

L. VAN GILDER & E. M. POST.
FLEXIBLE ELECTRICAL CONDUCTOR.

APPLICATION FILED NOV. 8, 1902.

NO MODEL.

Fig. 1.

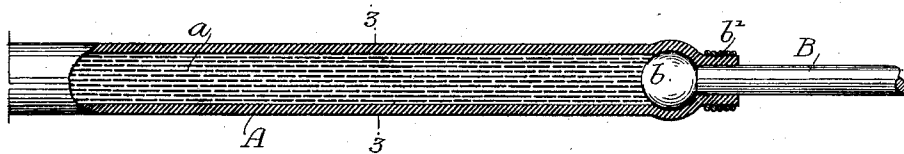


Fig. 4.

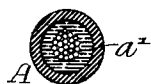


Fig. 6.

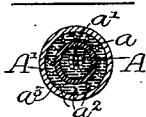


Fig. 5.



Fig. 2.

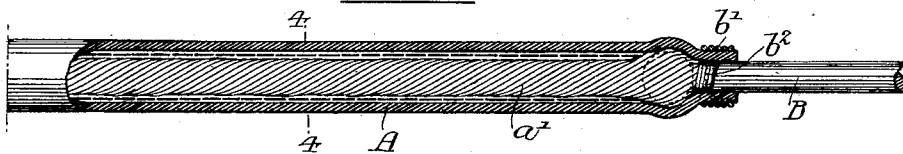
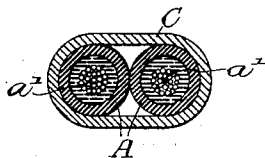


Fig. 3.



Witnesses:-

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UNITED STATES PATENT OFFICE.

LINCOLN VAN GILDER AND EDWARD M. POST, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS OF ONE-HALF TO HAROLD GODFREY AND CLINTON GODFREY, OF PHILADELPHIA, PENNSYLVANIA.

FLEXIBLE ELECTRICAL CONDUCTOR.

SPECIFICATION forming part of Letters Patent No. 730,847, dated June 9, 1903.

Application filed November 8, 1902. Serial No. 130,532. (No model.)

To all whom it may concern:

Be it known that we, LINCOLN VAN GILDER and EDWARD M. POST, citizens of the United States, and residents of Philadelphia, Pennsylvania, have invented certain Improvements in Flexible Electrical Conductors, of which the following is a specification.

Our invention consists of an improved form of flexible insulated electrical conductor, having for its object the provision of an improved form of conductor which while being more flexible than other electrical connecting means at present known to the art shall be much less liable to breakage or interruption of its electrical conductivity from parting of a part or the whole of its conducting-body either from prolonged use or rough treatment than has hitherto been the case. This object we secure as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is an elevation, partly in section, of a portion of an electrical conductor made according to our invention and illustrating the method of the attachment of the conductor to a terminal of some form of electrical apparatus or to another conductor. Fig. 2 is an elevation, partly in section, showing the application of our invention to a well-known form of electrical conductor at present in use. Fig. 3 is a transverse sectional elevation of the conductor shown in Fig. 1, taken on the line 3 3 of said figure. Fig. 4 is a transverse sectional elevation taken on the line 4 4, Fig. 2; and Figs. 5 and 6 are transverse sectional elevations of double conductors constructed according to our invention.

In certain classes of electrical work in which flexible electrical conductors are required it has been found to be absolutely essential in order to secure satisfactory service that all of the individual strands of said conductors remain unbroken, and with this object in view it is customary to employ a conductor made of a large number of very fine wires twisted or laid together and inclosed in a casing of suitable insulating material. In the class referred to the breakage of even one of these small strands of wire will give rise to a highly objectionable action of the electrical appara-

tus in circuit with the same, and for this reason as soon as it is discovered that such breakage of a small strand of the conductor has occurred the whole conductor is discarded, it being seen that this necessity greatly increases the cost of operation for such class of electrical devices. It is to overcome this difficulty that we have devised our present improved conductor, and in the drawings above referred to A represents a flexible tube or conduit, preferably of india-rubber or other liquid-tight material, the interior of which is filled with a solid and continuous column *a*, of mercury or, preferably, an amalgam of the same. In order to form electrical connection with another conductor or to provide a terminal which may be attached to electrical apparatus, we provide a metallic piece B, which in the figures is shown as solid and provided with a spherical head *b*, whose diameter is greater than the internal diameter of the containing-tube A. After said tube has been filled with mercury or amalgam this rounded head is inserted into the end thereof, so as to press tightly against the liquid or semiliquid material, and the tube is confined and tightly held to the main portion of the conductor B by means of a suitable wrapping or binding *b'*, so that there is no possibility of escaping of the material from within the tube A, it being understood that the drawings are intended to illustrate but one end of our improved conductor, since the second end is in every way similar to that shown.

Such a conductor as the above will have a flexibility only limited by the flexibility of the tube A, and in view of the nature of the metallic conductor *a* cannot under any possibility have its conductivity interrupted by breakage, it being understood that the walls of the tube A have sufficient resisting power to withstand compression under operating conditions sufficiently to avoid variation of the conducting powers of the device from this cause.

By the use of a rubber tube, as above noted, as the container for the electrical conductor of mercury or amalgam we secure a very material advantage, adding greatly to the value of our invention, such advantage being due

to the fact that should the temperature of the said conductor be caused to rise from any cause—as, for example, from an excessive flow of current—the rubber tube would melt and by permitting the mercury or amalgam to flow out break the electric circuit through the same. With the well-known flexible conductors, in which plain cotton braiding is used to inclose rubber-covered wires, there is always danger of the said braiding catching fire from overheating of the conductors by abnormally heavy currents, whereas by the use of a rubber tube filled with a liquid or semiliquid conducting mass there is provided means by which the electric circuit will be broken before the said conductor has reached a dangerously-high temperature.

Where it is desired, a stranded conductor a' of the ordinary form may be employed within a flexible insulating-tube, as shown in Fig. 2, the strands of said conductor being bent around the spherical head of the terminal connection B and electrically connected to the body thereof by a winding b^2 . The internal diameter of the tube A is in such case made greater than the external diameter of the conductor a' , and the cavity so left is filled with mercury or amalgam, as before noted. With this construction should breakage of one of the small strands of the wire or cable a' occur the liquid or pasty metal would immediately bridge such break, so that there would be none of the varying resistance and the consequent objectionable effects always occurring where a strand of the conductor breaks under ordinary conditions in the class of work above referred to.

Where it is desired, a non-conductor of one or more strands of thread or cord may be employed within the flexible insulating-tube, the arrangement of this being the same as that shown in Fig. 2. The threads of said non-conductor are attached to the spherical head of the terminal connection B and run through the tube in the same manner as when metallic wires are employed.

When either a conductor or non-conductor is employed, the extension or stretching of the flexible insulating-tube is prevented, as is also the separation into two or more portions of the contained pasty or liquid metal by compression or bending, since channels are provided into which the mercury or amalgam may flow, the tendency being to hold the mercury or amalgam in place by the capillary action of the strands of the conductor or non-conductor, as the case may be, within the tube.

In practical operation we preferably employ as our liquid or semiliquid conductor an amalgam having a very decided viscosity—as, for example, sodium amalgam—so that unlike ordinary amalgams, a single body of this material is not easily divided into a number of other bodies or masses, but tends to remain in a single mass, somewhat in the same way as does molasses.

Where it is desired to provide a multiple

conductor, we employ the construction shown in Figs. 5 or 6 or a modification thereof, there being shown in the first of these figures two flexible rubber or other insulating tubes A, each containing in the structure illustrated a stranded conductor a' and filled with a liquid or semiliquid metallic conductor which completely surrounds said stranded conductor. These two separate devices A are then inclosed within a casing C, of woven fabric or other insulating covering.

Fig. 6 illustrates a form of the invention in which the insulating-tubes are concentrically arranged, there being a stranded conductor a^2 placed around the outside of a conductor of the construction shown in Figs. 1 to 4 and within the space between the two tubes A and A', this space also containing mercury or amalgam a^3 .

We claim as our invention—

1. The combination of a tube of non-conducting material having free ends, terminals projecting therefrom and a body of viscous amalgam interposed in said tube between said terminals, substantially as described.

2. The combination of a flexible insulating-tube, an electrical conductor therein containing mercury and terminals in electrical contact with said conductor, with means extending longitudinally of the tube for preventing elongation thereof, substantially as described.

3. The combination of a flexible insulating-tube, an electrical conductor therein containing mercury and terminals in electrical contact with said metallic conductor, with strands of inelastic material within the tube for preventing elongation of the same, substantially as described.

4. The combination of a flexible tube of insulating material, a headed metallic terminal extending into said tube and means engaging the tube and confining it tightly to said terminal immediately beyond the head, the interior of said tube being filled with fluid conducting material in electrical connection with the terminal, substantially as described.

5. The combination of an insulating-tube, a solid electrical conductor therein and a body of fluid electrical conducting material surrounding said solid conductor within the insulating-tube, the said conducting fluid being in electrical contact with the solid conductor, substantially as described.

6. The combination of an insulating-tube, a solid electrical conductor therein, metallic terminals extending into the tube in electrical contact with the solid conductor and electrically-conducting fluid material confined within the tube and surrounding and contacting with the solid conductor, substantially as described.

7. The combination of an insulating-tube, a stranded metallic conductor therein and an electrical conductor containing mercury, surrounding and electrically contacting with said stranded conductor within the tube, substantially as described.

8. The combination of a tube of insulating material, metallic conductors extending into the same provided with means whereby said tube is held tightly thereto, a solid metallic conductor within the tube in electrical connection with said terminal extending into the tube and a pasty electrical conductor filling the space between said solid conductor and the interior walls of the tube, substantially as described.

9. The combination of a flexible insulating tube, an electrical conductor therein containing mercury, a second flexible tube surrounding the first tube, and a second body of electrically-conducting material having mercury for its base and contained in the space between said two tubes, substantially as described.

10. The combination of a flexible insulat-

ing-tube, an electrical conductor within the same, a second conductor surrounding the said tube and a second tube inclosing the whole with two independent bodies of an electrical conducting material containing mercury as a base, surrounding said two conductors respectively, substantially as described.

11. The combination of a tube of flexible insulating material with a fluid metallic conductor of electricity therein, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

LINCOLN VAN GILDER.
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Witnesses:

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