

L. B. BUCHANAN.
 INCLOSED ELECTRIC FUSE.
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1,033,754.

Patented July 23, 1912.

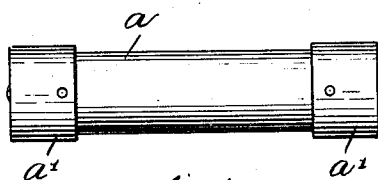


Fig. 1.



Fig. 2.

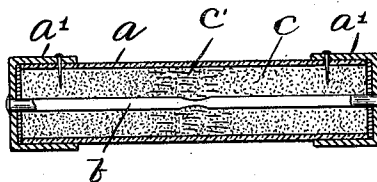


Fig. 3.

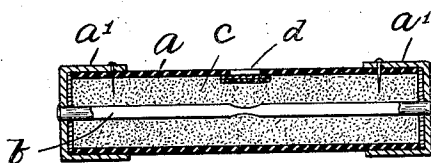


Fig. 4.

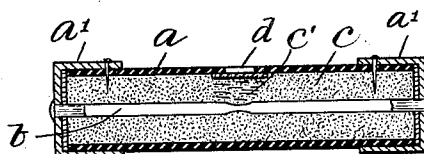


Fig. 5.

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UNITED STATES PATENT OFFICE.

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INCLOSED ELECTRIC FUSE.

1,033,754.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LEONARD B. BUCHANAN, of Woburn, county of Middlesex, and State of Massachusetts, have invented an Improvement in Inclosed Electric Fuses, of which the following is a specification.

This invention relates to electric-fuses, and particularly to fuses of the inclosed type, having means for indicating when the fuse is blown.

The invention consists in making a part or the whole of the fuse-case of glass, mica, cellulose acetate, or other substance through which the color of the material in the case may be seen, and placing within the case, close to a transparent part thereof, a material which will undergo a chemical change when the fuse blows, resulting in a change of color by reason of the chemical action upon it of gases formed within the fuse-case on the fusion of the fusible element, such gases being formed from the filler under the influence of the electric-current and the metal vapor of the fusible element. Other indicating-devices have been proposed in which a part outside the wall of the fuse-case is burned, charred or burst by the heat or expansion of the gases in the case, but such devices are open to the objection that the fire outside the fuse-case may ignite surrounding material, and, unless there is a burning heat outside the case, the device does not operate, and in general any device involving an opening in the side wall of the fuse-case is dangerous as permitting the escape of burning gases on short circuit. These objections have been met to a considerable extent in devices now used, but extreme care in construction is required, and, in spite of extreme precaution, dangerous flames and annoying failures to indicate still occur.

Among the advantages of my device is the elimination of the opening in the side wall of the fuse-case through which flame may escape, and the elimination of shunt or other auxiliary wires or connections requiring delicate adjustment and complicating the operation of assembling and filling the fuse. Moreover, since in my device the color change of the indicating means is effected by a chemical reaction, as distinguished from burning, charring, melting, or bursting, the change of color will take place at the fuse-

case wall, at any temperature or pressure, and the use of explosives at the fuse-case wall, to produce the requisite heat or pressure required in many devices now used, is avoided.

Figure 1 is a plan view of an inclosed electric-fuse embodying this invention before the fuse has blown, Fig. 2 is a similar view after the fuse has blown, Fig. 3 is a longitudinal vertical section of the fuse shown in Fig. 1, Fig. 4 is a longitudinal vertical section of a modified form of fuse, the fuse-case being composed in part of transparent material, and an indicating material applied to the interior of the transparent part thereof, Fig. 5 is a similar longitudinal vertical section of the fuse shown in Fig. 4, the indicating material being mixed with the filler.

In practising my invention it is for many reasons desirable to employ as a fuse-case a tube *a* of mica or cellulose acetate closed at the ends with metal caps *a'*, see Figs. 1 and 2, but, owing to the expense, this is not always practicable, and it is sufficient if the fuse-case be composed principally of fiber, closed at the ends with metal caps, a part of the wall, as *d*, of which is made of mica, glass, cellulose acetate, or other reasonably transparent material of sufficient strength and pressure-and-heat-resisting qualities. With this exception the ordinary construction of the fuse with metal end-caps and zinc or other metal-fuse-strip *b* may be used. In both instances, it will be observed, a fuse-case is produced which is devoid of a side opening through which flame may escape. In said fuse-case, and around the fuse-strip *b*, an arc-smothering material or filler *c* is placed; and also in said case an indicating material *c'* is placed, the color of which is adapted to be changed by chemical reaction.

In practising my invention it is important to use as or in connection with the arc-smothering material *c* a substance releasing some gas, non-condensing at ordinary temperatures, which will spread through the fuse-case after the fuse has blown and metathetically react upon the indicating material *c'* and change its color. Plaster of Paris, set or unset, is well suited for this purpose, as H_2S and other sulfur-bearing gases are liberated from this, when the fuse blows, by the action of the hot metal vapor

of the fuse-strip on the plaster of Paris filler under the influence of the electric current. Other substances may be mixed with this to increase the amount of H_2S given off on slight overload under mild conditions, for instance, iron pyrites. In such cases the additional substances should preferably be near the fusing point of the strip, but such substances are merely auxiliary and are not necessarily included in my invention.

As is well known to chemists, sulfureted hydrogen and other sulfur-bearing gases, will react metathetically upon many well-known substances to change their color, and some such substance, stable under ordinary conditions, should be chosen as the indicating material. Lead compounds, particularly the acetate and carbonate, or the lead oxid minium, are, perhaps, the most common and simplest of these to use. Acetate or carbonate of lead are, white substances which react with sulfureted hydrogen metathetically to form sulfid of lead, a black substance. A further advantage of the use of acetate or carbonate of lead is that the zinc vapor formed when the fuse blows may assist the effect by reacting metathetically upon it to form a black compound, but this is unreliable on slight overload and is not the principle on which my indicator operates in practice. The indicating material may be colored by red oxid of lead, or other suitable coloring matter, to give any color distinct from black without departing from my invention, which covers any contrasting colors.

I prefer to apply the indicating material c' by washing the transparent part d of the fuse-case with it, see Fig. 4, but another simple way is to mix a small amount of it with the filler c , see Fig. 5, in which case sufficient of it will be next to the transparent part to furnish the required indication. In either case, until the fuse is blown the indicating material shows through the transparent portion of the fuse-case, and the observer may determine from its color whether the fuse has blown or not.

It is obvious that almost any substance changing in color by the action of H_2S may be used as an indicating material without departing from my invention.

I claim:

1. An inclosed electric-fuse of the cartridge type, having an exterior non-conducting tube with metal end-caps, said tube having a transparent portion, lead acetate within the casing, visible through said transparent portion, a fusible metal current-conducting element within the tube, and finely divided plaster of Paris within the tube surrounding the fusible element, substantially as described.

2. An inclosed electric-fuse of the cartridge type, having an exterior non-conduct-

ing tube with metal end-caps, said tube having a transparent portion, a lead compound characterized by forming a sulfid on contact with sulfureted hydrogen, substantially as described.

3. An inclosed electric-fuse of the cartridge type, having an exterior non-conducting tube with metal end-caps, said tube having a transparent portion, a compound characterized by forming a sulfid on contact with sulfureted hydrogen, and a filler which when acted upon chemically by the vapors of the fusible metal will produce sulfureted hydrogen, substantially as described.

4. An inclosed electric-fuse of the cartridge type, having a fuse-case with a transparent portion, a fusible metal current-conducting element within the case, plaster of Paris within the case surrounding the fusible element, an indicating material within the case, visible through said transparent portion which will change in color when acted upon by the gases formed from the plaster of Paris upon the blowing of the fuse.

5. An inclosed electric-fuse having a fuse-case with a transparent portion and containing a metallic fusible element, a filler contained in said case and indicating material other than said filler also contained in said case, visible through said transparent portion, which is adapted to be changed by chemical reaction produced by a gas formed from the filler upon blowing of the fuse, resulting in a change in color, substantially as described.

6. An inclosed electric-fuse having a fuse-case with a transparent portion and containing a metallic fusible element, indicating material contained in said case and visible through the transparent portion thereof, and a filler also contained in said case containing a substance which reacts upon the indicating material when the fuse blows to produce a change in color of said indicating material, substantially as described.

7. An inclosed electric-fuse having a fuse-case with a transparent portion and containing a metallic fusible element, indicating material contained in said case and visible through the transparent portion thereof, and a filler also contained in said case, said fusible element and filler forming gases, when the fuse blows, which react upon the indicating material and change its color, substantially as described.

8. An inclosed electric-fuse of the cartridge type, having a fusible element within the casing and an arc-smothering filling material surrounding the fusible element which when acted upon chemically by the vapors of the fusible metal will cause an indication of the blowing of the fuse, visible from outside the fuse, consisting in a chemical change of an indicating material distinct

from the arc-smothering material, substantially as described.

9. An inclosed electric-fuse of the cartridge type, composed of a cylinder having
5 a non-conducting side with a transparent portion and metal end-caps, lead acetate within the casing, visible through said transparent portion, a fusible current-conducting element of metal within the casing, and a
10 filling material of finely divided plaster of

Paris within the casing surrounding the fusible element, substantially as described.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

LEONARD B. BUCHANAN.

Witnesses:

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H. B. DAVIS.