically shunt out the instruments or other resistances to be protected, thus allowing of the use of comparatively heavy fuses or other less delicate circuit-opening device, to thereby hasten the action of such device, and to thus insure the speedy disconnection of the crossed section of the circuit to be protected whenever it carries more than a given current or when it is simply brought to a relatively-high potential and is not carrying any current at all until the operation of the disrupting device.

My invention consists, further, in placing a cut-out—such as a fusible strip—between the instrument to be protected and any source of heavy currents and placing a branch circuit around said instrument, the branch being connected between the cut-out and instrument on one side and between the instrument and earth or directly to earth on the other side, and including a device of the character hereinafter described for assisting or hastening the burning out of the fuse as soon as the current rises above a certain predetermined strength.

My invention also consists in an arrangement of cut-outs for metallic circuits and for combined overhead and underground circuits, as hereinafter described.

In the accompanying drawings, which illustrate my invention, Figure 1 is a diagrammatic view of an arc-light circuit and a metallic telephone circuit with my cut-out devices connected thereto. Fig. 2 is a diagram illustrating the application of my invention to a combined overhead and underground con-

ductor system. Fig. 3 is a central section of a device which is included in a branch circuit at the telephone-station. Fig. 4 is a perspective view of an organized apparatus, including the fusible cut-out and the device shown in Fig. 2 and especially designed for use at a subscriber's station.

In the drawings, G indicates the generator, and 1 1 a circuit therefor, including translating devices, such as arc lamps or other devices requiring heavy currents. At one end of the circuit in Fig. 1 is shown a telephone apparatus 3, which is thrown into circuit by the gravity-switch when the receiver is removed, and a bell 4, which is in circuit when said receiver is hung on the supporting-hook. At some convenient point between the instrument to be protected and the line, preferably near the point where the line enters a building, is placed cut-out or circuit-breaker 5′, (one being placed in each limb when used with metallic circuits.) Between the cut-out and the telephone switch or instrument to be protected is an earth branch 6, including electrically-disconnected terminals 7′, securely inclosed, preferably separated by an air-space or a substance normally offering great resistance to the current, (so that the terminals are practically electrically discontinuous,) but which upon an increase of potential allows current to pass, such as silver sulphide. This device as a whole I term a "cell." The terminals are placed near to each other, but not in electrical contact, and upon an abnormal increase in the potential on the line, such as occurs when a cross is made between the two circuits, said current will pass from one terminal to the other and thence to ground more readily than it will pass through the instrument to ground, and as soon as it thus begins to pass it at once lowers the resistance of the branch circuit and shunts the instrument to be protected, so that a heavier current readily flows to ground, thereby instantly fusing the strip 5′, severing connection between the line and the instrument. This action will take place generally simultaneously at both ends of the line, thus severing the section crossed at both ends, and the central station or any intermediate office would be protected as well and as promptly as the office illustrated. In other words, I create a path of low resistance around the apparatus to be protected, and thereby invite the passage of a current of much greater ampèreage than would flow with a given potential through the resistance of the coils of the instrument, the effect being to melt the fuse much more promptly than heretofore. It also makes it possible to use a fusible conductor of larger conductivity than in previous arrangements. In the arrangement illustrated the dangerous currents are supposed to be due to a cross between the telephone-line and the arc-light circuit at 8. Of course if no ground-connection from the circuit 1 1 exists, there will be no tendency for current to flow therefrom to the telephone-line; but an accidental or other ground connection is supposed to exist at 9.

The use of the device described—that is, a device which responds to a rise in potential as contradistinguished from an increase in the current—is important. With a device of the latter character only in circuit a cross would not necessarily burn the fuse, and no notice of the cross would be given until the user of the telephone accidentally formed a ground-connection, when a severe and perhaps fatal shock might be received, or until a high-resistance arc was formed, causing fire.

At 7″ is shown a second arrangement which I may use. In this case a single disruptive device is placed between the two limbs of the metallic circuit and the ground branch is omitted.

Fig. 2 illustrates one application of the invention—connection with grounded circuits. A telephone-circuit runs from ground at a subscriber's station through the instruments, and on poles or house-tops for any desired distance, and to a box 15, also on a pole or house, constituting a cable-terminal. Wires from an underground line or cable 16 also run to this box, and are connected to the overhead lines through the cut-outs 5″. A cut-out 5′ is also placed at the subscriber's station. At the central office, C O, is preferably placed the potential circuit-closer, but no fuse or circuit-breaker. The portion of the circuit lying between the points 5′ and 5″ is the only portion in danger of being crossed with a light or power circuit. The portion between 5″ and C O is buried and at a distance from dangerous circuits. In this arrangement the part to be disconnected from the crossed wire is not only the central-office instruments, but such instruments and the entire underground line. It will be understood that all the wires from the cable extend to sub-stations, and are there provided with a protector such as I have described. They also extend to the central office, and are there provided with circuit-closing cells, one for each circuit, and each cell being separately and independently removable.

Fig. 3 illustrates the device which I prefer to employ in branch 6, and consists of two screw-threaded metal pieces 7, separated, preferably, by a perforated mica or other washer 11, and held together by an insulating non-combustible sleeve 12, as fully set forth in my application, Serial No. 293,193, filed December 10, 1888. With this construction the proper proximity of the terminals can be positively maintained, since the washer serves as a distance-piece. When a high potential current breaks across the space between the separated terminals, it carries metal particles from one plate to the other and builds up a conducting-bridge. In case the current is very heavy the terminals may be fused, and in previous constructions the melted material has escaped from the space between the terminals, leaving no conducting-path for the

current; but in my device the terminals are securely inclosed and held so near together that the fused metal cannot escape. It is thus physically impossible to avoid the forming and maintaining of a ground or shunt circuit for a sufficient period to operate the circuit-breaker. Since the inclosing-wall is practically non-combustible, danger from fire is avoided.

In Fig. 4 is shown a base, on which are mounted terminals for the line and for the instrument to be protected, said terminals being connected by a fusible strip or wire 5. One end of this strip is connected to a spring, the tension of which is in the direction of the arrow, for the purpose of breaking the circuit as soon as the fusible strip becomes abnormally heated. Connected with this spring, preferably by being mounted upon the same metal plate 13, is the device illustrated in Fig. 3, the lower terminal 7 resting on said plate 13 and the upper terminal being pressed by spring 14, which spring is connected to ground. By this arrangement good electrical connection is maintained, and the device can be readily removed and a new one substituted without loss of time.

I do not claim, generically, the combination of a circuit including an instrument to be protected, a circuit-opening device in the circuit between the line and instrument, a branch or shunt between the circuit-opening device and instrument containing electrically-disconnected circuit-terminals operative by a definite rise in potential before operation of such circuit-opening device, whereby an abnormal increase of potential creates a low-resistance path, thereby operating the circuit-opening device and severing connection between the line and instrument; but my present invention is confined to a system in which the circuit-opening device is wholly in the main circuit, and the branch or shunt contains no part of the cut-out apparatus, except the potential circuit-closer.

Having thus described my invention, what I claim is—

1. The combination of a circuit including an instrument to be protected, a circuit-opening device wholly in the main circuit between the line and instrument, a branch or shunt between the circuit-opening device and instrument containing electrically-disconnected-circuit terminals operative by a definite rise in potential before operation of said circuit-opening device, whereby an abnormal increase of potential creates a low-resistance path, causing an increased flow of current, thereby instantly operating the circuit-opening device and severing connection between the line and instrument, substantially as described.

2. The combination of a circuit including an instrument to be protected, a fusible cut-out wholly in the main circuit and between the line and instrument, a branch or a shunt between the cut-out and instrument containing electrically-disconnected-circuit terminals operative by a definite rise in potential before operation of said fusible cut-out, said branch containing no other part of the cut-out device, whereby an abnormal increase in potential creates a low-resistance path, causing an increased flow of current, thereby instantly fusing the cut-out and severing connection between the line and instrument, substantially as described.

3. The combination of a circuit including a telephone or a similar instrument, a cut-out wholly in the circuit between the line and instrument, a branch between the cut-out and instrument connected to earth and including circuit-terminals separated by a space and inclosed in a non-combustible case operative by a definite rise in potential before operation of the cut-out, whereby an abnormal increase of potential instantly and certainly operates the cut-out to sever the line from the instrument, substantially as described.

4. The combination of a line including instruments to be protected, a cut-out wholly in the circuit between the line and instrument at each end, a branch or shunt between each cut-out and instrument, including electrically-disconnected terminals operative by a definite rise in potential before operation of the cut-out, whereby an abnormal increase of potential lowers the resistance in the branch and severs the crossed lines from the instruments on both sides of the cross, substantially as described.

5. The combination of a metallic circuit including a telephone or similar instruments, a circuit-opening device wholly included in each limb of the circuit, and a branch or shunt to ground from each limb of the circuit between the circuit-opening device and the instrument to be protected, said branch including electrically-disconnected terminals operative by a definite rise in potential before operation of the circuit-opening device, substantially as described.

6. The combination of a metallic circuit including instruments to be protected, a circuit-opening device wholly included in each limb of the circuit, a shunt around the instrument attached to each limb of the circuit between the circuit-opening device and the instruments, said shunt including electrically-separate terminals operative by a definite rise in potential before operation of the circuit-opening device, substantially as described.

7. The combination, in a telephone-circuit, of an air-line, an underground line, a cable terminal or box in which said lines are connected, an instrument at the opposite end of the underground line to be protected, a cut-out between the exposed line and the cable, and a normally discontinuous ground branch or shunt between the instrument and cut-out operative by a definite rise in potential be-

fore operation of the cut-out, substantially as described.

8. The combination, in an electrical-instrument protector, of a normally-closed circuit-breaker interpolated in a circuit, an inclosed potential circuit-closer, one terminal of which is connected to one side of the circuit-breaker, the other terminal being connected to a ground branch or shunt, said circuit-closer being readily and independently removable, substantially as described.

This specification signed and witnessed this 15th day of February, 1890.

WILLIAM J. JENKS.

Witnesses:
D. H. DRISCOLL,
CHARLES M. CATLIN.