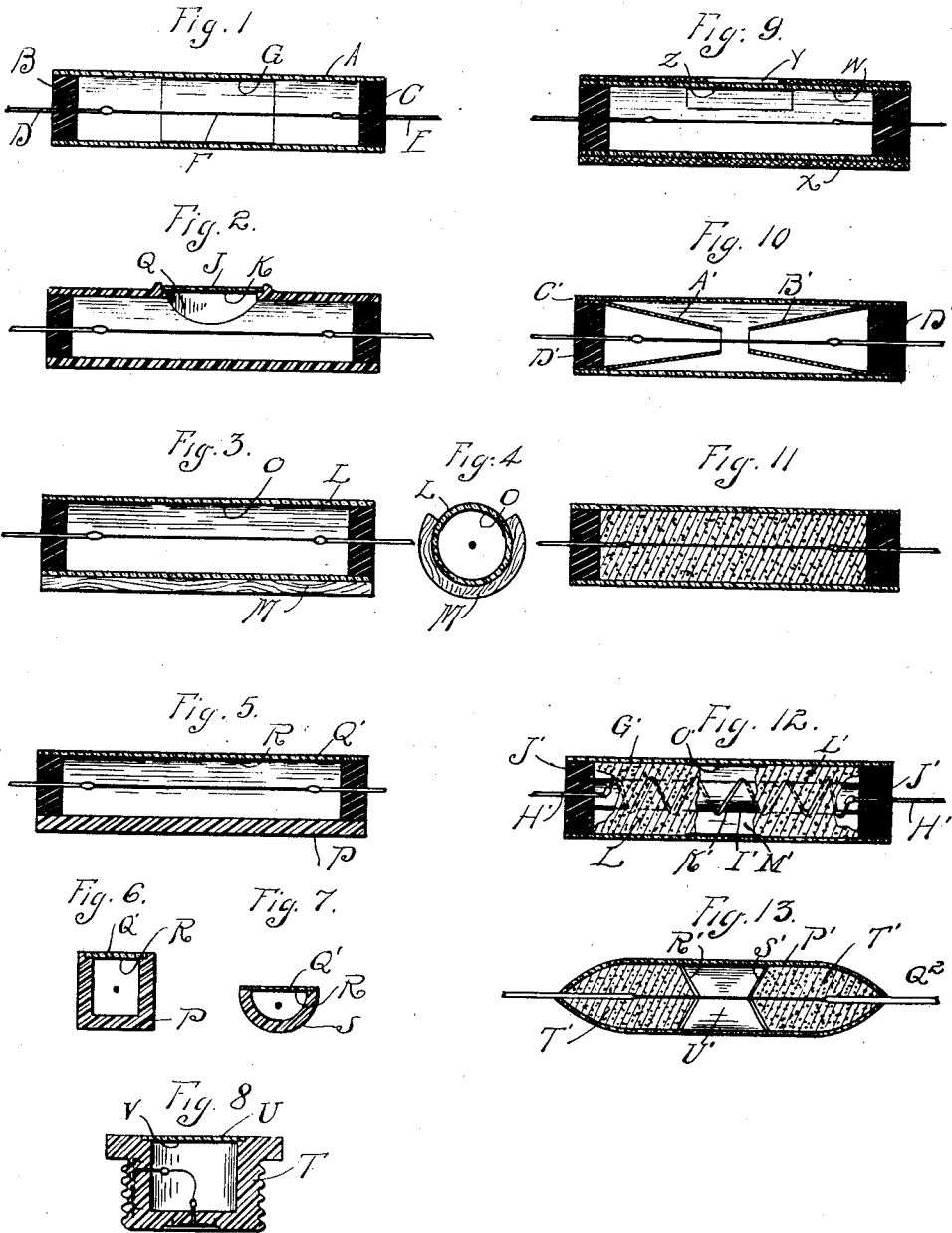


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W. J. PHELPS.
SAFETY FUSE.

APPLICATION FILED MAY 4, 1903.



WITNESSES.

Geo. H. Crover
Geo. P. Barry

INVENTOR
WILLIAM J. PHELPS.

BY

James Whittemore
ATTY.

UNITED STATES PATENT OFFICE.

WILLIAM J. PHELPS, OF DETROIT, MICHIGAN.

SAFETY-FUSE.

No. 856,292.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM J. PHELPS, residing at Detroit, in the county of Wayne and State of Michigan, a citizen of the United States, have invented certain new and useful Improvements in Safety-Fuses, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates particularly to inclosed safety fuses designed for the protection of electrical circuits, lamps, or instruments, and consists in the novel construction of a fuse of this character adapted to indicate visually the condition of the fuse strip or the fuse conductor, particularly when the latter has been disrupted by an excess of current.

The invention further consists in the peculiar arrangement and combination of the various parts of the fuse and in other details of construction as will be more fully hereinafter described.

In the drawings illustrating my invention, Figure 1 is a vertical central section through a safety fuse made in accordance with my invention. Figs. 2 to 9 inclusive are modifications of the construction shown in Fig. 1. Fig. 10 is a section through a fuse embodying my invention showing the means for interrupting the arc formed upon the disruption of the strip. Fig. 11 is a view similar to Fig. 10 showing a different method of interrupting the arc. Fig. 12 is a modified construction of fuse especially adapted for use in high potential circuits, and Fig. 13 is a further modification of a safety fuse showing a novel type of fuse strip.

In the drawings thus briefly referred to, reference being had to Fig. 1, A represents an inclosing casing in this instance transparent, being made of glass or mica, sealed at its ends by the plugs B and C of any suitable material, as for instance plaster paris. D and E represent respectively the terminal wires or what will be hereinafter referred to as the terminals, sealed in the plugs as shown. F is a fusible conductor preferably a copper wire of the proper section or the ordinary lead alloy known as fuse wire connected in any suitable manner as by soldering to the terminals.

It is desirable for various well known reasons to have an inclosed fuse of the kind just described constructed in such manner as to show plainly the condition of the fuse strip, whether the same is in operative condition or

is disrupted. For this purpose I have shown in the figure referred to an annular portion of the transparent casing coated upon the interior with material G which has an affinity for the gases evolved upon the disruption or what is generally termed the "blowing" of the fuse and which changes color when the disruption occurs.

Various materials may be employed to produce the desired result and the composition of the fuse strip may be varied with reference to the chemical affinity of the indicating material. Ordinary sulfur changes color and becomes dotted with black specks. One arrangement which I have found very effective in connection with a copper fuse is to coat the inside of the indicating area with a thin paste of ammonium carbonate and water. This looks white, before blowing, and changes to bright blue on the disruption of the fuse. A gas may also be employed such as sulfureted hydrogen which has an affinity for copper oxid.

In Fig. 2 a modified form of casing is illustrated being formed of porcelain and having a single inspection opening Q formed centrally within the casing, which is closed by a transparent cover J. In this case the interior of the cover may be coated as at K with an indicating material.

A further modification is illustrated in Figs. 3 and 4 where a double or compound casing is employed consisting of an inner transparent section L and an outer shell M of wood or other opaque material adapted to partially inclose the transparent section. The exposed portion of the inner casing in this instance is coated with a color changing material as indicated at O.

In Figs. 5 and 6 I have shown the casing in the form of a porcelain trough P rectangular in form and provided with a top Q of glass coated interiorly as at R with material that will change color as the fuse blows.

In Fig. 7 the casing S is semicircular in configuration.

The ordinary fuse plug T of the Edison type may also be made to indicate. A construction of indicating fuse of this character is shown in Fig. 8 wherein the plug is open at its top and covered with a transparent plate U coated with the material described, designated by the reference letter V.

A still further modification with respect to the casing is illustrated in Fig. 9, the casing being of the compound type consisting of the

inner tubular transparent section W and a similar inclosing section X of opaque material having an inspection opening Y through which the interior of the fuse may be viewed.

5 The portion of the transparent casing opposite the inspection opening described is coated in this instance as indicated at Z.

It is desirable to provide means within the fuse for interrupting the arc, which otherwise might follow the disruption of the fuse strip when used on circuits of ordinary voltage. One form of interrupting means is shown in Fig. 10 consisting of the oppositely extending cones A' and B' formed of fiber or
15 asbestos and sealed within the ends of the casing C' by the plugs D'. The fuse strip in this instance extends through both cones and connects with the terminals in the usual manner. The gases evolved upon the blowing of
20 the fuse combined with the expansion of the air from the heat produced, create a pressure in the space between the cones A' and B' the only outlet for which is through their apices in the opening lately occupied by itself. Thus
25 a quick expulsive blast follows the blowing of the fuse which acts mechanically to force back in both directions and prevent the formation of an arc.

In the construction shown in Fig. 11 the
30 interruption of the arc depends either on chemical affinity or on mechanical absorption and cooling or on these causes combined. When a fuse breaks down under an excess of current there is left for an instant a path of
35 hot gas between the terminals which offers relatively low resistance and invited a continuation of the current, which the fuse was put there to interrupt. This is the arc above
40 mentioned. The danger of arc increases very rapidly with the increase of E. M. F. The ease and certainty with which an arc may be prevented or instantly suppressed and the fact that the melted metal or gases evolved are wholly confined and prevented
45 from doing damage when a fuse blows constitute the chief advantage of the cartridge or inclosed type. In Fig. 11 a copper fuse may be surrounded by some material such as chlorid of lime which has an affinity for copper and which at once by chemical combination
50 removes the path of hot metal or gas. Or a filling such as asbestos may be used which acts like a blotting paper to absorb and cool the gases. Asbestos may be impregnated with ammonium carbonate solution or mixed with the dry powdered ammonium carbonate and then mechanically
55 interrupts the arc and chemically changes color and indicates.

60 The safety fuse shown in Fig. 12 is especially designed for high potential circuits and consists of the transparent casing G', the terminals H', a hollow core I' preferably of loosely woven asbestos extending longitudinally within the casing having its ends sealed

in the plugs J', and a spiral fuse strip K' which is wound about the core in the manner illustrated, its ends being connected to the terminals. Within each end of the casing
70 and surrounding the fusible conductor and the core, is arc interrupting material I', which in this instance may be plaster of paris. The quantities of material are spaced apart so as to form an opening M' at the center,
75 and the interior or transparent casing at this point may be coated as at O'.

In Fig. 13, a construction of safety fuse is shown wherein the indication is made by the black oxid of copper formed upon the disruption of the fuse, which collects and thus
80 indicates upon the transparent casing. In this modification the tube P' is of glass, and in the ends are sealed the terminals Q² by preferably melting the ends of the tube. Small apertured disks R' and S' are inserted
85 within the interior of the tube and serve to keep in the tube ends the filling material T' which acts to interrupt the arc. As thus constructed an air space U' is formed centrally in the tube and upon the blowing of
90 the fuse the black oxid of copper collects in this space and is deposited upon the interior of the transparent casing at this point thereby indicating the condition of the device.

It has been the general practice heretofore
95 to connect the terminals of the fuse by the ordinary fuse strip, the joints being formed by soldering. I have devised means for constructing the fuse in a manner which will perform the same results and can be manu-
100 factured at considerable less cost. To accomplish this result I make the fuse strip and terminals in one piece of the same cross section throughout its length, the strips being preferably copper. The ends of the strips I
105 make of relatively higher conductivity than the central portion thereof or fuse proper. A convenient maner of doing this is to coat the ends of the strip with copper.

What I claim as my invention is:

1. In a safety fuse, the combination with a casing closed throughout, of a fuse strip inclosed therewithin, and means connected to the inner surface of the casing and acting automatically upon the disruption of the
115 fuse for indicating the disrupted condition of the strip.

2. In a safety fuse, the combination with a fuse plug constituting a casing sealed throughout, of a fusible conductor therein,
120 the top of said plug being formed of transparent material and constituting an inspection opening, and a coating of indicating material mounted directly upon the inner surface of said top adapted to discolor upon
125 the disruption of the indicator.

3. In a safety fuse, the combination with a fuse plug constituting an inclosing casing, a portion of the inclosing casing being transparent, of a fuse strip within the casing, and
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means within the plug connected directly to the inner surface of said inclosing casing and acting automatically upon the disruption of the fuse for indicating the disrupted condition of the strip.

5 4. In a safety fuse, the combination with a fuse plug comprising sides and a bottom, of a transparent top therefor, a fuse strip within the plug, and said top having a coating of in-

dicating material applied directly upon its inner surface and separated from the strip for indicating the disruption of the fuse.

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

WILLIAM J. PHELPS.

Witnesses:

ESTELLE WORTMAN,
CORA PEARL BLISS.