

(No Model.)

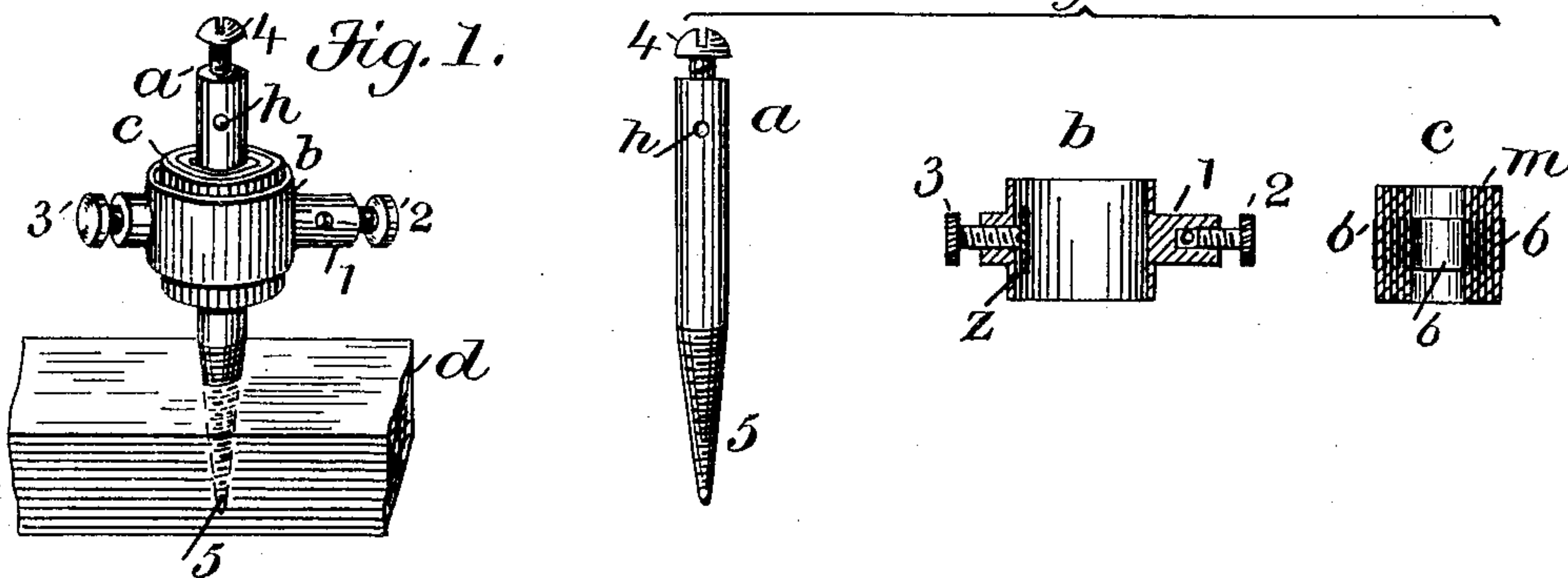
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PROTECTING DEVICE FOR ELECTRICAL APPARATUS.

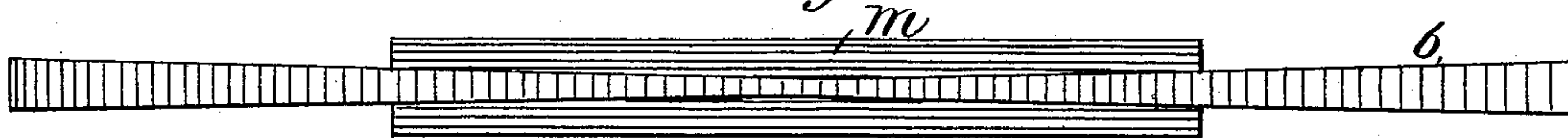
No. 377,073.

Patented Jan. 31, 1888.

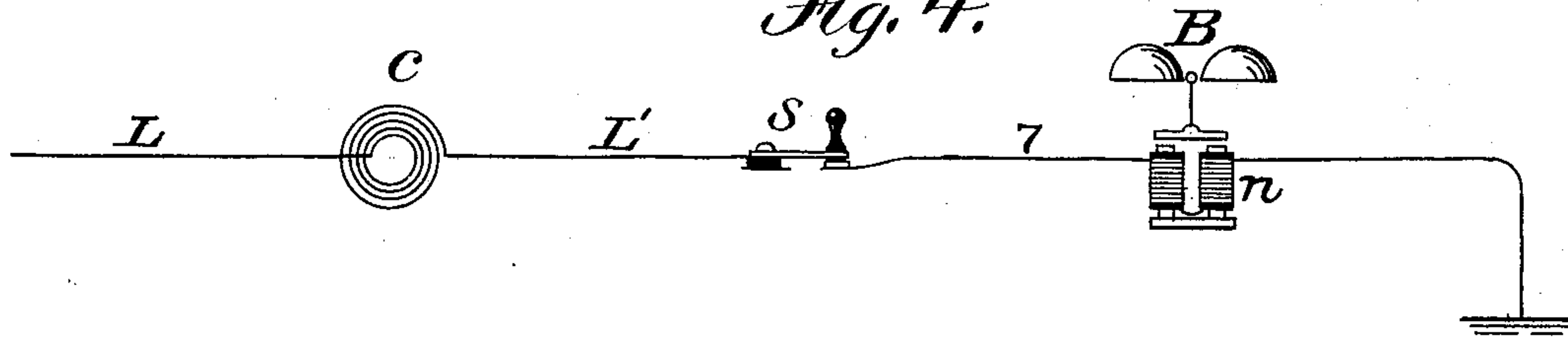
*Fig. 2.*



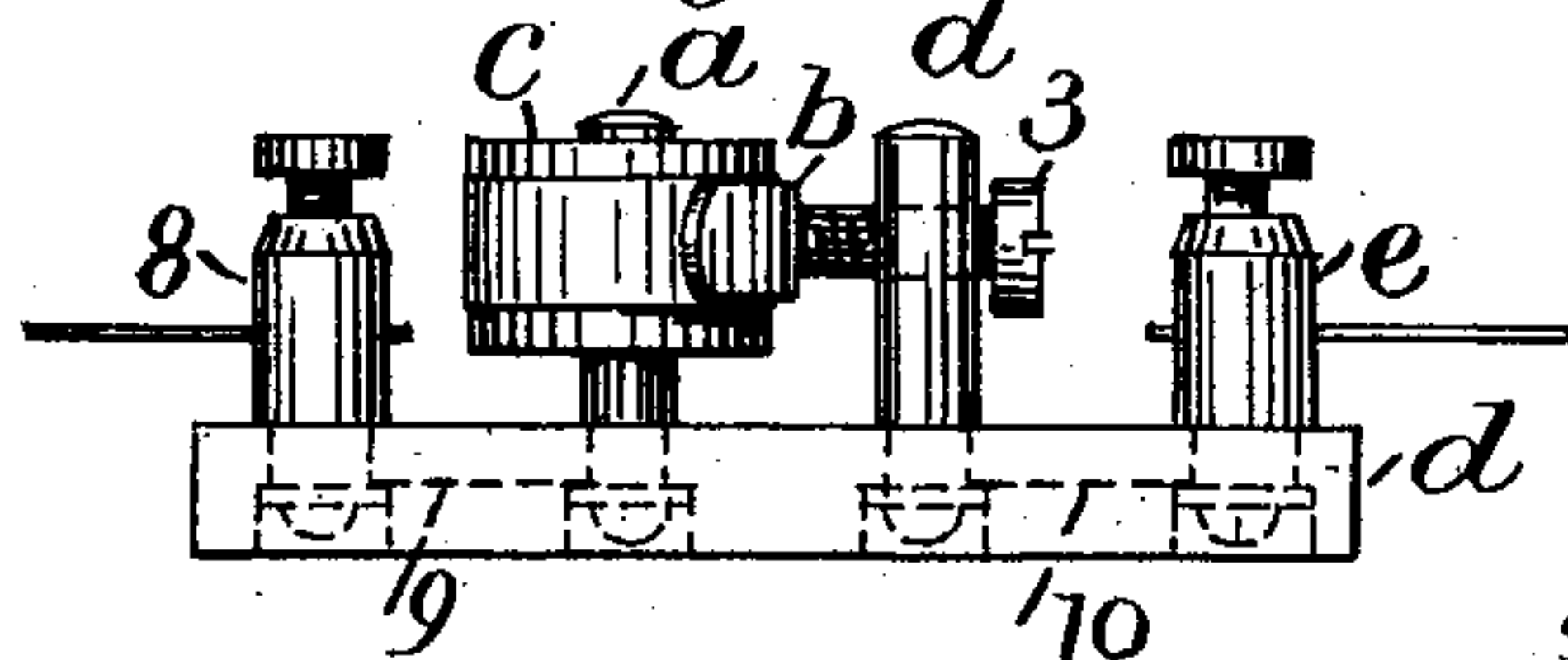
*Fig. 3.*



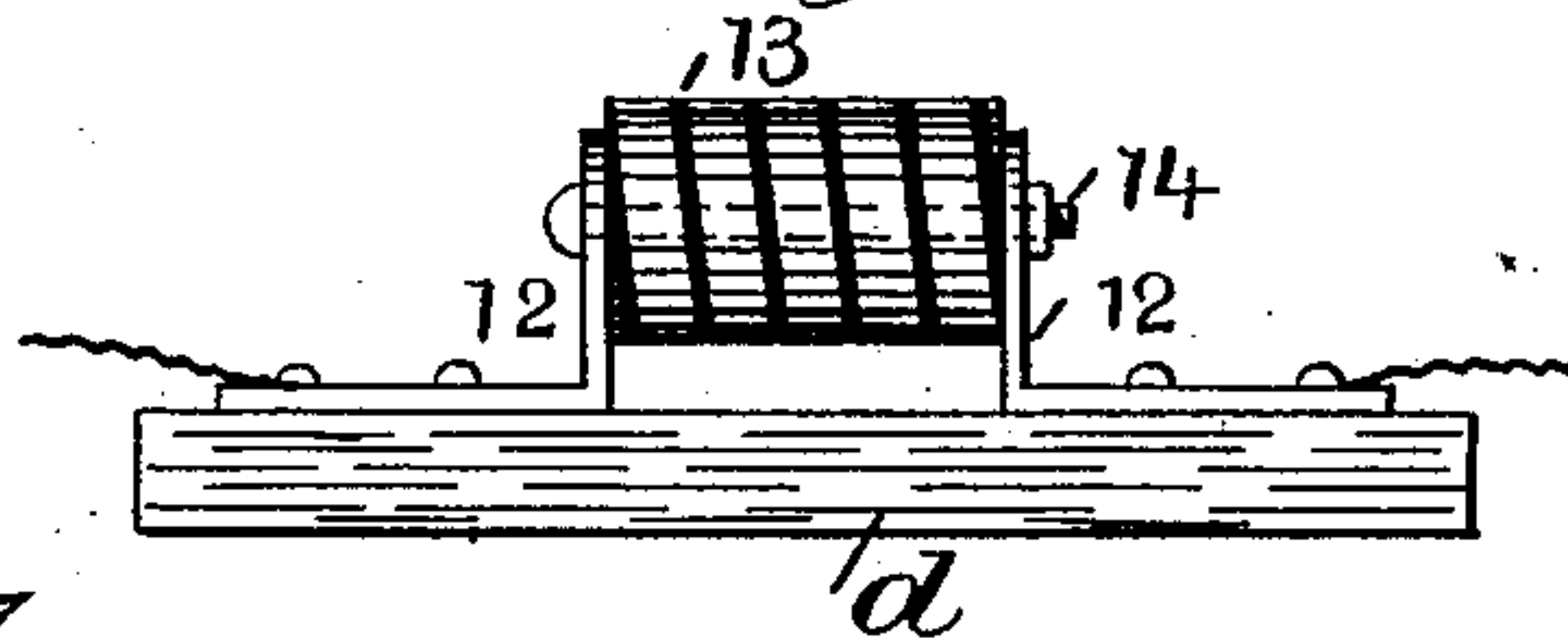
*Fig. 4.*



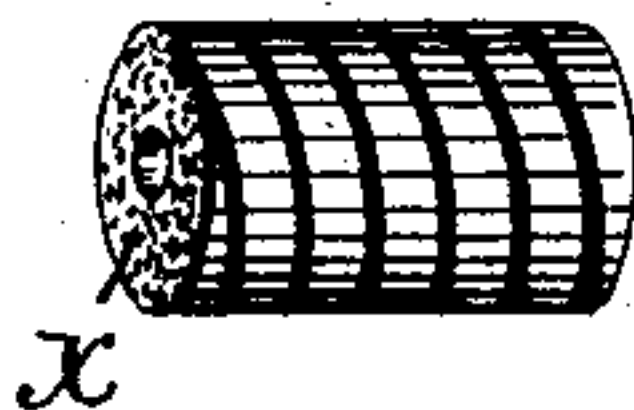
*Fig. 5.*



*Fig. 6.*



*Fig. 7.*



Witnesses.

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# UNITED STATES PATENT OFFICE.

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## PROTECTING DEVICE FOR ELECTRICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 377,073, dated January 31, 1888.

Application filed May 18, 1887. Serial No. 238,577. (No model.)

*To all whom it may concern:*

Be it known that I, ANGUS S. HIBBARD, residing at New York city, in the county of New York and State of New York, have invented certain Improvements in Protecting Devices for Electrical Apparatus and Circuits, of which the following is a specification.

My invention relates to the class of appliances which are employed for the purpose of protecting telegraphic, telephonic, and other electrical instruments from being destroyed by the action of electrical currents or discharges of abnormal strength which may through accident be caused to traverse a circuit in which the instruments are included. Various forms of such appliances have heretofore been proposed, and to some extent used, in the attainment of this end; but the form which has been most extensively used comprises a thin and narrow strip of metal foil inclosed in a tube or other non-conducting casing and provided at its ends with metallic attachments whereby the strip of fusible material may be included in the same electrical circuit with the instruments to be protected. Such an instrument is described in Letters Patent of Theodore N. Vail, issued July 14, 1885, No. 322,214, and my invention constitutes an improvement on that described in said patent.

My invention consists, generally, in mounting the fusible strip upon a strip of asbestos or on other non-inflammable and non-combustible insulating material and in coiling the conducting and insulating strips closely together round a metal post which is electrically united with the circuit in such a manner that the convolutions of each alternate with one another. The foil is made sufficiently long to extend over the two ends of the insulating-strip, and one end is first wound round the metal post so as to form the connection with it. The other end, when the winding is complete, is wound entirely round the outside of the roll, and may, if desired, be fastened down, by fusing or by suitable cement, so as to form a complete and continuous roll adapted to be placed upon the skeleton of any appliance adapted for it in a manner to be hereinafter described. When placed on the metal post, it is firmly held in position by a suitable clamping-ring or screw-plate, which is in electrical

connection with the other side of the circuit, so that the fusible strip is thus introduced into the circuit between the metal post and the clamping-ring or its equivalent. Experiment has demonstrated that a fusible strip of suitable length and width mounted in this way is very efficient and well adapted to act as a protector either against discharges of lightning or against electric-light or power currents which sometimes traverse the telephone-circuits when the latter are crossed with the wires properly conducting such strong currents.

Although each convolution of the fusible strip is continuously connected with its adjacent convolution, each is enabled also to exercise an inductive effect upon the adjacent convolutions through the intervening convolution of the insulating-strip; and I find that this arrangement thus increases the efficiency of the instrument.

In practice I narrow the strip very materially in one or two of the interior coils of the foil, so that in case of an electric-light cross it always fuses or disrupts promptly at this point of extreme fragility, and I connect the incoming line-wire first to the post at the interior of the coiled strip, so that the circuit passes through the convolutions from its inner to its outer end before reaching the instrument, cable, or other appliance to be protected. I have also devised certain modifications. Instead of applying to the insulating-strip a strip cut from tin-foil, I may in some cases electroplate the said non-conducting strip thinly with tin or like metal, which would be equally as fusible as the foil, but which would avoid the mechanical difficulties of winding, besides still further lessening the cost of manufacture; and in some cases I find it convenient to provide a spool of plaster-of-paris and cut a groove helically in the surface thereof, which groove is first pointed with a shellac sizing and then with a coating of metallic powder. The ends of the spool are also metallized in a similar way, and contact made by springs or screws and brackets with each end thereof. Instead of the metal powder, the groove and the spool ends may be plated.

The object of this invention is to provide an efficient protector or safety-link, which will be cheap, be easy of attachment, and which



will occupy but a very small space. It is especially adapted for use at cable-boxes, terminals on poles, and in towers where a great many wires are to be terminated within a limited space.

In the drawings which form part of this specification, Figure 1 is a perspective view of one exemplification of my invention. In Fig. 2, *a* is a view of a central post, *b* a section of the clamping-ring, and *c* a section of the convolutions of the conducting and non-conducting strips. Fig. 3 is a representation of the foil and insulating-strips prior to winding. Fig. 4 is a diagram showing the connection of the appliance in an electrical circuit. Fig. 5 shows another exemplification of the same principle. Fig. 6 is a modification, and Fig. 7 a detail of Fig. 6.

Referring to Figs. 1, 2, and 3, *a* is a metal screw-post, having a hole, *h*, for the reception of a wire end, a binding-screw, 4, and a screw end, 5, for attachment to any convenient base or bracket, *d*; or in lieu of the latter feature a machine-screw may be used, passing through the base-board and fastened on the other side with a nut; or the post *a* may have a metallic base-plate to be attached to a base-board with wood-screws, these being obvious and well-known equivalents.

I take a strip, 6, of foil, of tin or other metal or alloy, about five inches long and one-quarter of an inch wide at its broadest part, but narrowed interiorly, as shown, and paste or cement it upon a shorter strip, *m*, of asbestos or other insulating and non-inflammable material. The dimensions I have mentioned are most convenient, but are not essential. I then roll the double strip round the brass post *a*, the non-conducting strip being inside; but as the end of the foil 6 extends over the end of the non-conductor the foil makes one or two convolutions round the post before the non-conductor is reached. Upon completing the coil the final end of the foil extends completely round the outside of the roll. This end may be cemented down to the exterior convolution; but such cementation is not essential, as the pressure which the outer convolution experiences is sufficient to keep it in place. The complete roll thus formed therefore has a central hole with a continuous metallic surface, and also an external continuous metallic surface. The surface of each metallic convolution is separated from the surface of the next, as shown in the sectional view *c*, by the non-conducting convolutions of *m*, although all the conducting convolutions are of course serially united. I then provide, for an outside connection, a clamping-ring, *b*, (shown in section in *b*, Fig. 2,) provided with a jam-screw, 3, and a binding-post, *I*, in which the second circuit-wire is fastened by a screw, 2. In placing the appliance in the circuit the external wire is placed in the screw-hole *h* of the central post and fastened there by the screw 4, and the wire leading in is placed in the screw-hole *I* and fastened by the screw 2. If desired, the

jam-screw may be provided inside the ring *b* with a bearing-plate, *z*, whereby the screw end is prevented from tearing the outer layer of foil. Thus the internal end of the coiled foil is connected with the outside wire, as shown in the diagram, Fig. 4, in which the line-wire *L* connects with the inner end of the protecting-foil *c*, the external end of the protector being united with the continuation of the circuit *L'*, leading through any class of instruments to be protected—for example, through the switch *s* and wire 7 to the magnet *n* of the polarized bell *B* and to earth.

Fig. 5 illustrates a modification of the same idea, and is perhaps the best exemplification of my appliance complete in itself. The whole is mounted on a base, *d*, of hard rubber or like material, the various elements being secured thereto by machine-screws. (Shown in dotted lines.) The coiled protector *c*, made as hereinbefore described, is mounted upon the metal post *a*, which is electrically united by wire 9 with the line binding-screw 8. By this means the foil is connected with the incoming line. A curved metal plate, *b*, is held against the outside foil-convolution by the pressure-screw 3 in the post *d*, which is electrically united by wire 10 with the binding-screw *e*, this being connected with the other circuit-wire. Thus the screw 3 and curved plate *b* hold the roll *c* in place, and serve also to effect a maintenance of continuity in the circuit. Should a dangerous current or discharge fuse or disrupt the continuity of the protector, it is only necessary to loosen the screw and slip the roll *c* from the post *a*, substituting another and similar one.

The form of protector shown in Figs. 6 and 7 differs in formation from the foregoing, but is quite similar in principle. I provide a cylinder, of plaster-of-paris, of any convenient size—for instance, half an inch in diameter by three-quarters of an inch long. Into the surface of this is cut a flat helical groove, 13, about one-sixteenth of an inch broad and one-sixteenth of an inch deep, extending some five or six times round the cylinder, and terminating at the two ends thereof. This groove is painted with a "sizing" of shellac, after which a coating of bronze or other metallic powder is rubbed in, the ends being likewise metalized in the same manner as shown at *x*, Fig. 7. This is adapted for connection in an electrical circuit by being mounted longitudinally, as shown, between angle-plates 12, which may be secured to any base-board, *d*. The cylinder may be attached to the angle-plates by a bolt, 14, passing lengthwise through it. Thus the coating of bronze forms the equivalent of the conducting foil-strip and the ridges on the plaster-cylinder, the equivalent of the non-conducting strip heretofore described.

Instead of metal powder, the groove and ends may be plated with any desired metal; and in the forms hereinbefore described I may, instead of the metal foil, deposit a thin metal plating upon the non-conducting strip. In



these appliances I propose to dip the ends of the insulating supports (especially in the earlier forms) in shellac or varnish or other water-proof material for the purpose of excluding moisture. By using any of the forms herein described I am enabled to provide a very efficient protector at an extremely low cost, and one which is very small and compact.

Having now described my invention and the mode in which I propose to apply the same, I claim—

1. In a fusible protector for electrical circuits and apparatus, the combination of a strip of non-inflammable insulating material, and a strip of foil or other narrow and thin coating of metal placed thereon and rolled up helically therewith, the two ends of the said metal strip being provided with attachments, whereby it may be included in an electrical circuit.

2. A protector for electrical circuits and apparatus consisting of a thin narrow strip of metal in helical form, the successive convolutions thereof being separated by insulating material, and means, as indicated, for including the two ends of the strip in an electrical circuit, substantially as described.

3. The combination, in an electrical circuit and apparatus protector, of a metallic post connected with or constituting a binding-screw or circuit-terminal, a compound roll consisting of a strip of metal foil and a strip of non-inflammable insulating material placed side by side and wound helically together upon said post, the metal strip being the longest, so that one end of it may be in contact with said post and so that the other may be extended quite round the complete roll thus formed, and a clamping ring or plate to hold or press against the external conducting - surface, provided with a jam-screw to maintain such pressure, and the said clamp being connected with the complementary circuit-terminal, substantially as specified.

4. The combination, in an electrical circuit and apparatus protector, of a hollow roll formed, as described, of a thin and narrow metal strip stretched upon a non-conducting and non-inflammable strip, the ends of said metal strip extending over the ends of the said non-conducting strip, so as to form homogeneous internal and external surfaces for said hollow roll, a metal screw-post serving as a circuit-terminal and passing through the center of the hollow roll in contact with the inner conducting-surface thereof, and a clamping-ring surrounding the said hollow roll when mounted on the metal post and making con-

tact with the external conducting - surface thereof, the said ring being provided with a jam-screw, and a screw circuit-terminal, whereby the condenser-like roll may be held in place upon the metal post, and whereby electrical continuity may be maintained between the said post and the clamping-ring through the metal strip, substantially as specified herein.

5. The combination, in an electrical-circuit protector of the character hereinbefore described, of a non-conducting base-board, a metal post mounted thereon and forming a screw-terminal, a strip of metal mounted upon a shorter strip of asbestos, or like material, and rolled around said post, so that one end of said metal strip is in contact with said posts and so that the other end forms an external conducting-coating for the complete roll, a metal clamping - ring surrounding the compound rolled strip, a binding-screw terminal attached thereto, and a jam-screw therefor to hold the rolled strip in contact with the central post and to maintain the external layer of said strip in contact with the said ring and binding-screw, substantially as described.

6. The combination, with a telegraphic or telephonic line circuit and apparatus included therein, of an appliance for protecting said apparatus from the destructive effects of abnormally strong electrical discharges or currents, said protecting appliance consisting of a strip of thin metal foil placed upon a shorter strip of non-conducting and non-inflammable material and rolled up therewith upon a metal post, forming a circuit-terminal, so that the inner end of said foil extending over the non-conducting strip may make contact with said metal post, the outer end of said foil being caused to completely surround the roll, and a metal clamping-ring and jam-screw therefor carrying a second circuit-terminal in contact through said ring with the external layer of said foil, the said appliance being connected in the circuit external to the apparatus to be protected, and in such a manner that the central post terminal and the inner end of the helically-wound foil are connected to the line-wire and the clamping-ring terminal and outer end of the foil are connected to the instrument-wire, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 9th day of May, 1887.

ANGUS S. HIBBARD.

Witnesses:

FRANCIS J. HOVEY,  
J. C. VAIL.