

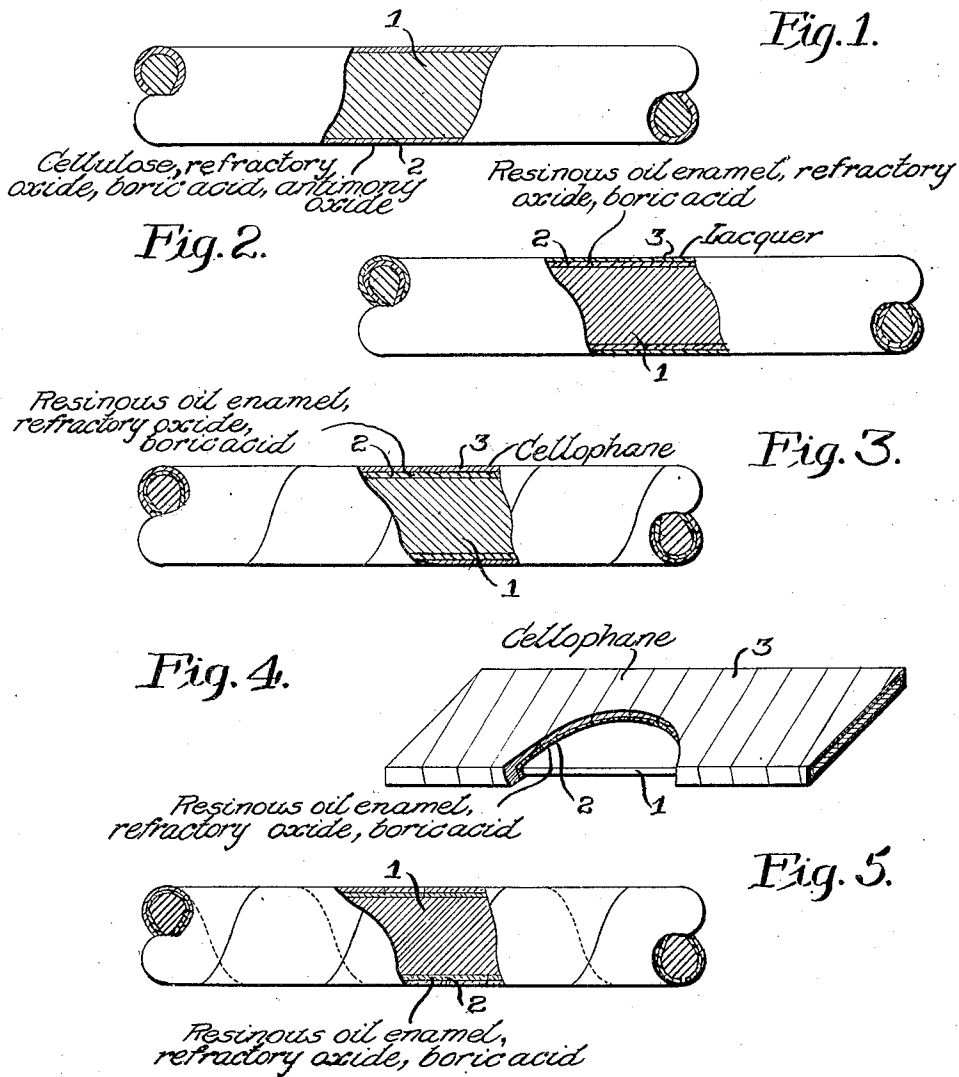
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INSULATED WIRE

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2,084,825

INSULATED WIRE

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5 Claims. (Cl. 173—264)

This invention relates to an improved type of insulated wire and to a method of making the same.

5 An object of the invention is to produce an insulated wire or conductor that is flexible, water-proof and capable of withstanding high temperature and abrasion without injury.

Another object is to provide a water-proof and flexible overcoat for insulated wires now in use.

10 A further object is to produce a protective winding for insulated wires so as to enable them to better withstand machine winding and abrasion.

Further objects will be apparent from the 15 disclosure.

This application is a continuation in part of my applications filed December 3, 1930, Serial Number 499,845, Patent Number 1,896,043; May 2, 1931, Serial Number 534,711, Patent Number 1,896,041; August 15, 1931, Serial Number 557,383, Patent Number 1,896,042. In those applications I described a wire having a coating of a refractory insulating material, such as an oxide, held in place upon the wire by relatively low temperature material, such as an organic binder of the resinous type and a relatively higher temperature binder of the inorganic type, such as boric acid.

In one group of wires within the scope of this application I may utilize a combination such as is described in my pending applications, substituting for the resinous binders described therein, a cellulose lacquer. As is well known, these cellulose lacquers are generally made by separately dissolving in suitable solvents, nitrocellulose and gum. The solutions are clarified, mixed and a plasticizer such as dibutyl phthalate, tricresyl phosphate, etc., added. Generally it may be stated that these cellulose lacquers are composed of nitrocellulose, resinous gums, plasticizers, solvents and diluents. For a typical coating material in this group I may take 450 cc. of such a cellulose solution, 200 grams of chromium sesquioxide, 80 grams boric acid and 20 grams of antimony oxide, the mixture being 45 milled until the various materials are thoroughly ground. It will be seen that in this coating I have three binders effective at various temperatures, first, the cellulose binder which is effective in holding the particles together and upon the 50 wire at low temperatures, second, the boric acid which becomes effective at higher temperatures such as 186° C., and, third, antimony oxide which becomes effective at a much higher temperature than the boric acid.

55 Such a coating may be applied to the wire and

air dried or baked. Preferably, a continuous coating process is used, the wire passing through cups containing the insulating compound and being heated and baked in furnaces located between the cups. When necessary to thin out the mixture, a thinner of the acetate type is preferable. In addition to acting as a binder the boric acid also reacts with the other materials of the mixture and also to a lesser degree with the surface of the wire.

I may add to or incorporate in the cellulose lacquer, one of the so-called "glyptals" or "glyptal" lacquers which have as a base, an alkyd (synthetic) resin which is a combination of glycerine and phthalic anhydride; or I may use such an alkyd resin lacquer in substitution of the cellulose lacquer, the other materials remaining the same. In place of the boric acid and/or antimony oxide I may use other materials, such as zinc borate, sodium borate, lead borate, etc. In place of the chromium sesquioxide I may use other insulating or refractory materials such as one or more of the insulating metals or metalloid combinations which include the oxides, borates, silicates, and in some cases hydroxides. Among those insulating materials, which may be used singly or in combination, may be mentioned the oxides of such metals or metalloids as beryllium, magnesium, aluminum, silicon, tantalum, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, molybdenum, tungsten, lead, thorium, zirconium. Where the borates, silicates, hydroxides or hydrates of these elements form insulating compounds, these may be used. Mixtures containing more than one compound, for example, beryl or mica, may also be used in combinations or otherwise. The materials should be ground to as fine a state as possible.

In a second group of wires within the scope of this application I use the cellulose or glyptal lacquer in a different manner. For instance, I may coat a wire with a mixture such as is shown in one of my three copending applications, consisting of either, a mixture of an oxide, shellac, Venice turpentine, boric acid and alcohol, or a mixture of an oxide, drying oils, natural and/or synthetic resins, boric acid and a solvent, and after such a coating has been applied to the wire, apply a top or over-coat of the lacquer. This has the effect of water-proofing and increasing the flexibility and abrasion resistance of the wire.

In a third group of wires within the scope of this application, I may coat a wire with any of the insulating mixtures described in my copending

applications or in this application, or I may coat a wire with one of the ordinary oil-resin enamels used for that purpose, and over the insulated wire I may wind a tape of one of the oil-proof, homogeneous non-fibrous cellulose sheet materials, such as are popularly designated "Cellophane"; this may be wound around the insulated wire by machine in a fashion similar to that now used in winding paper, cotton or silk covered wire. The "Cellophane" should be of minimum thickness, preferably under one mil and it should be narrow, preferably $\frac{1}{8}$ " or narrower. It may be wound straight, spiral or crosswise, single or double layer.

Generally, it may be stated that "Cellophane" can be made as follows: Highly purified cellulose is mercerized with caustic soda, the resulting alkali cellulose being treated with carbon bisulphide to form cellulose xanthate which is dissolved in water and caustic soda to form viscose. Thin layers of viscose are coagulated by a solution of mineral salts and the cellulose regenerated by mineral acids. The sheet so obtained is washed, bleached, impregnated with a softener such as glycerol and dried.

Such a coating is of great assistance in protecting the wire insulation from abrasion due to machines or handling of the wire. It is of particular benefit when used with square or rectangular wire, such as copper ribbon used in generator windings. This "Cellophane" ribbon or tape may also be wound directly on bare wire where further insulation is not required, the "Cellophane" itself having high dielectric strength.

Figures 1 to 5 of the drawing illustrate the various groups of wires.

In Fig. 1, the copper wire (1) has an insulating coating (2) consisting of a mixture of cellulose, refractory oxide, boric acid, and antimony oxide.

In Fig. 2, the wire (1) has an insulating coating

(2) consisting of a mixture of a resinous oil enamel, refractory oxides, boric acid, and a protective layer of lacquer (3) over said insulating coating.

In Fig. 3 is shown a wire (1) having an insulating coating (2) similar to that described in Fig. 2, and having a protective winding of "Cellophane" (3).

In Fig. 4 is shown a copper ribbon (1) having an insulating coating (2) similar to that described in Fig. 2, and having a protective "Cellophane" winding (3).

In Fig. 5 is shown a bare wire (1) having a protective and insulating double layer winding of "Cellophane" (2).

I claim:

1. A wire having an insulating coating containing a cellulose lacquer, a boron compound and a refractory insulating compound.

2. A wire having an insulating coating containing a refractory insulating compound, a cellulose lacquer, a boron compound and a binding material effective at a higher temperature than the melting point of said boron compound.

3. A wire having an insulating coating consisting substantially of a refractory oxide, a binder of cellulose lacquer and another binder effective at temperatures greater than the ability of the cellulose to withstand.

4. A wire having an insulating coating consisting substantially of a mixture of chromic oxide, a cellulose lacquer and another binder effective at temperatures higher than that where the cellulose lacquer ceases to be effective.

5. A wire having an insulating coating consisting substantially of a mixture of chromic oxide, a cellulose lacquer and a boron compound.

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