(No Model.)

P. G. GARDNER.

ELECTRIC FUSE.

No. 377,851. Patented Feb. 14, 1888.

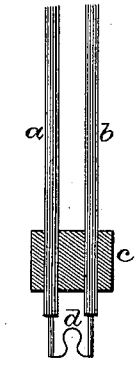


Fig. 1.

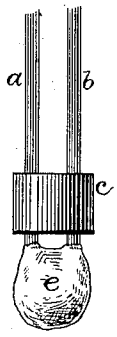


Fig. 2.

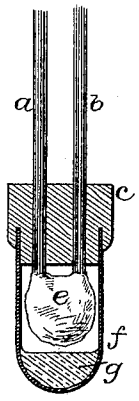


Fig. 3.

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UNITED STATES PATENT OFFICE.

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ELECTRIC FUSE.

SPECIFICATION forming part of Letters Patent No. 377,851, dated February 14, 1888.

Application filed April 14, 1887. Serial No. 234,803. (No model.)

To all whom it may concern:

Be it known that I, PERRY G. GARDNER, of North Adams, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Electric Fuses; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of my invention.

The prime object of my invention is to reduce the proportion of misfires to a minimum. It is well known that misfires are sometimes due to imperfect insulation of the conductors and the presence of moisture at the initial firing-point, and these should be carefully guarded against in all cases; but they have nothing to do with my invention.

Many misfires incident to the use of electric fuses as heretofore constructed are known to be due to a lack of intimacy between the adjacent explosive or firing medium and the electrode or wire which operates as a firing-wire when made incandescent by the electric current. A still greater proportion of misfires are also known to be due to the breakage and derangement of the said firing-wire at some time between its union to the conductor-tips and its attempted use for exploding. This firing-wire in its best form is extremely delicate, and it is consequently exposed to serious injury after its union to the conductors and before it is combined with the usual cap or detonator, and still more so during the operation of combining them, and also to some extent while being thereafter handled. It is these several liabilities to injury that I seek to guard against to the fullest extent consistent with the quite as important matter of intimate and reliably-close relations of the firing-wire with the explosive firing medium on which reliance is had for the initial explosive firing effect needed for properly igniting the usual explosive contents of a fulminate cap or other form of detonator.

I accomplish said ends by for the first time housing the firing-wire and incidentally the adjacent ends of the conductors within a solid mass of explosive matter, which, when in proper condition for use, serves as a protecting-shield for the firing-wire, and it is readily fired, because said wire is closely embedded therein. This matter is adhesively applied, and it may be largely varied in its components and character and in its mode of preparation, as well as in its application to the metal portion of the fuse, without in any manner departing from my invention, the gist of which is embedding the firing-wire and adjacent portions of the conductors in a mass of explosive matter so soft or pliable, or non-abrasive, that in applying it in close relation to said wires no damage can accrue to them, and also of such a character that after having been thus applied it will harden and serve as a reliable shield for protecting the firing-wire from abrasive injury.

Of the many explosive bodies heretofore employed at the firing-wire as initial firing agents, the fulminates are generally preferred, and of the latter the fulminate of mercury is deemed the most reliable, and hence I will first describe its use in accordance with my invention.

Referring to the drawings, Figure 1 illustrates the electric conductors and their firing-wire in the usual form and held in a wooden hub, which is shown in section. Fig. 2 illustrates one of my fuses in side view; and Fig. 3 illustrates the same combined with a metal cap containing compressed fulminate, said hub and cap being shown in section.

The electric conductors and firing-wire preferably used by me are of the usual and well-known form shown in sectional view, Fig. 1, the conductors *a* and *b* occupying a block or hub, *c*, of wood or other suitable material, and the delicate firing-wire *d*, usually platinum, being in metallic connection with the tips of the conductors. For obtaining the best results I first prepare a plastic explosive compound by mixing with ordinary collodion such a proportion of fulminate of mercury as will develop a mass of the consistency of jelly, and into this mass I dip the tips and firing-wire one or more times, as may be desired, permitting the matter thus taken up to properly harden after each dip, and then, after proper exposure to drying and hardening influences with sufficient time and a dry atmosphere, the fuses are ready for use.

In lieu of the collodion a light solution of

common starch and water is also used as an adhesive vehicle for the fulminate with very good results, but involving obviously more time and care in the drying or aging operation. In lieu of the starch, but in aqueous solutions, I have also obtained good results with glue or gelatine, and also with such gums as are soluble in water—as, for instance, gum-arabic—and in lieu of such gums I have obtained good results by the use of sugar. I have also obtained good results with such gums as require specially volatile solvents, such as shellac and gum-copal in alcohol or ether.

Now, while I prefer to employ the adhesive explosive mass, so that the operation of dipping will serve to charge the metal with the explosive, I can obtain good results by the use of the explosive in a more thoroughly plastic mass, involving the application of it to the metal as if it were putty, and I have also obtained good results by not first preparing the plastic or adhesive explosive mass, but proceeding progressively by first dipping the metal part of the fuse into the adhesive medium, and then dipping it into the dry and finely-powdered explosive, and by one or more successive accretions in this way build up to the bulk desired in each case.

It is now to be distinctly understood that, while I prefer the fulminate of mercury adhesively applied to the metal parts of an electric fuse and shall make special claim thereto as the best known embodiment of my invention, I am not, under the main feature of my invention, restricted to any particular fulminate nor to any particular explosive matter so long as it can be applied in like manner as the fulminate of mercury and serve my purposes with a suitable adhesive matter—as, for instance, gun-cotton or other short nitrated fibrous matter—or in a flocked condition can be relied upon with fair results, especially with light or thin non-aqueous adhesive solutions. With, say, finely-comminuted nitrated fiber, the metal part of the fuse is first dipped into the adhesive solution and then into the dry fiber, and as it hardens it can be gently pressed between the thumb and finger, and when well hardened a second dip into both may be given, if needed, with similar manipulation as a finishing operation.

It will be seen that by either of the desired modes of procedure the metal parts of the fuse which are to be made incandescent must of necessity be in intimate contact with the initial firing medium, and that said medium will serve effectually as a protecting-shield for the firing-wire not only as to abrasion, but also as to oxidation.

Electric fuses constructed in accordance with my invention would of course somewhat differ in appearance, according to the particular materials employed, as well as the manner of applying them.

With the mixture of the fulminate of mercury and the collodion suitable for the dipping operation, the fuses resemble closely the form illustrated in Fig. 2, the explosive shield being shown at *e* fully inclosing the tips and firing-wire.

As it is desirable in the use of all electric fuses to employ therewith a cap containing compressed fulminate, it follows that my explosive shield when in the cap should be free from actual contact with the surface of the compressed explosive, and hence I prefer to combine my fuse with a loaded cap, substantially as is illustrated in Fig. 3, the cap *f* and plug or hub *c* being there shown in section, with the compressed fulminate at *g*, and above it the suspended explosive shield *e*. The plug *c* at the junction of its head and shank has an annular score, which is snugly occupied and filled by the edge of the cap, thus accurately gaging the shield *e* with respect to the surface of the compressed fulminate.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electric fuse, the combination, substantially as hereinbefore described, of the wire which is made incandescent for firing, and a protecting-shield for and in close contact with said wire, composed of solid adhesive explosive matter.

2. In an electric fuse, the combination, substantially as hereinbefore described, of the wire which is made incandescent for firing, and a mass of fulminate of mercury adhesively applied to said wire and serving as a protecting-shield therefor, and also as an initial explosive medium in close contact with said wire.

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