(No Model.)

J. MACBETH.

ELECTRICAL FUSE.

No. 394,192. Patented Dec. 11, 1888.

FIG. 1.

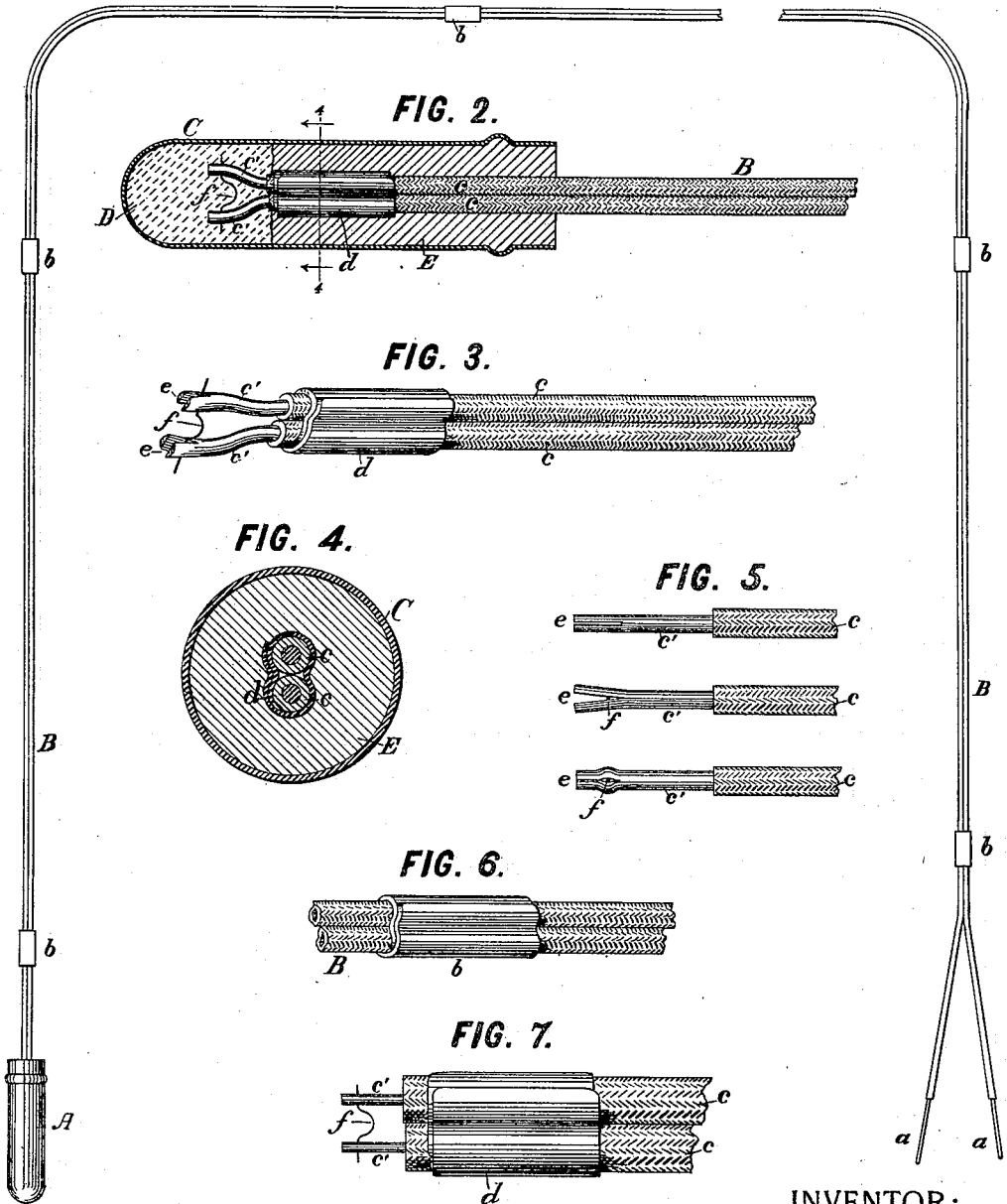


FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

WITNESSES:

J. A. C. Criswell.

C. K. Fraser.

INVENTOR:

James Macbeth,

By his Attorneys,

Arthur C. Fraser & Co.

UNITED STATES PATENT OFFICE.

JAMES MACBETH, OF BROOKLYN, NEW YORK.

ELECTRICAL FUSE.

SPECIFICATION forming part of Letters Patent No. 394,192, dated December 11, 1888.

Application filed July 19, 1888. Serial No. 280,403. (No model.)

To all whom it may concern:

Be it known that I, JAMES MACBETH, of Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Electric Fuses, of which the following is a specification.

This invention relates to electric fuses for blasting of that class wherein the exploder is constructed with a fine platinum or other high-resistance wire, forming a bridge between the ends of the fuse-wires, so that upon the passage of a current of electricity it is heated to incandescence and ignites a charge of fulminate or other inflammable or explosive material within the shell of the exploder.

The objects of my invention are to provide an exploder of improved and simplified construction, the manufacture of which shall be cheap and easy, and whereby it shall be rendered practicable to make the exploders of uniform resistance.

My improved construction effectually prevents any dislocation of the platinum or high-resistance wire. It also provides against the disarrangement of the fuse-wires and their injury in tamping the blasting-charge.

In electric fuses of this class as heretofore made the fine platinum wire has been soldered at both ends to the exposed ends of the leading-in or fuse wires, and difficulty has been experienced in uniting the respective wires by means of solder alone, both in making an electrically-perfect connection and in connecting the platinum wire so firmly as to avoid its dislocation when it is subsequently thrust into the charge of fulminate in the exploder shell or cap. Such dislocation, when it occurs, renders the fuse inoperative, and is a defect very difficult of discovery before the attempt is made to fire the fuse. It is highly desirable that electric fuses should have always the same resistance, as otherwise when a number of them are connected in the same circuit for simultaneous firing their action will not be simultaneous, and consequently certain of the blasting-charges will be left unexploded by the first current passing over the circuit, and it may subsequently be impossible to explode them, owing to the disarrangement of the circuit by the explosion of the charges which have been set off. This is the case when the fuses are coupled in circuit in multiple arc, whereas if coupled serially it is absolutely essential, in order that all may explode, that they should all be very nearly of the same resistance. This desideratum ought easily to be obtainable by the use always of the same size of platinum wire and by connecting always the same length thereof between the terminals of the leading-in wires; but in practice it is found that, although these conditions are observed, there is nevertheless a considerable variance in the resistance of the fuses. This variance is due to the varying degrees of perfection with which the soldered joints are made.

My invention provides a means by which the soldered joints may be made always of uniform resistance, or so extremely close an approximation to absolute uniformity that the differences which may exist are so slight as not to be noticeable. I attain this result by splitting or bifurcating the ends of the leading-in wires and inserting the ends of the platinum wire in these bifurcations, after which the bifurcated ends are closed together, so as to embrace or pinch between them the ends of the platinum wire, thereby holding the latter strongly and securely and affording an extended clean surface in contact with it, so that in the subsequent operation of soldering a large and perfect solder joint is formed, the resistance of which is less than that of any portion of the platinum wire, so that the varying resistances of the soldered joints are eliminated as an element in the determination of the resistances of the respective fuses.

In the construction of the fuse the leading-in wires, which are preferably copper wires having an insulating-coating of suitable material, are bared of insulation for a short distance back from their ends, and just back of the bared portion they are clamped firmly together by means of a metal clasp, which is passed around them and forced by stamping or otherwise to embrace them closely, thereby holding them firmly together without other separation than that afforded by their insulating-covering. The bared end portions of the wires are then spread somewhat apart, by preference, which is done with absolute uniformity by striking them in a die. The ex-

treme ends of the wires are split open either before or after spreading the wires, this operation being performed, preferably, by means of a saw, although it may be done in other ways. The fine platinum wire is then inserted in the bifurcations, the proper length of this wire being looped between the copper wires in order to give the desired resistance, this length being determined by the application of any suitable gage. The bifurcated ends are then nipped together, after which their joints with the platinum wire are made perfect by soldering them. The exploder is then completed, as heretofore, by thrusting the wires into a metal shell or cap until the platinum wire is embedded in a charge of fulminate therein, and finally running in molten sulphur, in order to cement the wires into the cap and prevent entrance of moisture. The molten sulphur forms an insulating-cement entirely surrounding the metal clasp and separating it from the metal shell.

The insulated leading-in or fuse wires, which are usually several feet in length, according to the depth of the drilled hole into which the fuse is to be inserted, are bared of insulation at their outer ends and tinned in the usual manner, and, instead of being twisted together, as heretofore, are fastened together at intervals by means of metal clasps similar to the clasp applied within the exploder. The wires are thus kept straight and free from kinks, are rendered much easier to handle, and are less liable than formerly to become disarranged within the blasting-hole, and consequently to be injured in the tamping process.

In the accompanying drawings, Figure 1 is an elevation of my improved fuse on a small scale. Fig. 2 is an enlarged longitudinal section of the exploder. Fig. 3 is a perspective view of the wires, illustrating the bifurcation of the leading-in wires and the application of the platinum wire thereto. Fig. 4 is a transverse section of the exploder on the line 4 4 in Fig. 2. Fig. 5 is a view of the end of one of the leading-in wires, showing the successive steps in the process of uniting the platinum wire thereto. Fig. 6 is a perspective view of one of the clasps applied to the fuse-wires outside of the exploder. Fig. 7 shows a modification of the leading-in wires.

In Fig. 1, A designates the exploder as a whole, and B the fuse-wires as a whole. At the opposite end from the exploder these wires are bared of insulation, and their naked ends are tinned, as shown at *a a*, in order to make connection with the circuit-wires. The clasps by which the two fuse-wires are bound together at intervals are shown at *b b* in Fig. 1 and more in detail in Fig. 6.

In Figs. 2 and 4, C designates the metal exploder shell or cap, which is usually made of copper. D designates the charge of fulminate or other detonating or inflammable material. E designates the filling of sulphur or other cement, and *c c* designate the leading-in wires, which in practice are preferably the same as the external fuse-wires, although this is not essential. These wires *c c* are bound together by the sheet-metal clasp *d*, as shown in Figs. 2, 3, and 4, and their bared ends *c'* are bifurcated at *e*, preferably by making a saw-cut in them, as shown at the upper view in Fig. 5, after which they are spread out, as shown in the middle view in Fig. 5, and the platinum wire *f* is placed in the bifurcations, as shown in Fig. 3, after which they are closed together, as shown in the lower view in Fig. 5. The ends are then soldered, whereupon the wires are ready to be thrust into the exploder-shell. The filling of sulphur or other suitable cement is then run in, which completes the exploder, as shown in Fig. 2.

The insulating-covering on the leading-in or fuse wires should be so thick and dense as not to be liable to injury by the applying of the metal clasps *b d*, which are preferably applied by striking them in a die. The insulating-covering should be thick enough to prevent any possible contact of the naked ends *c'*. By making this insulating-coating thick enough these ends *c'* may be thereby sufficiently separated, so that bending them apart will be unnecessary. This modification is shown in Fig. 7. So thick an insulation, however, is not considered necessary.

I am aware that the leading-in wires of an electric exploder have been bound together by a wrapping of thread or very fine wire; but this means of connection is found in practice not to afford sufficient strength and rigidity to enable the wires to sustain the strain to which they are subjected in the filling of the cap and subsequently in the tamping of the blast. The metal clasp *d* is very quickly and cheaply applied and holds the wires with the desired firmness.

I am also well aware that a metal clamp has been applied to the leading-in wires in order to hold them spaced apart within the shell, the clamp being made of sheet metal and bent separately around each of the wires and indented between them in such manner as to prevent their approaching one another.

I make no claim to such means for holding the wires apart; but, on the contrary, I claim the clasp only as a means for holding the wires together with their insulating-coverings in contact.

I claim as my invention the following-defined novel features and combinations, substantially as hereinbefore specified, viz:

1. In an electric fuse, the combination, with the high-resistance or platinum wire, of the leading-in wires having their ends split and embracing the ends of the high-resistance wire between the bifurcations of their split ends, which are closed together upon and soldered to the ends of the high-resistance wire.

2. In an electric fuse, the combination, with the shell and the high-resistance platinum wire, of the leading-in wires cemented into the shell and having their ends split and embracing the ends of the high-resistance wire be-

tween the bifurcations of their split ends, which are closed together upon the platinum wire.

3. In an electric fuse, the combination of a shell, two insulated leading-in wires entering said shell, a metal clasp embracing said wires within the shell, whereby they are held firmly together and separated by only the thickness of their insulating-coatings, and the ends of said wires beyond said clasp bared of insulation and spread apart, with a high-resistance platinum wire fastened at its opposite ends to the ends of said leading-in wires, and a filling of insulating-cement around said leading-in wires and entirely surrounding said clasp and separating it and said wires from the shell.

4. In an electric fuse, the combination, with the exploder, of the fuse-wires leading thereto, suitably insulated and bound together at intervals by means of metal clasps bent around the two wires, whereby they are protected from disarrangement and from consequent injury in tamping.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES MACBETH.

Witnesses:
ARTHUR C. FRASER,
JNO. E. GAVIN.