

Oct. 16, 1928.

1,687,912

E. B. WHEELER  
INSULATED CONDUCTOR  
Filed March 27, 1924

*Fig. 2.*

*Fig. 1.*

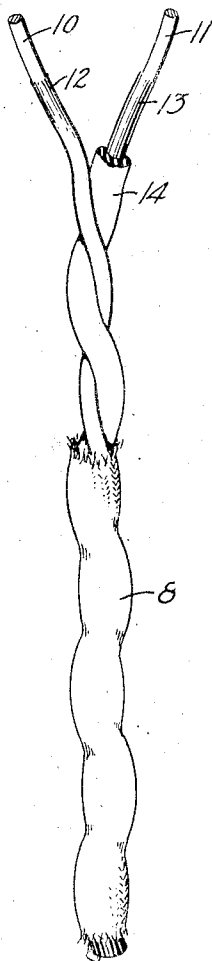
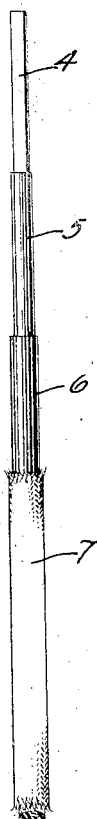
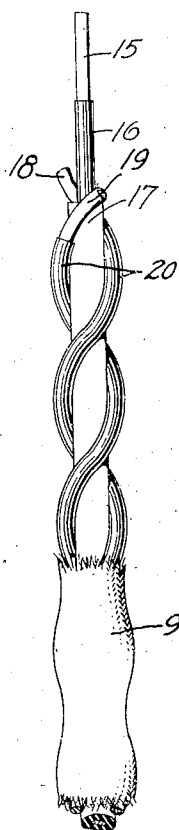


*Fig. 3.*



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## UNITED STATES PATENT OFFICE.

EDMUND B. WHEELER, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## INSULATED CONDUCTOR.

Application filed March 27, 1924. Serial No. 702,176.

This invention relates to insulated conductors.

An object of the invention is to provide an insulation for conductors which occupies a small amount of space and which has satisfactory dielectric properties together with exceptional continuity and imperviousness.

Baked enamels, while having many desirable qualities as insulators for electrical conductors, are exceedingly thin, and therefore often contain pin holes or like imperfections, and also in certain cases fail to provide the necessary dielectric between associated conductors.

In accordance with the general features of this invention, there is provided a conductor having a coating of enamel which is surrounded by a layer of vulcanized rubber. In case a plurality of conductors are to be used together, all except one of the conductors may be coated with enamel only and may be spiralled about a central conductor which may be coated both with enamel and with rubber. The rubber layer upon this conductor may be made sufficiently thick so that there will be the necessary dielectric between it and the other conductors. If more than one enamel coated conductor is used, these conductors should be so spaced that they are not in mechanical contact.

The various features and objects of the invention will appear more fully from the following detailed description taken in connection with the accompanying drawings.

Fig. 1 shows a conductor insulated in accordance with this invention.

Fig. 2 shows such a conductor with an enameled conductor spiralled about it.

Fig. 3 shows the conductor of Fig. 1 with two enameled conductors spiralled about it.

In Fig. 1 the conductor 4 is covered with an enamel coating 5 surrounded with a covering of vulcanized rubber 6. Such an insulation is readily formed when an enamel which can withstand the usual vulcanizing temperature of rubber is used, and when the heat is carefully controlled during the vulcanizing. A self-vulcanizing rubber compound may also be used. Weak spots in the layers 5 and 6 tend to be staggered and therefore the layer of rubber covers any holes in the enamel, so that there is produced an exceedingly continuous and impervious insulation. In order to protect the insulation from wear or mechanical injury,

it may be covered with a protective braiding

7. Such braidings are often impregnated with flame resistant material which is hygroscopic and which makes necessary the use of an impervious insulation on the conductor to prevent short circuits. Thus, the impervious character of the insulation of the invention will be particularly useful in this connection. An enamel that may be used in practicing the invention is disclosed in U. S. patent to Holmes et al. 1,101,281 dated June 23, 1914. This patent also discloses a suitable manner of applying the enamel to the wire. Several suitable rubber insulations are known to the trade, which vulcanize at temperatures well below the baking temperature of that enamel.

A conductor such as shown in Fig. 1 is superior to a conductor insulated only with rubber, both because of its excellent electrical properties and because it occupies less space and is cheaper to produce, inasmuch as only a thin layer of rubber is required. For example, a conductor insulated with enamel and then covered with a layer of rubber  $\frac{1}{4}$ " thick is superior for many purposes to a conductor insulated only with rubber when the rubber layer is  $\frac{1}{2}$ " thick.

Fig. 2 shows two spiralled insulated conductors 10 and 11. Conductor 10 is insulated with an enamel coating 12 while conductor 11 is insulated with an enamel coating 13 and then covered by a vulcanized rubber layer 14 of sufficient thickness so that there will be the necessary dielectric between the conductors. The pair of conductors may be enclosed within a protective braiding 8.

Fig. 3 shows a conductor 15 insulated with an enamel coating 16 and then covered by a layer of rubber 17. Two uniformly spaced conductors 18 and 19 which are coated with enamel 20 are spiralled about the insulated conductor 15. The assembly, which will be practically cylindrical in form, may be enclosed in a protective braiding 9. Three or more enamelled conductors may, of course, be spiralled about the insulated conductor 15 provided that they be spaced so that the electrical demands (such as insulation resistance, capacity, and conductance) of the system as a whole may be met. Thus, a number of conductors may be associated with each other in an exceedingly small space without sacrificing those electrical properties which it is desired to maintain.

What is claimed is:

An insulated electric conductor comprising a conductor, a thin inner coating of baked enamel and a thin outer coating of vulcanized rubber, said enamel being too thin to alone serve as a sufficient insulating coating but sufficient to protect the conductor from the deleterious action of the ingredients of said rubber and the said rubber

alone being too thin to afford sufficient resistance to moisture but thick enough in combination with said enamel to produce a satisfactory insulation of great thinness and flexibility.

In witness whereof, I hereunto subscribe my name this 24th day of March, A. D. 1924.

EDMUND B. WHEELER.