E. C. BALLMAN.

CARTRIDGE TYPE FUSE.

APPLICATION FILED NOV. 15, 1918.

1,350,055. Patented Aug. 17, 1920.

Fig. 1.

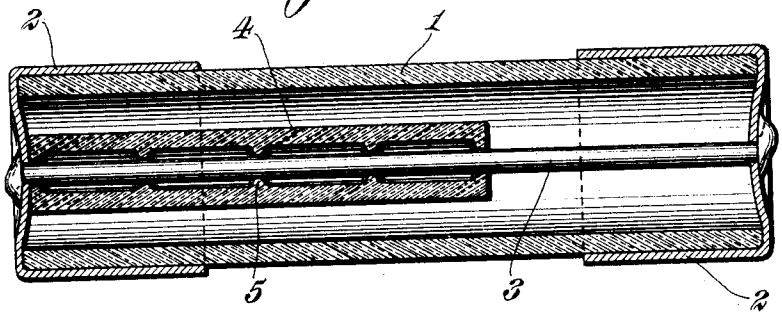


Fig. 2.

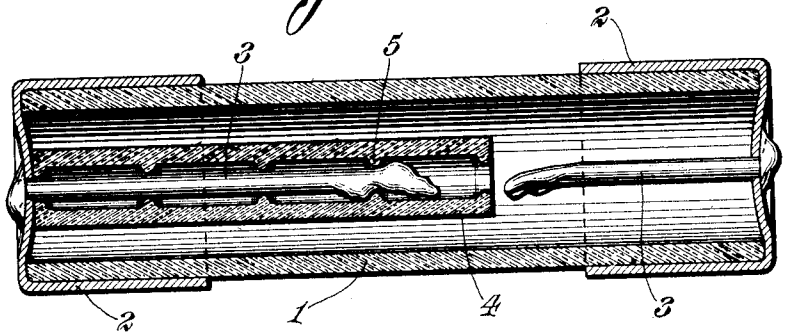
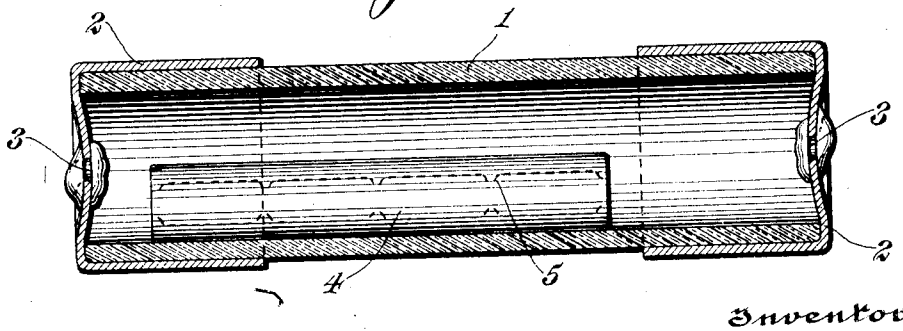


Fig. 3.



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UNITED STATES PATENT OFFICE.

EDWIN C. BALLMAN, OF ST. LOUIS, MISSOURI, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO VALLEY ELECTRIC COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

CARTRIDGE-TYPE FUSE.

1,350,055. Specification of Letters Patent. **Patented Aug. 17, 1920.**

Application filed November 15, 1918. Serial No. 262,696.

To all whom it may concern:

Be it known that I, EDWIN C. BALLMAN, a citizen of the United States, and residing at St. Louis, Missouri, have invented the new and useful Improvement in Cartridge-Type Fuses, of which the following is a specification.

This invention relates to electric fuses, and more particularly to fuses of the cartridge type.

One of the objects of this invention is to provide an electric fuse which will not only extinguish the arc formed upon rupture of the fuse-link, but which will also intimate the condition of the fuse-link, as well as the character of the current flow which caused the rupture of the fuse-link.

Further objects will appear from the detail description taken in connection with the accompanying drawing, in which,

Figure 1 is a cross section of a fuse embodying this invention;

Fig. 2 is a similar view showing the condition when the fuse-link is ruptured by an overload current; and,

Fig. 3 is a view similar to Fig. 1, showing the condition when the fuse-link is ruptured by a short-circuited current.

Referring to the accompanying drawing, 1 designates a case which may be of fiber, a paper impregnated with sodium-silicate, or other fire-proofing compound, or any other suitable insulating material. Connected to the ends of the case are terminal caps 2 of any suitable metal, and connecting these caps is a fuse-link or wire 3, which may be of any suitable fuse-link metal having the necessary low melting point.

Mounted on the fuse-link 3 and within the case is a tubular element 4 which may be made of any suitable insulating and fire-proof material, such as clay, porcelain, glass, or of the same material as the case 1 is made of. This tubular element is open ended, of a length less than the length of the case, and while the connection is such that the tubular element is loose on the fuse-link, so that this element will slide freely on the link, the connection is not so loose that this element will rattle when the case is given a sidewise vibration. The interior of the tubular element is provided with corrugations or projections 5, or the interior is simply roughened or left unglazed when paper, porcelain or clay is used, for a purpose hereinafter to be described.

When the fuse is in good condition with the fuse-link unruptured, the tubular element is slidable endwise on the fuse-link, but will not rattle if the case is given a sidewise vibration. When, however, the ordinary overload current traverses the fuse-link, thereby causing it to slowly melt at some point within the tube 4, this being the hottest part, the fuse-link will rupture, as shown in Fig. 2, but the molten metal of the fuse-link will flow into and between the interstices between the projections 5, or into the pores of the unglazed inner surface of the tubular element, thereby adhering thereto. This will cause the tubular element to adhere to and be removably retained by the fuse-link, so that if the case is shaken either endwise or sidewise, no rattling can be heard. This condition is clearly shown in Fig. 2. If, however, the fuse is blown under short-circuit conditions, the arc which is formed in the tubular element 4, causes a very rapid expansion of gases inside of this element, which blows out the arc that is formed, thereby giving a better means of suppressing the arc than when the case is filled with an inert porous substance, as in the present fuses. Moreover, this rapid expansion of the gases inside of the tubular element blows the molten metal endwise out of the tube and against the ends of the case, as shown in Fig. 3, thereby completely freeing the tubular element. When, therefore, the case is shaken either endwise or sidewise, the tubular element will rattle in the case.

It will, therefore, be seen that this invention accomplishes its objects. Not only is the arc caused by the rupturing of the fuse-link under short-circuit conditions completely extinguished, but means are furnished for intimating not only the condition of the fuse-link, but also the character of the current which caused rupture of the fuse-link. If the fuse-link is unruptured, it will intimate by endwise and sidewise movements of the case, the unruptured condition of the fuse-link, for at that time the tubular element can slide endwise, but will not rattle sidewise. If the fuse-link has been ruptured under ordinary overload conditions, then it will not rattle at all either upon endwise or sidewise vibration of the

case. If the fuse-link has been ruptured under short-circuit conditions, then the tubular element will rattle both upon endwise and sidewise movements of the case.

It is obvious that various changes may be made in the details without departing from the spirit of this invention. It is, therefore, to be understood that this invention is not to be limited to the specific construction shown and described.

Having thus described the invention, what is claimed is:

1. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and an element mounted on said fuse-link, adapted to intimate the condition of said fuse-link.

2. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and an element mounted on said fuse-link, adapted to intimate the character of the current flow which caused rupture of said fuse-link.

3. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a freely movable, tubular element mounted on said fuse-link.

4. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a freely movable, tubular element mounted on said fuse-link but free from contact with said case.

5. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a freely movable, tubular, open ended element mounted on said fuse-link.

6. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a freely movable, tubular, open ended element of a length less than the length of said case and mounted on said fuse-link.

7. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a freely movable, tubular element mounted on said fuse-link and adapted to cause adherence thereto of the ruptured fuse-link.

8. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a tubular open ended element adapted to slide freely on said fuse-link.

9. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a tubular open ended element adapted to slide freely on said fuse-link but free from contact with said case.

10. An electric fuse, comprising, a case, terminals on said case, a fuse-link connecting said terminals, and a tubular open ended element adapted to slide freely on said fuse-link but free from contact with said case and adapted to cause adherence thereto of the ruptured fuse-link.

In testimony whereof I affix my signature this 7th day of May, 1918.

EDWIN C. BALLMAN.