

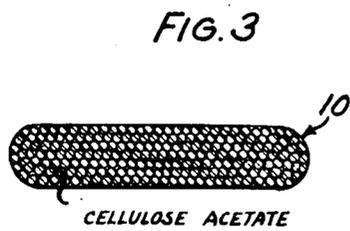
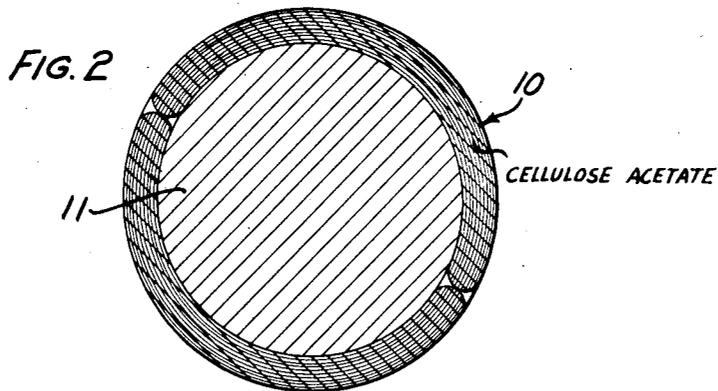
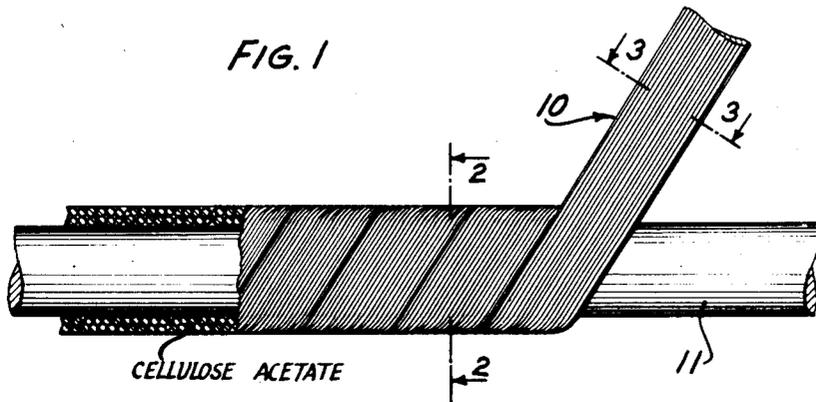
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INSULATED CONDUCTOR

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## INSULATED CONDUCTOR

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8 Claims. (Cl. 173—264)

This invention relates to insulated conductors and this application is a division of my copending application Serial No. 320,794, filed November 21, 1928 issued as Patent No. 1,966,509, dated July 17, 1934.

Objects of the invention are to provide inexpensive insulating materials having high insulating properties, and which may be readily applied to electrical conductors and to provide electrical conductors having thin, smooth, uniform and adherent coverings of effective insulating materials thereon.

In accomplishing the objects of the invention, one specific method embodying the invention comprises serving a flat band of artificial silk filaments around a conductor to produce a smooth, uniform layer of the silk upon the conductor, and heating the covered conductor to reduce the elasticity of the silk, so that it will have little tendency to unravel.

The above enumerated and other objects and features of the invention will be apparent from the following detailed description of specific embodiments of the invention taken in connection with the accompanying drawing, in which

Fig. 1 is a fragmentary, longitudinal view of a conductor embodying the invention showing how the insulating material is applied and having a part of the insulating material broken away to more clearly show the structure thereof;

Fig. 2 is a transverse sectional view thereof taken on line 2—2 of Fig. 1; and

Fig. 3 is a sectional view of the insulating material taken on line 3—3 of Fig. 1.

Natural silk has been used heretofore as an insulating material for electrical conductors, particularly for fine gauge wire such as magnet wire. In employing natural silk for this purpose it has been the practice in some cases to use a flat band comprising four to twenty-five parallel ends of substantially untwisted twenty denier threads composed of extremely fine individual filaments of one to three denier. This band is frequently applied to the wire in a thin spiral layer. Although natural silk is an excellent insulator, it is quite expensive, especially when used for insulating fine gauge wires because very fine, continuous filament silk yarns are required for such purposes. The present invention contemplates the substitution of a specially prepared artificial silk insulating material for natural silk and the application thereof to an electrical conductor in such manner that the conductor will be as effectively insulated as when natural silk is employed and at a much lower cost.

In the manufacture of artificial silk the material from which the silk is made is extruded in the form of a liquid through dies, commonly called "spinnerets", having a large number of minute holes therein through which the material passes and from which the material emerges in the form of extremely fine filaments, after which the filaments are passed through a suitable treating process, wherein the silk is solidified and converted into its final form. However, since artificial silk yarn of the usual type is of cylindrical cross-section and is composed of a plurality of individual filaments of the silk, it is difficult to produce a smooth, uniform insulating layer of such silk upon a conductor to form an insulator cover therefor. In practicing the present invention a special type of artificial silk yarn is employed consisting of a single band of individual filaments, wherein the filaments lie substantially parallel to one another, and are so positioned that the finished yarn will consist of a flat, thin, comparatively wide band which may be readily applied to a conductor to produce an exceptionally smooth and uniform insulating covering for the conductor. Also artificial silk as usually produced in an economical manner at present is considerably larger than the twenty denier yarn now employed in the natural silk insulating bands. In the present invention a sufficient number of individual fine filaments of artificial silk are extruded through a spinneret so as to produce a single flat band of eighty to five hundred deniers and comparable with the natural silk bands heretofore used for this purpose.

In the manufacture of artificial silks there are four commonly used processes; namely,

1. Cellulose-acetate
2. Viscose
3. Cupra-ammonium
4. Nitro-cellulose

By employing the cellulose-acetate process an artificial silk is produced which consists essentially of cellulose-acetate, which possesses insulating properties comparable to those of natural silk, whereas by practicing the other three processes enumerated above an artificial silk is produced which consists substantially of pure cellulose, which possesses insulating properties somewhat inferior to those of the cellulose acetate and natural silks. The differences in the insulating properties of these artificial silks necessitate the use of slightly different procedures in the processes of insulating electrical conductors therewith, and various processes embodying the invention will now be described.

When cellulose acetate silk is employed as an insulating material for electrical conductors, it is formed into a flat, thin, comparatively wide band of ungrouped parallel filaments, such as is indicated by the numeral 10 in the accompanying drawing, and the thus formed band is served spirally around an electrical conductor 11, so as to form therearound a thin, smooth, and substantially uniform covering which comprises an effective insulator for the conductor.

Since artificial silk is generally smooth and comparatively free from interlocking fibres, and because it possesses comparatively high elasticity, it has a tendency to unravel from the cut end of a wire insulated therewith, and this tendency is overcome in the case of cellulose-acetate silk by either one of two methods. The conductor, after having been covered with the silk insulation, may be heated at a moderate controlled temperature to remove the natural strains in the silk and possibly to slightly soften the cellulose-acetate of which the silk is composed, whereupon the elasticity of the silk is reduced and the tendency of the silk insulation to unravel is therefore substantially eliminated.

Electrical conductors may also be insulated with satisfactory results by means of artificial silks made in accordance with the viscose, cuprammonium, nitro-cellulose or other processes in which the finished silk consists substantially of a regenerated cellulose only. When these silks are employed, they are served upon electrical conductors in the form of flat, thin, comparatively wide bands in the same manner as has been described hereinbefore in connection with the cellulose-acetate silk, to form smooth, substantially uniform, helical coverings upon the conductors. The insulated conductors are then treated with a lacquer composed of cellulose-acetate dissolved in a suitable solvent, such as acetone, which lacquer serves the double function of increasing the insulating properties of the silk insulation to a value substantially equal to that of natural silk, and at the same time acting as an adhesive to retain the insulation in intimate contact with the conductor, so that the insulation will not readily unravel.

It will thus be seen that the invention provides inexpensive insulating materials having high insulating properties, that insulated conductors embodying the invention may be made therewith which have very desirable characteristics, and that such insulating materials may be easily, cheaply and effectively employed in practicing the methods embodying the invention to produce such conductors.

#### What is claimed is:

1. An insulated conductor, comprising a conductive wire and a substantially uniform covering therefor composed of a band of untwisted artificial filaments of a cellulose derivative helically wrapped around said wire, said filaments being ununited and heat treated to remove internal strains.
2. An insulated conductor, comprising a conductive wire and a substantially uniform covering therefor composed of a band of untwisted and ununited artificial filaments of a cellulose ester helically wrapped around said wire, said filaments being heat treated to remove internal strains.
3. An insulated conductor comprising a conductive wire and a substantially uniform covering therefor composed of artificial filaments of a cellulose derivative wrapped around said wire, said filaments being ununited and heat treated to remove internal strains.
4. A method of making insulated wire which comprises helically wrapping a band of untwisted filaments of a cellulose derivative around a conductive wire and heating the filaments below the coalescing temperature of said cellulose derivative but sufficiently to remove internal strains.
5. A method of making insulated wire which comprises wrapping a uniform covering of artificial filaments of a cellulose derivative around a conductive wire, and heating said filaments below the coalescing temperature of said cellulose derivative but sufficiently to remove internal strains.
6. A method of making insulated wire which comprises helically wrapping a band of untwisted filaments of a cellulose ester around a conductive wire, and heating the filaments below the coalescing temperature of said cellulose ester but sufficiently to remove internal strains.
7. An insulated conductor, comprising a conductive wire and a substantially uniform covering therefore composed of artificial filaments of a cellulose derivative wrapped around said wire, said filaments being ununited and heat treated to remove the strains, thereby preventing any tendency to unravel.
8. A method of making insulated wire which comprises wrapping a uniform covering of artificial filaments of a cellulose derivative around a conductive wire, and heating the filaments below the coalescing temperature of said cellulose derivative to remove the strains, thereby preventing any tendency to unravel.