

R. L. BAKER.
 PROTECTIVE APPARATUS FOR ELECTRIC CIRCUITS.
 APPLICATION FILED JAN. 13, 1912.

1,061,894.

Patented May 13, 1913.

4 SHEETS—SHEET 1.

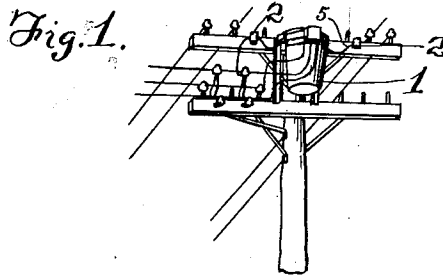


Fig. 2.

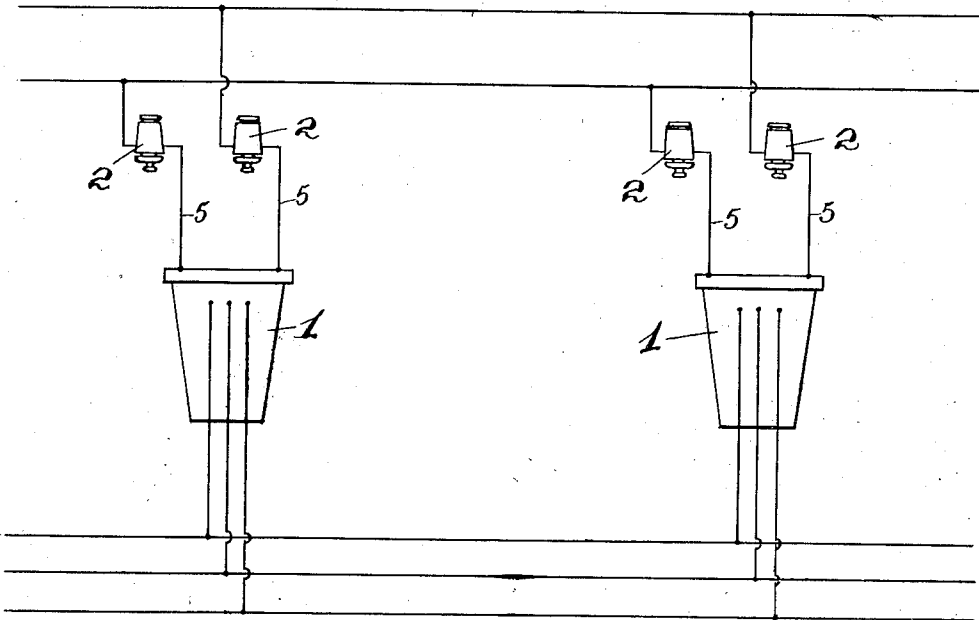


Fig. 7.

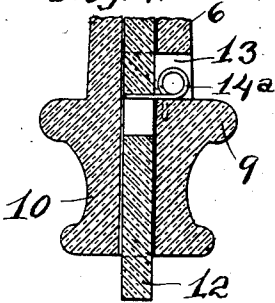


Fig. 8.

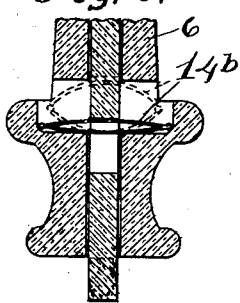


Fig. 9.

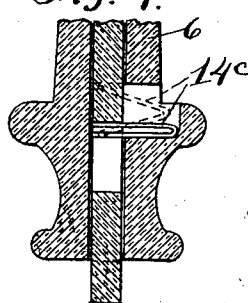
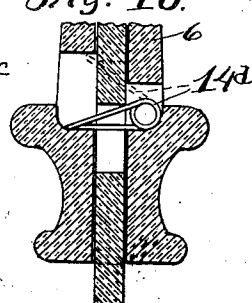


Fig. 10.



Witnesses

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Fig. 3.

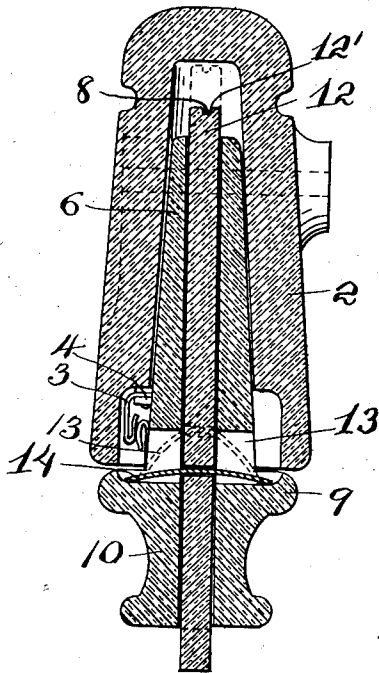


Fig. 4.

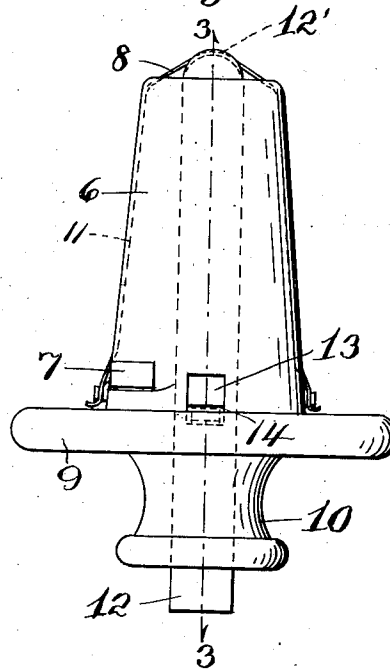


Fig. 6.

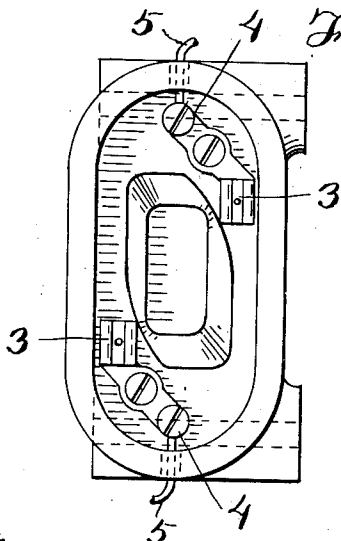
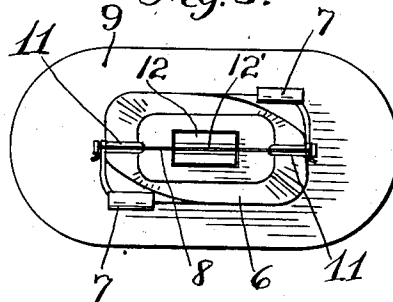


Fig. 5.



Witnesses

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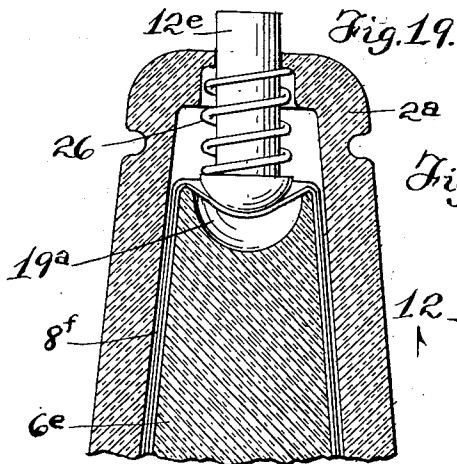
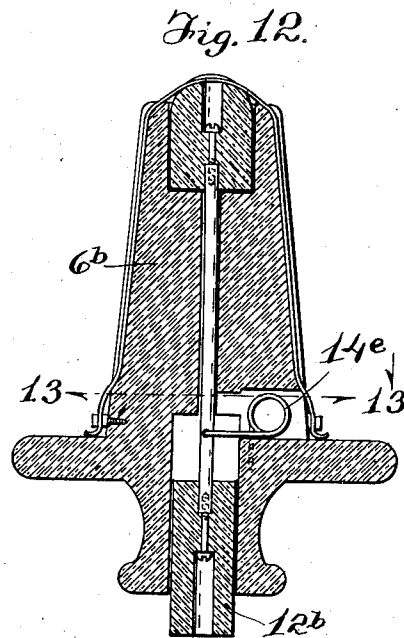
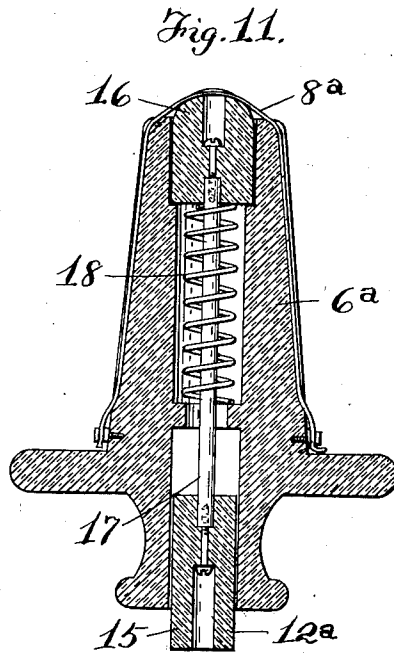
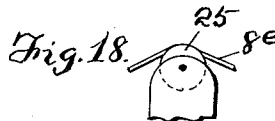
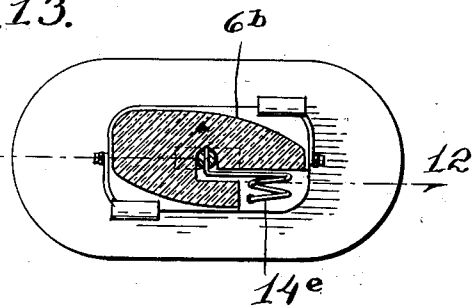


Fig. 13.



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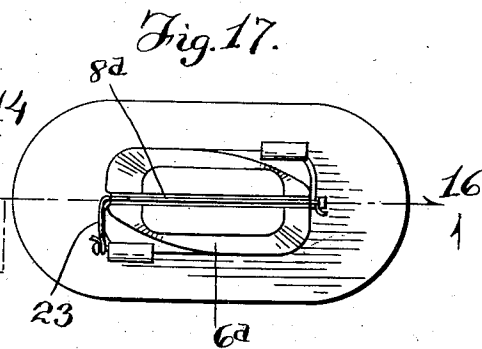
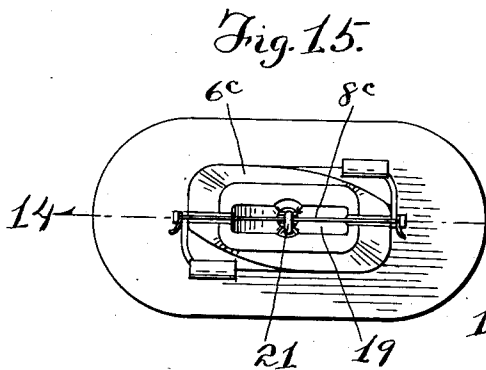
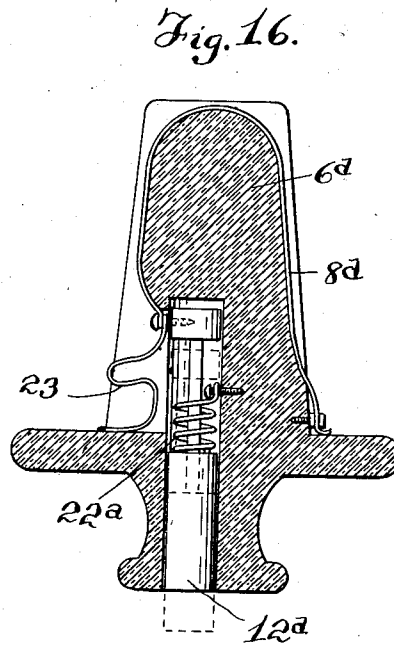
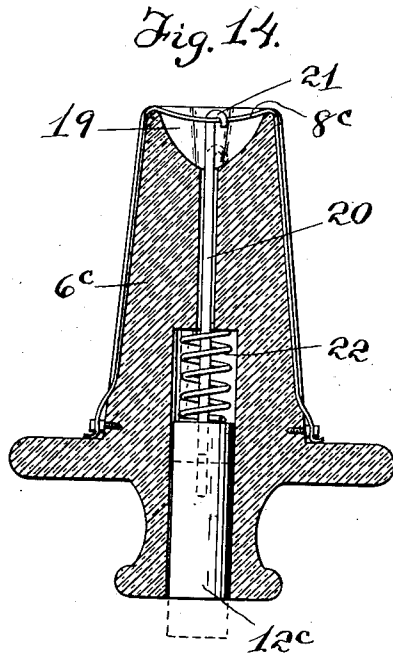
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4 SHEETS—SHEET 4.



Witnesses

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UNITED STATES PATENT OFFICE.

ROSS LEE BAKER, OF JOPLIN, MISSOURI.

PROTECTIVE APPARATUS FOR ELECTRIC CIRCUITS.

1,061,894.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed January 13, 1912. Serial No. 671,053.

To all whom it may concern:

Be it known that I, ROSS LEE BAKER, a citizen of the United States, residing at Joplin, in the county of Jasper and State of Missouri, have invented certain new and useful Improvements in Protective Apparatus for Electric Circuits; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in protective appliances for electrical circuit apparatus, and more particularly to the type commonly known as plug fuse.

It is the common practice to supply distribution circuits with high tension low amperage current, and to transform the current for particular use, and to protect the various apparatus in circuit it is customary to provide fuses in the conductors leading to the transformers. These fuses are usually sustained by what is commonly known as fuse plugs mounted in fuse blocks and thus protected against the weather, the transformers and blocks being usually mounted on poles and exposed to climatic conditions. Or the transformers with their fuse plugs may be arranged in manholes or other out of the way places which are more or less difficult of access. Frequently several transformers are "banked," and, with the fuse blocks and plugs now commonly in use, it is necessary to withdraw each fuse plug and examine it for ascertaining whether or not its fuse is in good condition so as to determine whether or not the particular transformer is "working." Thus it will be seen than an inspector passing along a roadway must climb each pole on which is mounted a transformer and withdraw both of the fuse plugs to ascertain the condition of the fuses, and whenever there happens to be two or more transformers banked, two plugs must be withdrawn for each transformer, with the attendant risk and danger to the operator.

The object of the present invention is essentially to obviate this labor and render it possible to make a reliable inspection at a glance, and this object is proposed to be attained in a fuse plug and block adapted particularly for out-of-door application on lines carrying high voltage, say in excess of one thousand, but relatively low currents.

With this and further objects in view, as will in part hereinafter become obvious and

in part be stated, the invention comprises certain novel constructions, combinations and arrangements of parts as will be herein specified and claimed.

In the accompanying drawings,—Figure 1 is an applied view showing a transformer mounted on a pole and provided with protective appliances embodying the features of the present invention. Fig. 2 is a diagrammatic view illustrating banked transformers similarly provided. Fig. 3 is a detail, vertical, central section through a fuse block and plug embodying the features of the present invention. Fig. 4 is a view in side elevation of the fuse plug detached. Figs. 5 and 6 are plan views respectively of the fuse plug and the fuse block. Figs. 7, 8, 9 and 10 are, respectively, fragmentary, vertical sections through the plug illustrating modified embodiments of the signal actuating spring. Fig. 11 is a vertical, central section through a modified form of plug. Fig. 12 is a similar view of a further modification, the section being taken on line 12—12 of Fig. 13. Fig. 13 is a transverse section taken on line 13—13 of Fig. 12. Fig. 14 is a view similar to Fig. 11 of a further embodiment. Fig. 15 is a plan view thereof. Fig. 16 is a similar view of a still further embodiment. Fig. 17 is a plan view thereof. Fig. 18 is a detail, fragmentary view of a modified form of a portion of the signal plunger. Fig. 19 is a vertical section through a further modified embodiment, showing both the fuse block and plug. Fig. 20 is a fragmentary, detail view of a further modified embodiment.

In Fig. 1, I have indicated a transformer supplied with current through conductors passing through the fuses of fuse blocks 2, each embodying the features of the present invention.

In Fig. 2, I have illustrated the transformers 1 as banked and the current to both controlled by the fuse blocks 2, 2.

Obviously, the present invention is susceptible of numerous embodiments, one efficient embodiment being illustrated in Figs. 3 to 6 inclusive, which may for the purposes of this application be considered the preferred embodiment. In this embodiment the fuse block 2 consists of a hollow block or casing of insulating material, preferably glass, porcelain, or the like, and provided with means for receiving supports after the manner of the well known type of fuse block. Within the block are arranged con-

tact terminals 3, 3, fixed to the block and electrically connected with the binding post 4, 4, to which the ends of the conductor 5 are connected. Between the contact terminals 3 is the plug receiving opening or space 5 of the block, and the plug 6 is adapted to be introduced therein in position for having the fuse terminals 7, 7 thereof contact with the terminals 3, 3, for closing the circuit through the fuse 8, which connects the terminal 7. Fuse 8, of course, may be a wire or ribbon of lead or other fusible substance adapted to be ruptured by excessive fluctuations in the load prior to injury to any other apparatus in line. The fuse plug 6 consists of a tapering body having at its outer or lower ends a flange 9, and a pendent operating knob 10 adapted to be grasped by the fingers of the operator for withdrawing the plug or thrusting it to place in the block. The body of the plug may be variously proportioned, but is conveniently arranged with greater width than thickness, and along the edges are arranged 25 grooves 11, 11, in which extends the fuse wire 8, which wire is thus retained against accidental displacement. The plug 6 is formed throughout its length with a central bore, which also extends through the knob 10, and in which is mounted the signal plunger 12, which consists of a shaft extending throughout the length of the plug, and at its inner or upper end engaging the fuse wire 8. The upper end of the plunger 12 may be grooved, as at 12', for receiving the wire 8 and preventing lateral displacement thereof. The plunger 12 is of a greater length than the plug and normally has its lower end projecting below the knob 10 so as to be clearly exposed to view. The body of the plug is formed with lateral openings 13, 13, adjacent flange 9, and a spring 14 extends through plunger 10 and has its ends projecting through the apertures 13. The spring is susceptible of numerous embodiments, but as shown consists of a semi-elliptic plate spring tensioned to project its middle portion upwardly to the position indicated in dotted lines in Fig. 3 when free. The tension of the spring is such as to insure elevation of the plunger in the instance of rupture of wire 8, but is not such as to effect injurious stretching of the wire.

When the plug 6 has been seated in the block 2 with the parts in the position indicated in full lines in Fig. 3, current may flow along conductor 5 and along wire 8, and the wire 8 will retain the plunger 12 in position with its lower end protruded. For convenience of inspection, I propose to form the lower end of the plunger 12 of white substance, or to color it white, while the plug itself and the fuse block will be of some 65 other color, as for instance a very dark

color if formed of porcelain. The plunger is, of course, of non-conducting substance, and the space within the block 2 is of sufficient area to accommodate the upper portion of the plunger when projected upwardly or to the retracted or signaling position as indicated in dotted lines in Fig. 3. So long as the fuse wire 8 remains intact, the lower end of the plunger 12 will be protruded, and, therefore, the inspector needs only to observe this fact to be assured that the fuse block is in perfect condition, and if he sees that the plunger has been retracted he will know that the block requires attention, and he is thus relieved of the necessity for climbing poles or getting down into man-holes merely to inspect. When a rupture has occurred, it is not necessary to discard any part of the plug or block, but the operator merely replaces a new fuse wire and returns the plug to its position in the block. The parts are then again in operative condition.

In Figs. 7, 8, 9 and 10, I have illustrated various embodiment of springs well adapted for actuating the plunger, and as the modifications relate solely to the construction or arrangement of the spring I employ the same reference numerals as above employed for the same parts.

In Fig. 7, a spring 14^a is provided and consists simply of a coiled spring wire having one end embedded in the material of the plug, and the free end extending into an aperture in the plunger and exerting an upward pressure thereon.

In Fig. 8, a full elliptic spring 14^b is provided and extends through an aperture in the plunger, having one of its plates resting against the material of the plug, and the other plate engaging the plunger for pressing the plunger upwardly.

In Fig. 9, the spring 14^c consists merely of a spring wire having a return bend disposed to have one leg of the bend rest against the material of the plug, and the other leg extending into an aperture in the plunger and pressing the plunger upwardly.

In Fig. 10, the spring 14^d is provided and is very similar in construction and arrangement to spring 14^c except that the wire is coiled at the bend and both legs extend entirely through the plunger, so that the lower leg rests on the material of the plug at both sides of the plunger.

Obviously, in these several modifications, the recesses or apertures in the parts will be varied proportionately to the size, disposition and action of the respective springs.

In Fig. 11, 6^a is the plug carrying the fuse wire 8^a engaged by the signaling plunger 12^a operating in the same general way and for the same purpose as the plunger 12, but differing therefrom in being formed of three sections consisting of the end sections 15 and 130

16 of insulating material, and an intermediate stem or rod 17 which may be of metal. A spring 18 is coiled about the stem 17 and rests on a seat formed of material of the plug, and has its upper end engaging the section 16 for pressing the plunger inwardly and upwardly. The stem 17 may be connected to the end sections in various ways, and I find one convenient method of connection to consist in the use of countersunk screws extending through the end sections and threaded into the ends of the stem.

In Figs. 12 and 13 I have illustrated a slight modification from the structure seen in Fig. 11, the same general form of plug 6^b and plunger 12^b being employed, but the plunger being actuated by a modified arrangement of the spring. The spring in this embodiment is quite similar to the spring seen in Fig. 7, and consists of a spring wire 14^c coiled and having one end embedded in material of the plug, and the free end bent and passed through the stem of the plunger 12^b so as to have pivotal engagement therewith. Spring 14^c is tensioned for having its free end press in an upward direction.

In Figs. 14 and 15, I have illustrated quite a material variation in the action of the signaling plunger, which in this embodiment indicates rupture of the fuse wire when projected instead of when retracted. The plug 6^c is provided with the usual fuse wire 8^c, but the inner end of the plug is recessed, as indicated at 19, so that that portion of the fuse wire which crosses the inner end may be subjected to tension in a downward direction. The plunger 12^c consists of a lower section of insulating material, and a stem 20 fixed to and extending from the lower section throughout the remaining length of the plug, the plug being suitably bored for accommodating the stem. The upper or inner end of the stem is formed with a hook 21 which overhangs and engages the wire 8^c so as to subject the same to tension by virtue of the weight of the plunger, which may be sufficient to alone afford assurance of effective signaling action on rupture of the wire 8^c. Or if desired a spring 22 may be coiled about the lower portion of the stem and have one end engage the material of the plug, and the other end engage the upper end of the lower section of the plunger for pressing the same downwardly.

Obviously, any break in the wire 8^c will release the hook 21 and allow the plunger to move downwardly to the dotted line position indicated in Fig. 14, and thus indicate that the fuse has been destroyed.

In Figs. 16 and 17, I have indicated a further embodiment, varying only slightly from the structure just described. In these last figures the plug 6^d is shown as provided

with the fuse wire 8^d which is not engaged intermediate its ends, but which has one of its ends directly connected to plunger 12^d, and a flexible terminal conductor 23 is connected to the same binding post which connects the end of the fuse wire to the plunger. In this embodiment the bore of the plug does not extend throughout the length of the plug, but is of sufficient length to accommodate the inclosed plunger which is made up of upper and lower insulating sections and an intermediate stem, which latter is surrounded by a coil spring 22^a, connected at one end to the material of the plug, and having its other end pressing downwardly on the lower section of the plunger. Thus when rupture occurs in the length of the fuse wire, the plunger will be projected downwardly to the signaling position.

In Fig. 18, I have indicated merely a fragment of one of the plungers which engages the fuse wire, and have shown a pulley or anti-friction roller 25 journaled in the end of the plunger and over which is passed the fuse wire 8^e, the said pulley insuring against any frictional resistance to the movement of the plunger after rupture of the fuse wire.

In Fig. 19, I have shown a further rearrangement in which the signal plunger acts through the fuse block instead of through the plug. In this embodiment the plug 6^e carries the fuse wire 8^f and is formed with a recess 19^a across which the fuse wire extends. The signaling plunger 12^e extends through the upper end of the fuse block 2^a in line with the recess 19^a so that the lower end of the plunger rests on the unsupported portion of the fuse wire 8^f. The plunger may act by gravity, or may be assisted by a coil spring 26 disposed to thrust the plunger downwardly when the wire 8^f is ruptured. As long as the fuse wire remains intact the upper end of the plunger 12^e will remain exposed, but will drop down out of sight as soon as the fuse wire is broken, thus indicating that the circuit is broken.

In Fig. 20, I have indicated a further slight modification consisting in providing the usual plug 6^f with the usual plunger 12^f, but the fuse wire arrangement is varied by having the main fuse wire 8^g supported in a groove throughout its length in the plug 6^f and not engaged by the plunger. An auxiliary fuse wire 27 preferably of lighter gage, is connected to and arranged parallel with wire 8^g and extends across the upper end of plunger 12^f for retaining the plunger in its safety position, that is the position indicating that the fuse wire has not been ruptured, which position will be maintained until the wire is broken. Of course, as soon as the main fuse wire is broken, the auxiliary wire will give way, and the plunger will

thus be allowed to move to a position indicating the destruction of the fuse.

What I claim is,—

1. In combination, a fuse block, a fuse plug adapted to be thrust longitudinally into the block and to be removable therefrom, a fuse carried by the plug and extending across the inner end thereof, a signaling plunger extending through the plug and engaging the fuse at the end of the plug and a spring arranged in the plug and having a portion engaging the plunger and tensioned for subjecting the plunger to pressure in a direction maintaining the fuse under tension.

2. In combination, a fuse plug formed with a longitudinal bore, a reciprocable plunger extending through the bore, a fuse extending across the bore and adapted to engage the plunger and retain the same against movement, the plug being recessed laterally from the bore at the side of the plunger, and the plunger being formed with a recess, and a spring arranged in the recess of the plug and engaging the plug and extending into the recess in the plunger and movably engaging the plunger for normally exerting pressure against the plunger for pressing the same against the fuse.

3. In combination, a fuse plug formed with a bore, a plunger reciprocably mounted therein, a fuse extending across the bore and engaged by the plunger, the plug being recessed laterally from the bore at opposite sides thereof, and a plate spring extending into the lateral recesses of the plug and through the plunger and tensioned to exert pressure against the plunger for pressing the same against the fuse.

4. In combination, a fuse plug formed with a bore, a plunger reciprocably mounted therein, a fuse extending across the bore and engaged by the plunger, the plug being recessed laterally from the bore at opposite sides thereof, and a plate spring extending into the lateral recesses of the plug and through the plunger and tensioned to exert pressure against the plunger for pressing the same against the fuse, the plate spring being arcuate and tensioned to vary the length of its arc for imparting a thrust to the plunger when released.

5. In combination, a fuse plug formed with a bore, a plunger reciprocably mounted therein, a fuse extending across the bore and engaged by the plunger, the plug being recessed laterally from the bore at opposite sides thereof, and a plate spring extending into the lateral recesses of the plug and through the plunger and tensioned to exert pressure against the plunger for pressing the same against the fuse, the plate spring being longitudinally arcuate and tensioned

for increasing the radius of its arc when released for imparting a thrust to the plunger.

6. In combination, a fuse block, a fuse plug adapted to be thrust longitudinally into the block and to be movable therefrom, a fuse carried by the plug and extending across the inner end thereof, a signaling plunger extending through the plug and engaging the fuse at the end of the plug, and means pressing the plunger longitudinally for subjecting the fuse to tension.

7. In combination, a fuse plug, a reciprocable plunger carried thereby, a fuse carried by the plug and engaging the plunger for retaining the same against reciprocation while the fuse is intact, and a spring extending through the plunger and engaging the plug and tensioned for pressing the plunger against the fuse.

8. In combination, a fuse plug, a signaling plunger reciprocably mounted therein, a fuse carried by the plug and disposed to be engaged by the plunger for retaining the plunger against movement while the fuse is intact, the plug being formed with a lateral recess, and a spring extending into the recess and adapted to expand and contract therein and engaging the plug and plunger and tensioned for pressing the plunger against the fuse.

9. In combination, a fuse plug formed with a longitudinal, substantially central bore, a reciprocable plunger extending through the bore, a fuse carried by the plug and extending across the end of the plunger for retaining the plunger against movement, the plug being recessed laterally from the bore, and a spring operating in the recess and engaging the plug and plunger for relatively exerting pressure on the plunger toward the fuse the lateral recess being disposed for accommodating operative movements of the spring therein.

10. In combination, a fuse plug formed with a longitudinal, substantially central bore, a reciprocable plunger extending through the bore, a fuse carried by the plug and extending across the end of the plunger for retaining the plunger against movement, the plug being recessed laterally from the bore at opposite sides of the plunger, and cushioning means operating in the recesses and engaging the plunger for pressing the same toward the fuse the lateral recess being disposed for accommodating operative movements of the cushioning means therein.

In testimony whereof I affix my signature in presence of two witnesses.

ROSS LEE BAKER.

Witnesses:

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