(No Model.)

W. E. HARRINGTON.

FUSE CUT-OUT.

No. 560,128. Patented May 12, 1896.

FIG. 1.

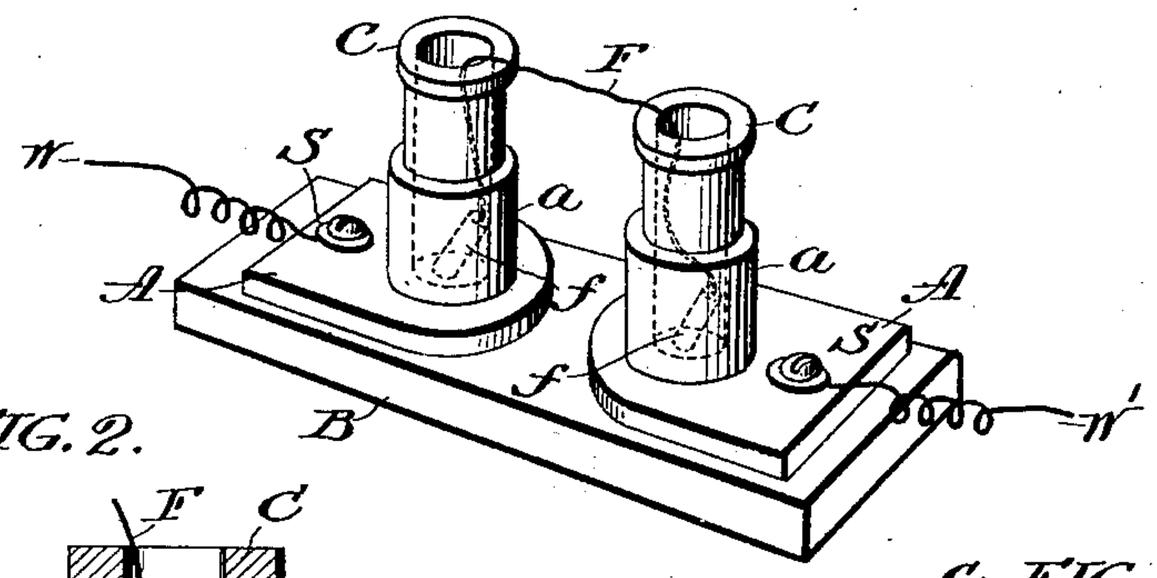


FIG. 2.

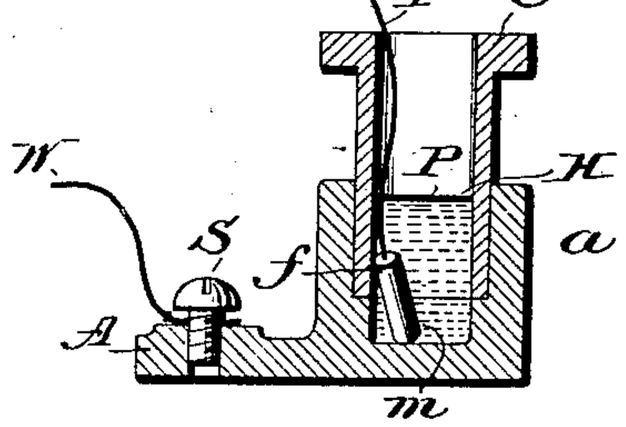
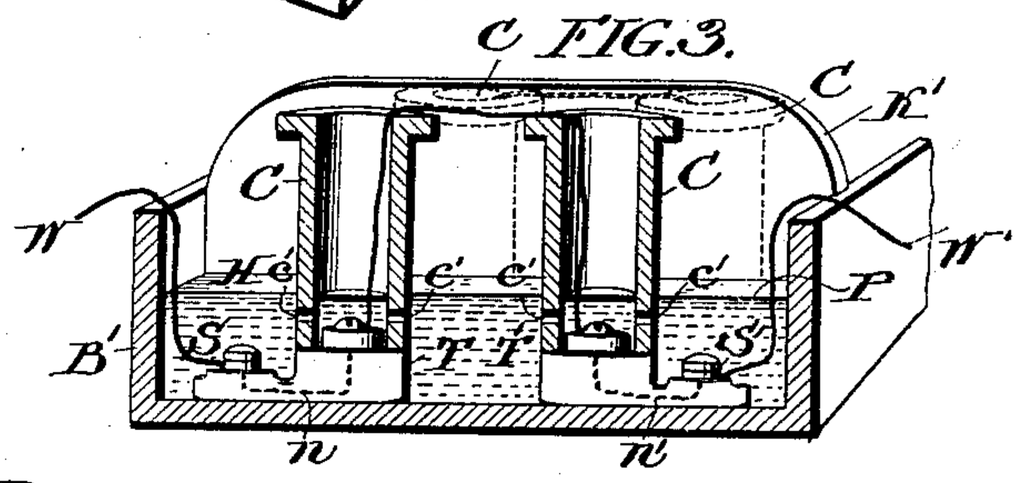


FIG. 3.



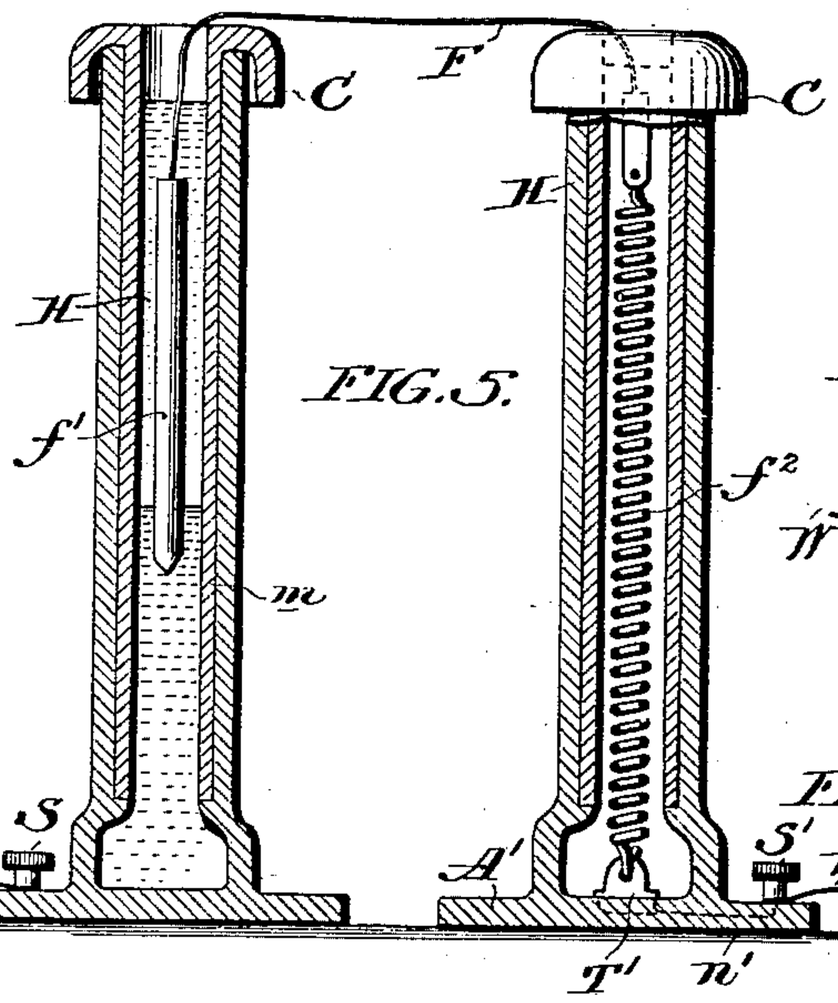


FIG. 5.

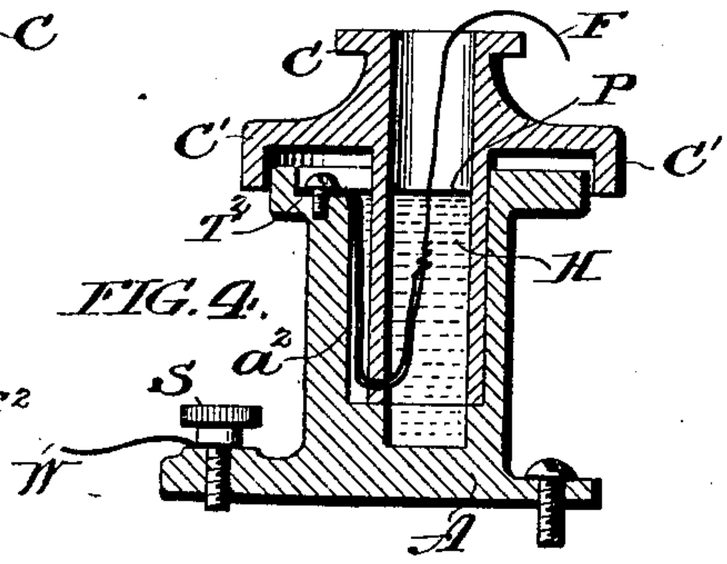


FIG. 4.

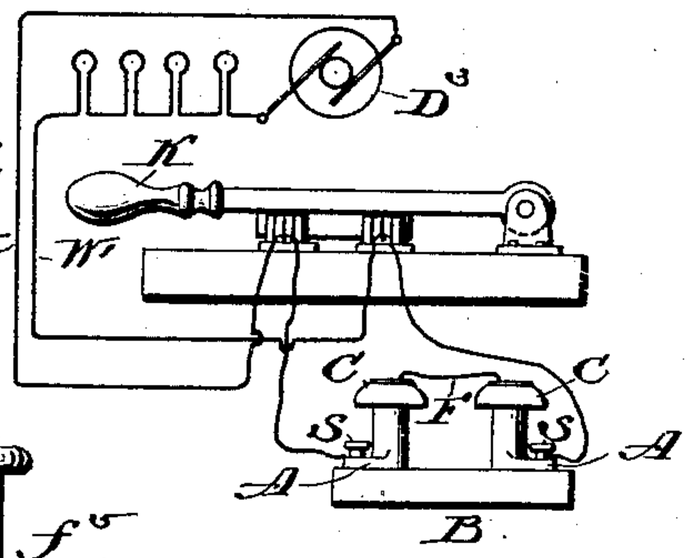


FIG. 7.

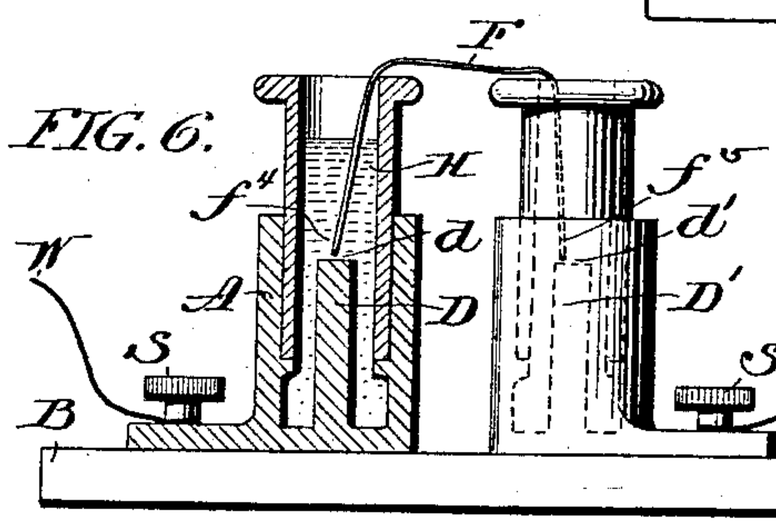


FIG. 6.

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FUSE CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 560,128, dated May 12, 1896.

Application filed June 1, 1894. Serial No. 513,122. (No model.)

To all whom it may concern:

Be it known that I, WALTER E. HARRINGTON, a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Fuse Cut-Outs, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to fuse cut-outs for electric circuits, and has for its main object to provide a cut-out so constructed as to effectually prevent the destructive arcing which is incident to the opening of any circuit, either by an ordinary switch or where an undue current is broken by the "blowing" or burning out of a fuse.

To prevent this arcing, my invention mainly consists in providing a suitable liquid in which a part of or all of the length of the fuse is immersed.

My invention also consists in arranging non-conducting tubes to contain the non-conducting fluid and in various other improvements, which will be more specifically pointed out in the claims appended to and forming part of this specification.

My invention will be best understood as explained in connection with the accompanying drawings, in which—

Figure 1 is a perspective view of a cut-out constructed according to my invention. Fig. 2 is a view in vertical section of one of the reservoir-tubes shown in Fig. 1. Fig. 3 is a view, partly in vertical section, of a somewhat modified arrangement. Fig. 4 is a view similar to that shown in Fig. 2, illustrating a somewhat modified arrangement. Fig. 5 is a view in vertical section of a further modification, showing means for positively drawing the fuse-wire beneath the non-conducting liquid when it is parted or melted. Fig. 6 is a view, partly in section, showing my cut-out arranged as a lightning-arrester; and Fig. 7 shows the application of my cut-out to prevent arcing or sparking when a current is opened by a switch.

Heretofore it has been common to employ a fuse-wire of metal which melts at a comparatively low temperature, which will be blown or melted when a current of undue intensity passes through it. It often happens, however, that after the fuse metal itself is burned the current will continue to pass along the path formed by the intensely-heated metallic particles, forming what is termed an "arc." This arc continues burning at the expense of the metal of the terminals to which the fuse proper was connected. To prevent this, I pass a portion or all of the length of the fuse-wire through a suitable fluid, which I have discovered will effectually prevent any arcing or burning of the terminals after the fuse-wire is itself melted, since of course the fluid fills up immediately any space left by the burning or melting of the fuse-wire and extinguishes and cools the melted particles. The fluids which I use are those from which no readily-conducting gases or fumes rise or are given off during the burning of the fuse, and are preferably fluids which not only give off no conducting-gases, but are of themselves non-conductors and non-inflammable at the temperature at which the fuse burns—such, for instance, as water or non-conducting oil.

In the construction shown, W W′ is a line-wire, to the terminals of which the fuse-wire F is secured. In Figs. 1 and 2 the wire W is shown secured to a metallic base A, the other wire, W′, (see Fig. 1,) being secured to a similar base A, S S′ being binding-screws to make the connection. The metallic base, as shown, has a tubular portion *a*, which serves as a receptacle for the non-conducting fluid, which is indicated at H, and in Fig. 2 a layer of mercury *m*, underlying the non-conducting liquid, serves as a terminal. The fuse-wire F, which connects the two terminals, passes through the non-conducting-fluid layer H, and a tube C, of non-conducting material, as porcelain or glass, is preferably arranged, as shown, only to carry the fuse-wire up away from the metallic base *a*, but also to prevent the violent scattering of the insulating fluid when the fuse-wire is melted. This tube, however, is not absolutely indispensable, though I prefer in most cases to employ it for the reasons above stated. The end of the fuse-wire which dips into the mercury I preferably

provide with a somewhat enlarged piece of metal *f*, which not only serves as a weight to keep the fuse-wire in place, but also to prevent the quick amalgamating which takes place when a small piece of fuse metal is placed directly in the mercury and reduce the contact resistance. The other end of the fuse-wire is preferably arranged in the same way, passing through a layer of non-conducting fluid to the terminal of the wire W′.

I have found that water makes a very efficient non-conducting fluid, practically the only objection to its use being its liability to evaporate if left standing any length of time and uncovering the terminals. Non-conducting oil may also, and perhaps preferably, be used. In any case, particularly if water be used, I prefer to provide a layer of paraffin or a similar substance, which, as indicated at P, will cover the water or other non-conducting fluid and effectually prevent evaporation. When an abnormal current flows over the circuit, the fuse-wire F melts, but it is impossible for an arc to be formed after the fuse-wire is melted, since the non-conducting fluid serves to check the formation of and cool the heated particles, and does not of itself give off conducting-gases. I may here remark that, while I prefer to arrange the fuse-wire so that a portion of it will be out of and above the non-conducting fluid, it is perfectly practicable to entirely submerge the wire. This, however, is apt to give rise to violent disturbances in the fluid when a fuse melts.

It will of course be perfectly obvious that it is not necessary to form the terminals of mercury. In Fig. 3 I have shown connections, as *n n′*, leading from the binding-screws S S′ to binding-screws T T′, to which the fuse-wire is connected. In Fig. 3 the binding-screws T T′ are shown beneath the level of the non-conducting fluid and inside the tubes C. This of course is not necessary, as this binding-screw may be at or above the level of the oil or other non-conducting liquid, as shown at T^2 in Fig. 4, making a more accessible connection. All that is necessary is that the fuse after leaving the terminal shall pass through the fluid.

In the construction shown in Fig. 4 or in similar constructions I prefer to form the end of the fuse-wire which is secured to the terminal thicker for some distance than the main part of the wire, so that fusion will commence in the thin portion of the fuse, the thick portion serving as part of the terminal proper. In Fig. 4 this thickened portion is shown as I prefer to form it, extending up into the body of the tube, and to insure that the fuse will be submerged I form a hole or notch c^2 at the base of the tube, through which the thickened portion of the fuse-wire passes. Fig. 3 shows also a very convenient mode of arranging a number of fuse cut-outs. In this construction a box or pan, as B′, is provided, which serves as a receptacle for fluid for a number of fuses. A number of pairs of tubes C C are set in the box or pan B′ and the fluid is permitted to enter the tubes through holes *c′ c′*, formed in their sides. The fluid in the box B′ can be easily maintained at a proper level and will supply all the tubes, and it will be noted that in case the paraffin employed to cover the fluid is partially melted by a fuse blowing off it will quickly harden again and prevent evaporation from the fluid in the box.

It is often necessary, particularly where a metallic base A is used, to provide a hood or shield to prevent the hot fused particles from the wire F from dropping onto the base and establishing an arc. In Fig. 1 such a hood is shown at C′, and is, in the construction shown, made with the tube C. Any suitable hood or shield can of course be provided.

In Fig. 5 I have shown a construction wherein the fuse-wire is separated by positively-acting means when any part of it is fused and the ends drawn beneath the non-conducting fluid. The left end of the wire is shown provided with a weight *f′*, whose lower end dips into a mercury layer at some distance above the bottom of the tube. When the wire fuses, the weight drops and draws the end of the fuse-wire attached thereto beneath the fluid. The right end of the fuse-wire is shown connected to a spring f^2, which connects the terminal binding-screw T′ with the end of the fuse-wire. The spring is under some tension and in case of fusion acts in the same way as the weight. In this case of course no mercury terminal is needed.

Fig. 6 shows how my cut-out can be employed as a lightning-arrester. These lightning-arresting devices consist of a grounded conductor, with a terminal at a short distance from a main-line circuit. This distance is so great that the grounded circuit is practically insulated from the main-line circuit. A static charge, such as occurs if lightning strikes the line-wire, will jump this space and go to ground. In such cases, however, an arc is often formed and the line-current following the static charge to ground short-circuits the line-current. To prevent this, I arrange a fuse-wire F with its end f^4 beneath a layer of liquid and near the terminal D, a short space (indicated at *d*) intervening between the two. The other end f^5 may be similarly arranged relatively to a second terminal D′, *d′* indicating the space between the end f^5 and this terminal. The wire W^2, connected to the terminal D′, will of course lead to ground. If now a static charge is given to the line-wire W, it will jump the space *d* or the spaces *d* and *d′* and pass to ground. No arc, however, can be formed on the melting of the fuse-wire, since the fluid will prevent this.

Fig. 7 shows the application of my fuse cut-out to a switch K, which is adapted to open and close a work-circuit W W′, D^3 being a dynamo or other source of electrical supply. To prevent arcing or sparking be-

tween the switch-jaws when the circuit is being opened or closed, the fuse cut-out is arranged in shunt across the terminals of the switch. The fuse cannot of course carry the full current, but it will do so momentarily or long enough to prevent arcing at the switch-jaws. Then the fuse-wire will be blown and the circuit opened.

It will of course be evident that this fuse cut-off can be applied in any place where it is desired to open a circuit on an abnormal current passing therethrough to prevent arcing.

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

1. In a fuse cut-out for electric circuits, two tubes, each containing a non-conducting fluid, as described, two terminals, one arranged near each tube, and a fuse-wire connecting the terminals, and so arranged that it passes from the first terminal through the non-conducting fluid contained in one tube out of the mouth of said tube and through the non-conducting fluid contained in the other tube to the second terminal.

2. In a fuse cut-out for electric circuits, the combination with a terminal, a fuse-wire leading therefrom, a non-conducting fluid through which a portion of the fuse-wire passes and a cover or hood to prevent the particles of melted fuse from falling on the terminal and establishing an arc.

3. In a fuse cut-out for electric circuits, a metallic base, as A, forming a terminal, a tube C of non-conducting material secured thereto and serving as a receptacle for non-conducting fluid, and a fuse-wire connected to the metallic base and passing through the non-conducting fluid contained in the tube.

4. In a fuse cut-out for electric circuits, a metallic base, as A, forming a terminal, a tube C of non-conducting material secured thereto and serving as a receptacle for non-conducting fluid, a fuse-wire connected to the metallic base and passing through the non-conducting fluid contained in the tube, and a hood to prevent melted portions of the fuse-wire from falling on the metallic terminal, and establishing an arc.

5. The combination in a fuse cut-out for electric circuits, of a non-conducting tube serving as a reservoir for non-conducting fluid, a terminal for an electric circuit consisting of a layer of mercury in the tube below the layer of non-conducting fluid and a fuse-wire, one end of which dips into the mercury layer and extends through the non-conducting fluid.

6. The combination in a fuse cut-out for electric circuits, of a non-conducting tube serving as a reservoir for non-conducting fluid, a terminal for an electric circuit consisting of a layer of mercury in the tube below the layer of non-conducting fluid and a fuse-wire F having an enlarged end *f* which dips into the mercury layer, said fuse-wire extending through the non-conducting fluid.

7. In a fuse cut-out for electric circuits, a non-conducting tube, as C, non-conducting fluid contained in said tube, a terminal, a fuse-wire leading from said terminal and passing through the con-conducting fluid, and positively-acting means for drawing the fuse-wire into the tube, and beneath the non-conducting fluid therein in case of burning out.

8. In a fuse cut-out for electric circuits, a receptacle, a number of sets of non-conducting tubes arranged therein, openings, as *c*, in said tubes, a non-conducting fluid in the receptacle adapted to partly fill the tubes, terminals connected with each tube, and fuse-wires for connecting the terminals so arranged that a portion of the length of each passes beneath the non-conducting fluid.

9. In a fuse cut-out for electric circuits, a pair of terminals, a tube of non-conducting material, a non-conducting fluid in said tube arranged to cover one of said terminals, and a fuse-wire arranged with its end close to, but not touching the immersed terminal whereby in the case of a static discharge the non-conducting fluid will prevent an arc being formed by an electric current flowing on the circuit whose terminal is under the fluid.

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Witnesses:

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D. STEWART.