

T. L. REED.

Insulated Electric Conductors.

No. 156,175.

Patented Oct. 20, 1874.

Fig. 1.

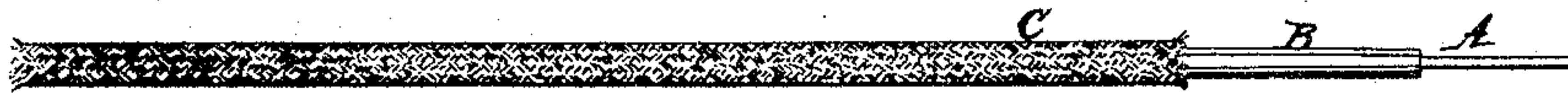


Fig. 2.

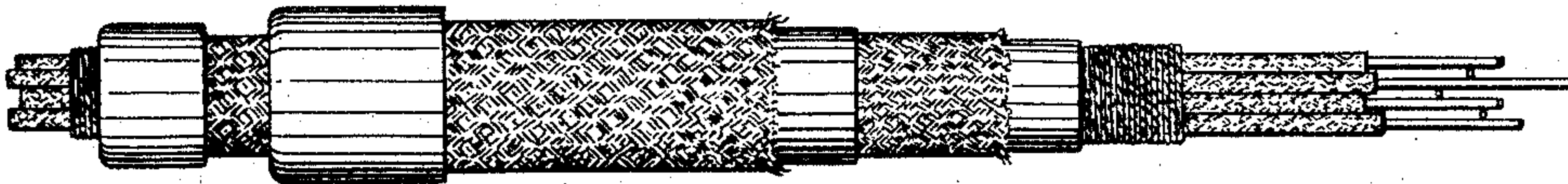


Fig. 3.



Fig. 4.



Fig. 5.

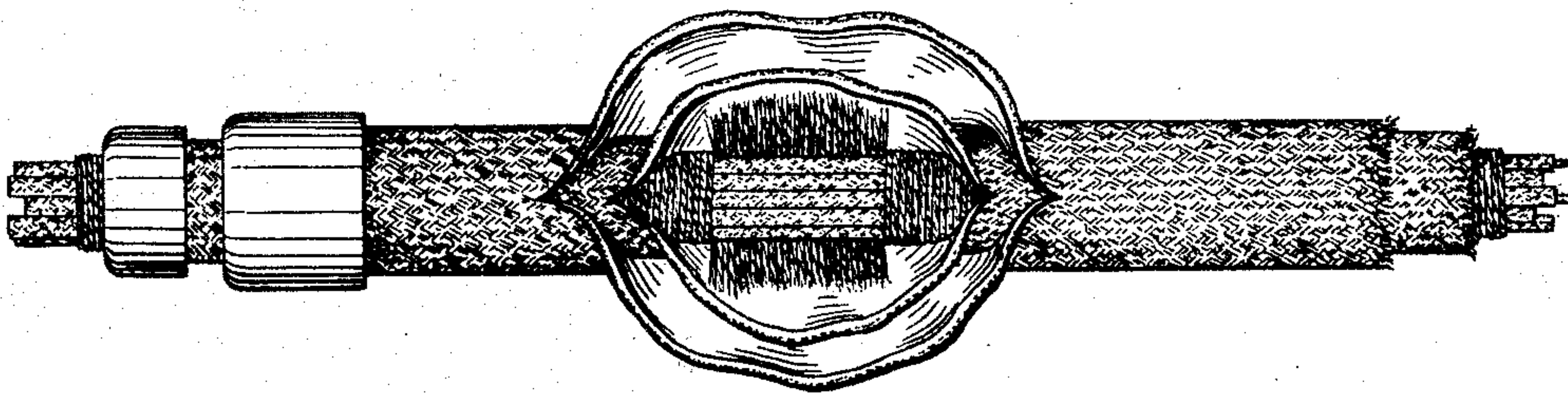
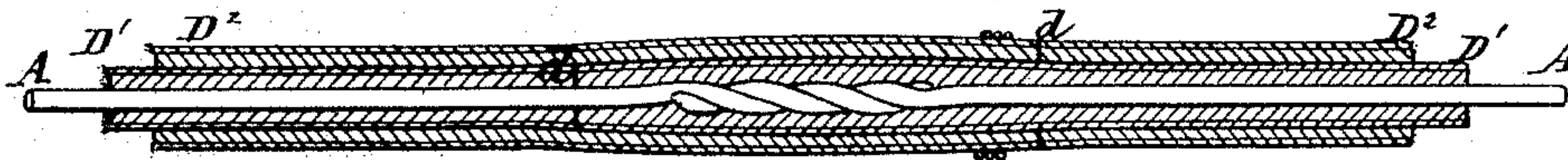


Fig. 6.



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# UNITED STATES PATENT OFFICE.

THOMAS L. REED, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR OF ONE-HALF HIS RIGHT TO EUGENE F. PHILLIPS, OF SAME PLACE.

## IMPROVEMENT IN INSULATED ELECTRIC CONDUCTORS.

Specification forming part of Letters Patent No. **156,175**, dated October 20, 1874; application filed July 6, 1874.

*To all whom it may concern:*

Be it known that I, THOMAS L. REED, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Insulated Electric Conductors; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and accurate description of my invention.

My improved electric conductors are adapted for use on telegraphic switch-boards, for office wire, and also for general electric service, whether in elevated or under-ground lines, or for ordinary submarine business.

Heretofore it has been proposed, and to some extent practiced, to incase metallic conductors in an insulating-jacket of rubber compound, subsequently vulcanized. In some instances this jacket has been so compounded of rubber and inorganic matter, as, when vulcanized, to result in a hard covering, more or less brittle, and one which requires to be heated to some extent to admit of its being bent. In other instances it has been proposed, and possibly to some extent practiced, to coat the metallic wire with a softer vulcanizing compound, containing a less proportion of inorganic matter than in the instance before referred to, whereby an elastic vulcanized jacket was obtained. It is well known that vulcanizable green-rubber compounds, if prepared with a view to elasticity after vulcanization, are tenaciously adhesive, and therefore contact of one portion of such coated wire with another, either before or during the process of vulcanization, necessarily results in more or less injury to one or both of the portions in contact, as they of necessity must subsequently be rent asunder. Moreover, during the period of "fluxing," as it is sometimes termed, which occurs at the time the caoutchouc fuses with the sulphur, the compound is more or less in a condition of fluidity, and it is at that time liable to change its position under the laws of gravitation. Hence, if a coil of wire so coated be placed on a rod horizontally in the heaters for vulcanization, all that portion of the wire located at the lower side of each coil is liable to be flooded with

an excess of compound, and the upper sides be depleted in like proportion. To obviate this it has been proposed to employ molds in which the compound will be maintained in its normal distribution during the vulcanizing process, but such method involves great expense in manipulation, and is so gradual in its workings, as to render it impracticable as a true advance in the art. Moreover, by these several methods it has been a difficult matter to vulcanize conductors of considerable length. These several difficulties have resulted in the adaptation and general use of caoutchouc, gutta-percha, and like gums, in their soft state, or combining them with various matters which dry or harden with the gum, thus evading the process of vulcanization. By reason of my invention I am enabled to insulate, with vulcanized elastic rubber compounds, conductors, of any size or length, single or combined; and said invention consists in laying upon the wire, by any well-known apparatus in common use for similar purposes, the vulcanizable gum compound immediately in advance of braiding an exterior jacket thereon, whereby the gum jacket is not only protected during subsequent handling and use, but is held in place in proper distribution throughout the process of vulcanization.

The accompanying drawings represent different kinds of conductors embodying my invention.

Figure 1 represents a length of a single wire conductor. Fig. 2 represents a length of several conductors united for submarine or other uses. Figs. 3 and 4 represent the two kinds in section. Fig. 5 represents a section of submarine conductor as if opened at a "fault." Fig. 6 represents a joint or "splice" of one of my conductors.

In each instance A denotes the metallic conductor, as represented in Fig. 1. The seamless layer of rubber at B is laid as the wire passes downward through a funnel-shaped reservoir, adapted to discharge the compound in a tubular coating, graduated, if necessary, by means of pressure applied to the upper surface of the compound contained in the reservoir. As it is thus coated, the braided jacket C is laid in strands by a braiding-machine of



ordinary construction adapted for such service, and this operation may be continued to any extent, and an indefinite length of the conductor may be so made and closely coiled, horizontally or otherwise, and in that form placed within the heaters until properly vulcanized. When several conductors are to be combined and incased in a single braided jacket, or series of such jackets, the conductors may be treated as before described, and singly jacketed, or they may be simply covered with braid, and charged with the insulating paraffine compound heretofore patented by me, and bound together with spirally-laid strands of hemp, cotton, or other fibrous matter, or even with flattened metal wire, if the character of the cable or conductor would warrant that construction. The several conductors, as one, are then passed through the funnel-shaped reservoir referred to, or equivalent charging apparatus, and immediately thereafter, and as fast as covered, the braiding-machine will lay the seamless jacket.

In complex conductors of this class the surface of the wires will, preferably, be wholly guarded against any possible corrosive action on the part of the sulphur employed in vulcanizable compounds of rubber. Single conductors may or may not be so guarded, although, in practice, it is advisable to prevent such corrosive action, if possible.

When extraordinary protection and insulation is required two or more of these braided jackets are applied with intervening layers of vulcanizable gum compound, which is vulcanized subsequently, as described.

It often occurs that submarine conductors become faulty, in which case openings can be readily made, as illustrated in Fig. 5.

Each jacket and the next interior adjacent layer of vulcanized rubber may be incorporated without adhesion to the exterior of the next interior braided jacket by treating the exterior surface of the latter, after vulcanization, with my patented compound before referred to, so that when cutting for a "fault" a longitudinal slit may be cut through the several jackets, the outer one, preferably, somewhat longer than in the next inner jacket, and each outer one may be readily lifted or removed from the next inner jacket, and so on until the wires are fully exposed, and, should the fault be found and repaired, these raised portions may be readily laid in place with suitable adhesive and insulating matter, and the whole cut portion exteriorly wound with wire cord or other suitable wrapping material. After having been so cut and repaired the tensile strength of the braided jacket is not materially impaired, as it has simply been cut longitudinally for a short space, leaving the main body of the inclosing fabric adjacent thereto practically intact.

Aside from the well-known value of vulcan-

ized caoutchouc as an insulating medium in connection with the braided jacket, it is of marked value in that it affords a cushion for the braid, and is so incorporated therewith that the braid is less liable to injury from cuts or abrasion than would be the case if the braided fabric was in direct contact with the metal.

The employment of the several concentric separable seamless jackets of braided fabric and elastic vulcanized caoutchouc involves peculiar value in splicing—as, for instance, it will be supposed that two or more wires individually insulated are incased within three concentric seamless jackets. The braid and rubber, both being elastic, will admit of the turning backward of each jacket at the two ends to be spliced, say, for the length of six inches. The wires of one end being cut off to a length of four inches, for instance, will be united with the connecting wires, and the inner jacket of one of the ends cut off, say, to the extent of four inches. The inner jacket of the opposite end will then be drawn over the joint. The next outer jacket on the opposite end will then be drawn over the jacket which covers the lap, and the next succeeding or outer layer, on being cut and returned in like manner, will result in a perfect breaking of joints, which, if properly treated with gum-cement, and, respectively, wrapped with twine or wire, will render the joint as perfect in insulation, and nearly or quite as strong as the normal portions of the conductor. This joint is illustrated in Fig. 6, in which A denotes the metallic conductor.

The seamless jackets of braided fabric and rubber are denoted at D<sup>1</sup> D<sup>2</sup>, respectively, and the several joints are shown at d.

It is of course requisite, in order that such splices may be readily made, that the outer surface of each of the interior jackets be treated with an insulating matter which will not incorporate with the rubber during vulcanization, and, as before stated, the patented insulating compound herein referred to is of special value in this connection.

It is to be distinctly understood that I make no claim herein to the braided jacket *per se*, nor to any insulating matter employed therewith other than vulcanized caoutchouc.

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

One or more electric conductors, inclosed, insulated, and protected by one or more seamless braided jackets and intervening seamless jackets of elastic vulcanized caoutchouc, substantially as described.

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Witnesses:

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