No. 622,511. Patented Apr. 4, 1899.

# W. M. MORDEY.

## ELECTRIC SAFETY FUSE OR CUT-OUT.

(Application filed Feb. 15, 1897.)

(No Model.)

Fig. 1.

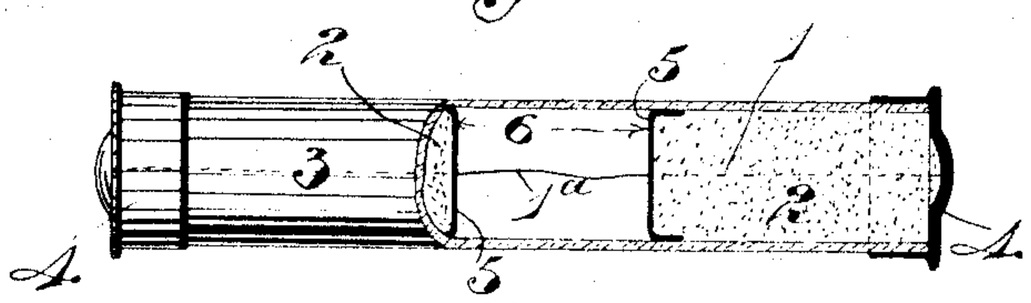



Fig. 2.

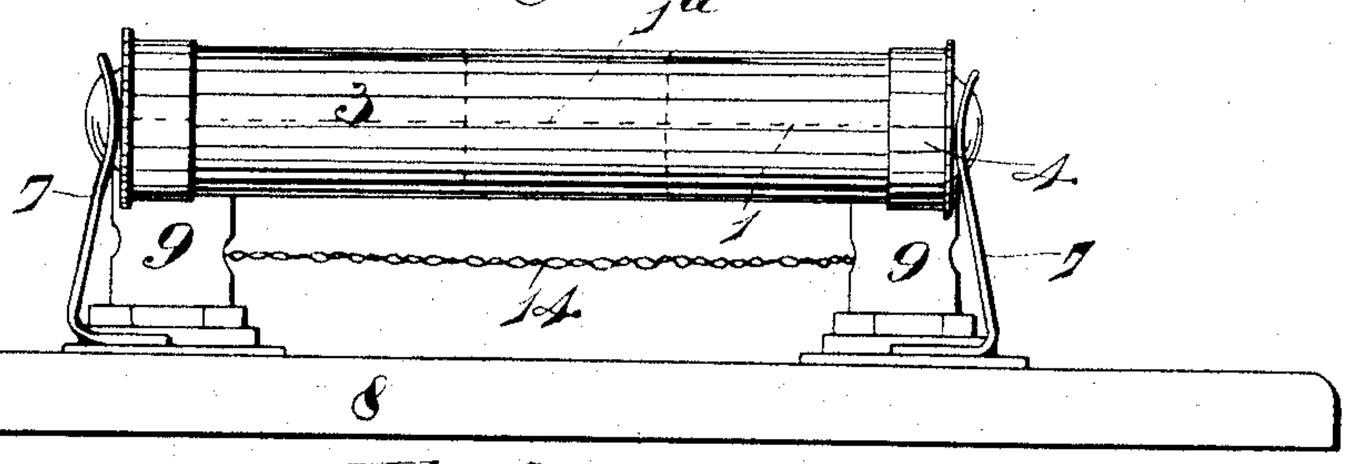



Fig. 3.

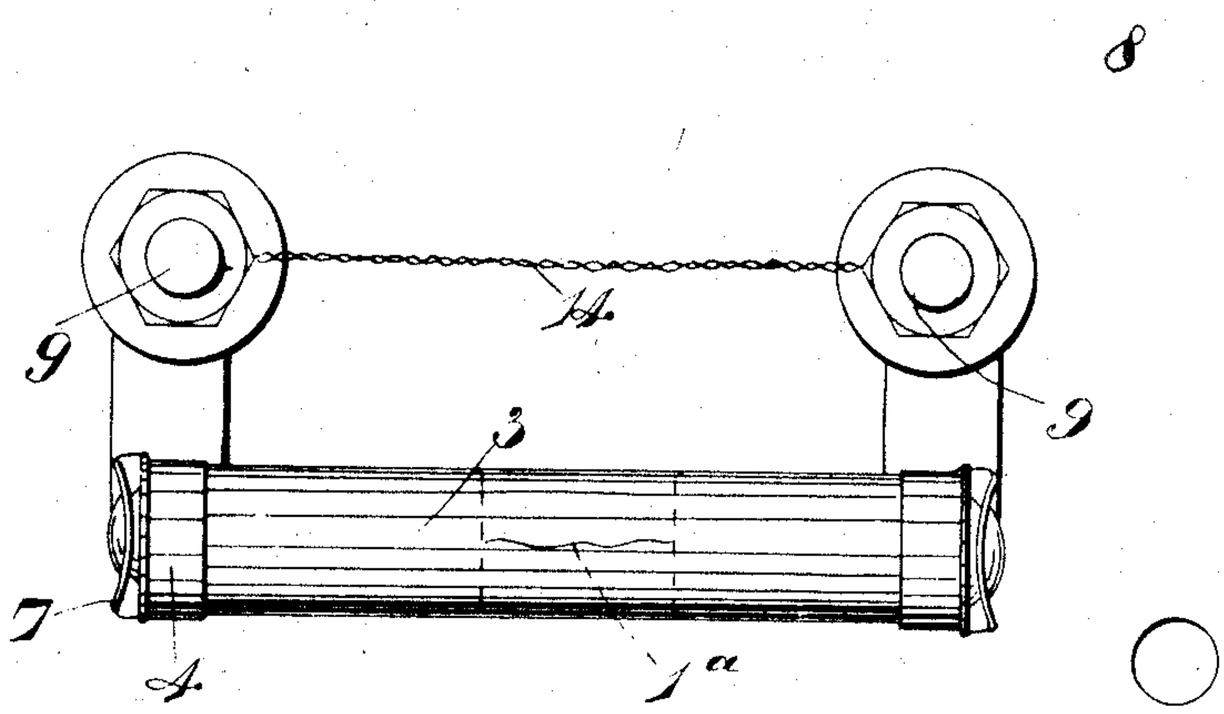



Fig. 4.

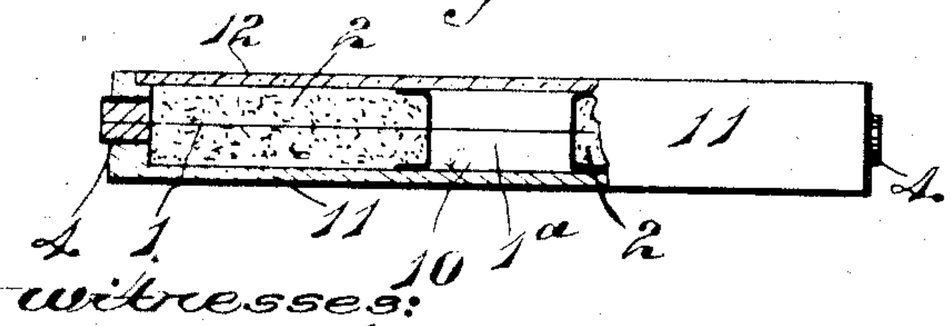
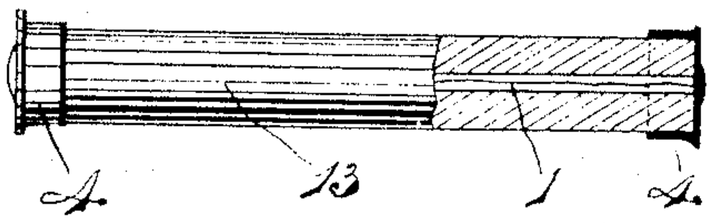



Fig. 5.




Witnesses:
A. C. Harmon.
Thomas J. Drummond.

Inventor:
William M. Mordey.
by Crosby Gregory Attys.

# UNITED STATES PATENT OFFICE.

WILLIAM MORRIS MORDEY, OF LOUGHBOROUGH, ENGLAND, ASSIGNOR OF ONE-HALF TO JOHN M. ORFORD, OF BOSTON, MASSACHUSETTS.

## ELECTRIC SAFETY FUSE OR CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 622,511, dated April 4, 1899.

Application filed February 15, 1897. Serial No. 623,450. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM MORRIS MORDEY, a subject of the Queen of Great Britain and Ireland, residing at Loughborough, in the county of Leicester, England, have invented Improvements in Electric Safety Fuses or Cut-Outs, of which the following is a specification.

My invention has for its object improved means of constructing safety-fuses especially suitable for high-tension electric circuits.

Hitherto it has been found necessary or advisable to make high-tension safety-fuses of a considerable length in order to prevent the formation of destructive and dangerous arcs occurring when the fuses are caused to melt by the passage of currents greater than they are intended to carry when used under normal conditions. Various plans have been proposed and used to further guard against the formation of such arcs. For example, the fuse (which has usually consisted of one or more wires) has been made to pass through holes, slits, or apertures in diaphragms or other dividing partitions or screens placed between the terminals or ends of the fuses. In spite of these and other precautions the difficulty of preventing the formation of dangerous or objectionable arcs has been considerable. The fuses made to meet this difficulty have hitherto been large, costly, and wasteful of energy. By my invention I am enabled to make fuses even for very high tension of a small size and which are inexpensive, absorb very little energy, and will break the circuit without any objectionable arc or risk of short circuit even under the most trying conditions.

In constructing fuses according to my invention the fusible conductor, which consists of a thin wire, or it may be two or more such wires or a strip of thin foil or sheet metal, (the metal used being preferably copper in all cases,) is supported in a glass tube or other suitable vessel or box. This tube or vessel is then partly or wholly filled with finely-divided or pulverized non-conducting or badly-conducting material, preferably incombustible or non-inflammable—such as dry chalk, marble, bath-brick, sand, mica, emery, asbestos, or the like—this material being made to cover and surround the fuse wire or strip, hereinafter called the "fusible conductor." The material which I have found very satisfactory in practice and cheap is "flue-dust," such as is deposited in the flues leading from boiler fire-boxes. A small space is or may be left uncovered by the finely-divided non-conducting material at some portion of the tube or vessel to enable the position and condition of the fuse-conductor to be observed. Contact is made in any convenient manner with the ends of the fuse. Thus when a glass tube is used the ends are closed by small caps of brass or are surrounded by rings or collars of brass or other metal, to which the ends of the flexible conductor are soldered. Connection is then conveniently made with these caps or rings by spring clips or holders permanently attached to a case or base in or on which the fuse is supported.

Figure 1 of the accompanying drawings shows, partly in side elevation and partly in longitudinal section, an electric safety-fuse constructed according to this invention. Fig. 2 is a side elevation, and Fig. 3 a plan, showing how the fuse can be mounted for use. Figs. 4 and 5 are similar views to Fig. 1, showing modified constructions of fuses according to this invention.

In the fuse shown in Fig. 1 the fusible conductor 1, in the form of a length of copper wire, is embedded in finely-divided insulating and incombustible material 2 of the kind mentioned, inclosed in a cylindrical glass tube 3, the ends of which are provided with metal caps 4, to which the ends of the fusible conductor are connected.

5 5 are dished disks or partitions, of suitable material—for example, paper—arranged a short distance apart to confine the finely-divided material in position and leave a clear space 6 at the central part of the tube 3, and shown as completely surrounding the conductor, through the middle of which said conductor passes, so that the condition of the portion of the conductor 1 traversing this space can be easily observed. With the construction Fig. 1 this observation may be had from any side of the tube, because the air-space completely surrounds the conductor.

Figs. 2 and 3 show a pair of spring clips or holders 7 7, between which the fuse can be easily inserted for use. These clips or holders are fixed upon a base-piece 8 and are provided with binding-screws 9 for placing the device in an electric circuit. Fig. 4 shows another way in which safety-fuses can be constructed according to this invention. In this case the fusible conductor 1 is supported in a longitudinal groove, trench, or recess 10 in a vessel or receptacle 11, made of porcelain or other suitable material, the groove or recess being charged with finely-divided or pulverized material 2, so as to surrround the wire, and the whole secured together by a cover or lid 12 of suitable material, such as porcelain or glass. A small portion $1^a$ of the conductor 1 is preferably left uncovered and visible, as in the other arrangement, to enable its position and condition to be observed. In the construction Fig. 4 the air-space likewise is shown as completely sourrounding the conductor, notwithstanding the observation can be had from the top of the sheath or vessel only when the cover is removed. This is because I consider that for the best results in the practical use and operation of the fuse and the maintenance of a substantially uniform fusing point or temperature the air-space should completely surround the conductor even though the inspection, if provided for, be restricted to one side only. It will also be noted that in both the constructions Figs. 1 to 4, inclusive, the air-space is central of the length of the tube and is relatively short as compared with the length of the tube. I have found this length and location of air-space to produce the best results. it best tends to concentrate the first blowing or rupturing point of the fuse within the air-space.

The above-described methods of carrying out my invention are those which I prefer; but I do not limit myself to them. Other methods may be used. Thus instead of surrounding the fusible conductor by the non-conducting incombustible material in a finely-divided form, as above described, in a glass tube or other receptacle I may make up the said material by compression or otherwise into a mass—as, for instance, in the form of a block or cylinder 13, Fig. 5—surrounding the fusible conductor or having one or more small holes through which the said conductor may be passed, the said material thus surrounding the conductor and inclosing an air-space traversed thereby, the hole constituting the air-space, and in which it may be secured and having its end connected to contact-pieces 4.

The action of the improved fuse is as follows: The passage of an excessive current causes the fusible conductor to be volatilized, the metal being deposited in a finely-divided condition among the particles of the surrounding non-conducting material. So complete is the dissipation of the metal that it is frequently difficult to find by inspection any trace of it after the conductor has been fused. The non-conducting material between the terminals reduces the amount of air in the vessel, prevents the formation of a conducting-chain of metallic particles, and forms a highly-resisting medium. Thus the occurrence of an arc is prevented. For large currents I prefer to use a small fuse constructed as above described or otherwise according to my invention and to shunt it by an ordinary fuse or by an electromagnetic or other cut-out, (indicated diagrammatically at 14 in Fig. 3.) This ordinary fuse or cut-out is arranged to carry practically the whole current. In the event of an excessive current the ordinary fuse melts or the cut-out acts, but does so with a scarcely-perceptible spark. The final rupture of the circuit then occurs in the small special fuse.

What I claim is—

1. In a safety-fuse, a fusible conductor combined with non-conducting material in a finely-divided state traversed by said conductor.

2. In a safety fuse or cut-out, a fusible conductor, and a tube or vessel of finely-divided, compressed incombustible non-conducting material surrounding said conductor and inclosing an air-space traversed thereby, substantially as described.

3. A safety-fuse comprising a fusible conductor, and a tube or vessel charged with finely-divided non-conducting material traversed by said fusible conductor, substantially as described.

4. A safety-fuse comprising a fusible conductor, a tube or vessel in which said fusible conductor is arranged, contact-pieces carried by the ends of said tube or vessel and connected to the ends of said fuse wire or strip, and finely-divided non-conducting material arranged in said tube or vessel, substantially as described.

5. A safety-fuse comprising a fusible conductor, a tube or vessel inclosing the same, finely-divided non-conducting material surrounding part only of said wire or strip so as to leave part thereof uncovered, and contacts in connection with the ends of said fusible conductor, substantially as described.

6. A safety-fuse comprising a fusible conductor, a glass tube surrounding said fusible conductor and provided at its ends with metal caps to which the ends of said conductor are connected, finely-divided non-conducting material surrounding said conductor, and partitions arranged to hold said finely-divided material in place and to form a clear unobstructed space traversed by said conductor, substantially as described for the purpose specified.

7. The combination with an ordinary fuse or cut-out adapted to carrying practically the whole of the current in the circuit with which it is to be used, of an additional fuse arranged as a shunt to the ordinary fuse, and compris-

ing a fusible conductor, and a vessel or tube charged with finely-divided non-conducting material traversed by said fusible conductor substantially as described.

8. A safety-fuse comprising a fusible conductor, an inclosing sheath or vessel in which said fusible conductor is arranged and surrounded by a mass of finely-divided refractory material placed in said sheath or vessel, in such a manner as to leave an air-space about the fuse-wire.

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

WILLIAM MORRIS MORDEY.

Witnesses:

PERCY G. MATTOCKS,

WM. O. BROWN.