

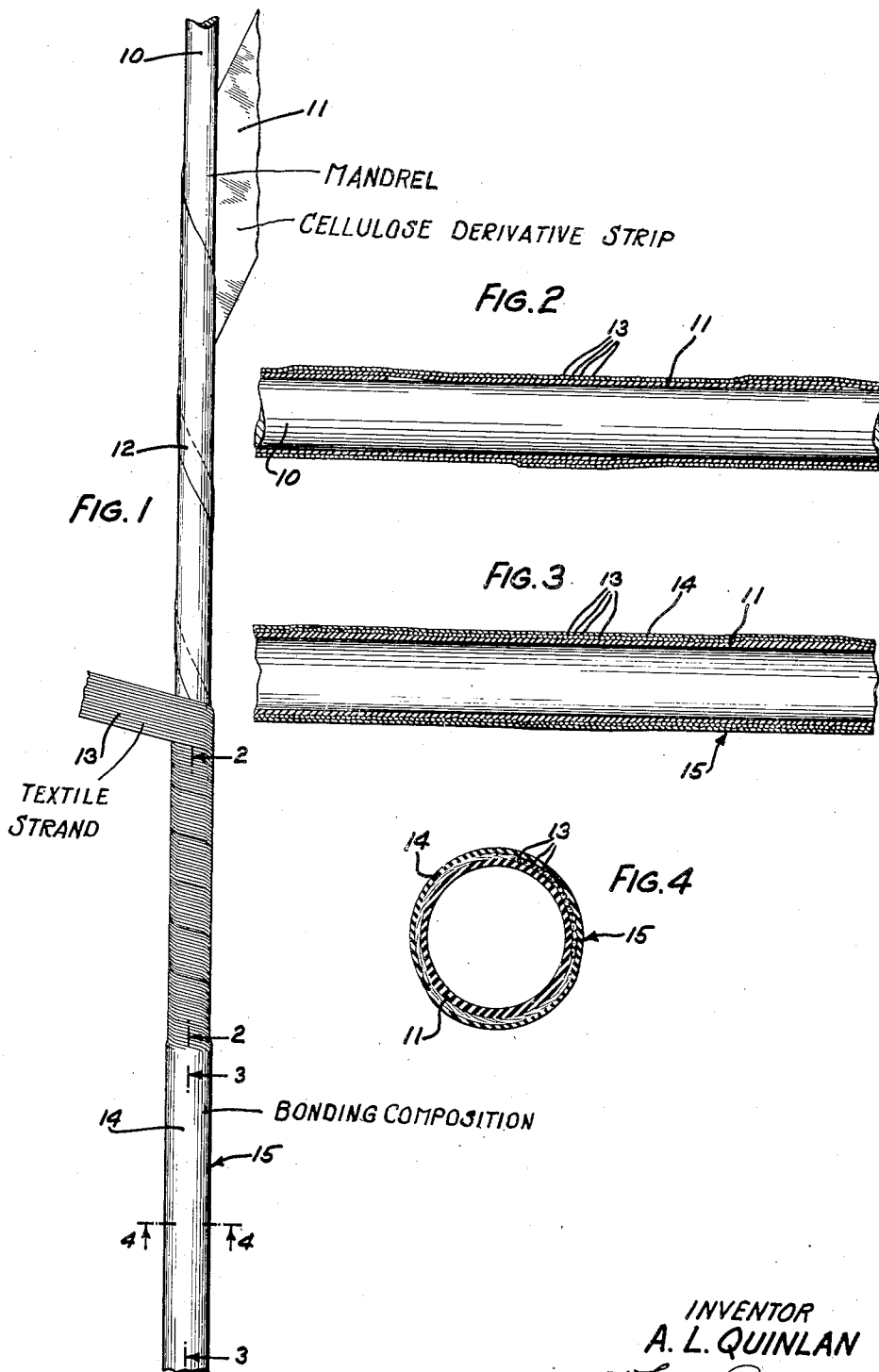
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ELECTRICAL INSULATING MATERIAL

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ELECTRICAL INSULATING MATERIAL

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9 Claims. (Cl. 154—2.6)

This invention relates to electrical insulating materials, more particularly to insulation for electrical conductors, and to methods for producing such insulation.

5 An object of the invention is the provision of a compact and inexpensive insulation having high dielectric values and resistance to mechanical abrasion for use as a covering for electrical conductors.

10 The invention is especially adapted to the production of tubing of the type employed on wire splices and the like, where substantial insulation and mechanical protection are required and the space available for a covering on the splice is limited. In one embodiment of the invention an improved tubing is produced for such uses by wrapping a cellulose acetate ribbon spirally on a mandrel with the edges of the ribbon overlapping, serving cotton strand over the ribbon, applying a composition to consolidate the strand and ribbon into a composite body and coalesce the overlapping edges of the cellulose acetate, and finally withdrawing the mandrel from the composite body to form the tubing.

25 Following is a more detailed description of the invention taken in conjunction with the appended drawing, in which—

Fig. 1 is an elevation showing the process in which tubing is formed in accordance with one 30 embodiment of the invention;

Fig. 2 is an enlarged sectional view of Fig. 1 taken on the line 2—2 to show details of the tubing structure at one stage of the process;

35 Fig. 3 is another enlarged sectional view of Fig. 1 taken on the line 3—3 to show the completed tubing, and

Fig. 4 is an enlarged sectional view of Fig. 1 taken on the line 4—4 to show another section of the completed tubing.

40 As shown in Fig. 1, the tubing is formed conveniently on a mandrel 10 having the approximate size and configuration desired for the inner contour of the tubing. First, cellulose acetate, or other cellulose derivative having the desired 45 properties, in the form of a ribbon 11 or strip is wrapped spirally on the mandrel with the adjacent edges of the strip overlapping slightly, as shown at 12. The width of the strip is selected to facilitate its smooth application on the mandrel and the degree of overlap is controlled to insure the edges of the strip being contiguous throughout the tube. The thickness of the strip depends largely upon the electrical requirements that the tubing will meet in service. It is desirable to use thin material for economy in cost 55

and in tube dimensions. For many fields of application .002" thick cellulose acetate strip is satisfactory, due to the high unit dielectric values of this material.

A serving of cotton or other textile strand 13 5 is applied over the cellulose acetate ribbon. Cotton is preferred because of its relative cheapness and generally satisfactory properties but in some cases, where a particularly thin tube wall is demanded, silk strand may be used. The cotton 10 or silk is applied in a plurality of parallel strands and in any manner known and used in the wire insulating art so as to provide a fairly continuous layer of textile on the spiralled ribbon.

In the next process step, a composition 14 is 15 applied to the assembled cellulose acetate and cotton layers to bond them into a flexible unitary body. The composition contributes insulating properties and also imparts mechanical strength and abrasion resistance to the structure. Particularly good results are obtained with a composition of the following ingredients, although some modifications of the listed proportions or materials can be made to provide equivalent 25 properties.

Parts by weight	
Cellulose acetate.....	100
Tricresyl phosphate.....	40
Diphenyl phosphate.....	35
Dimethyl pthalate.....	40
Ethyl lactate.....	10
Acetone.....	As required

The composition is applied in liquid form by any conventional method such as brushing or 35 conducting the assembled strip and strand through the liquid. The above ingredients are mixed with the necessary amount of acetone or other solvent to the proper consistency to insure adequate penetration of the composition and 40 also to coalesce the contiguous edges of the cellulose acetate strip. After the composition is applied, it sets rapidly by evaporation of the solvent, particularly under heat. As the composition consolidates, it bonds and tightly com- 45 pacts the structure elements and after the structure is consolidated, it is removed from the mandrel and cut into desired lengths.

The completed tube 15 has a continuous inner wall of cellulose acetate with high insulating 50 values and the cotton imbedded in the composition provides a tough, durable, abrasion resistant outer surface. Due to the properties of the composition and the arrangement of the structure elements, the tube is then walled and flex- 55

ible. The inner surface of the tube is smooth and uninterrupted due to coalescence of the joints in the cellulose acetate strip under pressure between the mandrel and the tightly applied cotton serving. The smooth inner surface, aided by the flexibility of the tube, facilitates its assembly over wire splices and the properties of the tube insure adequate electrical mechanical protection of the conductors.

The tubing can be made rapidly and economically in continuous lengths on conventional wire insulating or serving machines of the type used generally to apply strip or strand material on an advancing wire. The wire serves as a mandrel and the cellulose acetate strip and cotton strand are applied on the wire in order, impregnated with the composition, and dried by heating before it leaves the machine. The covered wire is then cut to short lengths and the wire is withdrawn readily from the short sections to provide the tubing. When a machine of this type is employed, the cellulose acetate ribbon can be coalesced before the cotton strand is applied by means of a wiper mounted in the machine and saturated with a solvent for the cellulose acetate.

It will be apparent that modifications of the construction and methods described herein are feasible, and it is to be understood that the invention is limited only by the scope of the appended claims.

What is claimed is:

1. A method of making insulating tubing comprising the steps of wrapping a strip of cellulose derivative spirally on a mandrel with the edges of the strip overlapping, applying a serving of strand material over the cellulose derivative, applying a composition comprising a solvent for the cellulose derivative to bond the strands to the cellulose derivative to form a composite body and to coalesce the overlapping edges of the cellulose derivative under pressure supplied by the strand, and removing the composite body from the mandrel in the form of tubing.

2. A method of making insulating tubing comprising the steps of wrapping a strip of cellulose acetate spirally on a mandrel with the adjacent edges of the strip overlapping, applying a serving of textile strand material over the cellulose acetate strip, applying a composition comprising a solvent for the cellulose acetate to the strands and cellulose acetate to bond the strands together and to the cellulose acetate to form a composite body and to coalesce the overlapping edges of the cellulose acetate under pressure supplied by the strand, and removing the composite body from the mandrel in the form of tubing.

3. A method of making insulating tubing comprising the steps of wrapping a strip of cellulose acetate spirally on a mandrel with the adjacent edges of the strip in contact, applying a serving of textile strand material over the cellulose acetate strip, applying to the strand and cellulose acetate a composition comprising cellulose acetate, tricresyl phosphate, diphenyl phosphate,

dimethyl phthalate, ethyl lactate and a solvent, and removing the composite body from the mandrel in the form of tubing.

4. A method of making tubing for use in insulating wire splices and the like comprising the steps of wrapping a strip of cellulose acetate spirally on a mandrel with the edges of the strip overlapping, applying a serving of cotton strand over the cellulose acetate strip, applying a composition comprising cellulose acetate, tricresyl phosphate, diphenyl phosphate, dimethyl phthalate, ethyl lactate and a solvent to bond the cotton strands together and to the cellulose acetate to form a composite body and to coalesce the overlapping edges of the cellulose acetate, and removing the composite body from the mandrel in the form of tubing.

5. A method of making tubing for use in insulating wire splices and the like, comprising the steps of wrapping a strip of cellulose acetate spirally on a mandrel with the edges of the strip overlapping, applying a serving of cotton strand over the cellulose acetate strip, applying a composition comprising 100 parts cellulose acetate, 40 parts tricresyl phosphate, 35 parts diphenyl phosphate, 40 parts dimethyl phthalate, 10 parts ethyl lactate and a solvent for cellulose acetate to bond the cotton fibres together and to the cellulose acetate to form a composite body and to coalesce the overlapping edges of the cellulose acetate, evaporating the solvent, and removing the composite body from the mandrel in the form of tubing.

6. A thin flexible tube for insulating wire splices and the like comprising a core of cellulose derivative, a serving of textile strand material on the core, and a composition comprising cellulose acetate, tricresyl phosphate, diphenyl phosphate, dimethyl phthalate and ethyl lactate imbedding and bonding said strands to the core.

7. A thin flexible tube for insulating wire splices and the like comprising an inner layer of cellulose acetate sheet having a smooth continuous inside surface, a layer of strand material on the cellulose acetate sheet layer, and a composition enclosing the strands and bonding said strands to the cellulose acetate sheet.

8. A thin flexible tube for insulating wire splices and the like comprising a cylinder of cellulose acetate having a smooth continuous inner surface, a serving of cotton strands on the cylinder, and a composition comprising cellulose acetate, tricresyl phosphate, diphenyl phosphate, dimethyl phthalate and ethyl lactate enclosing the cotton strands.

9. A thin flexible tube for insulating wire splices and the like comprising a core of cellulose acetate having a smooth continuous inner surface, a serving of cotton strands on the core, and a composition comprising substantially 100 parts cellulose acetate, 40 parts tricresyl phosphate, 35 parts diphenyl phosphate, 40 parts dimethyl phthalate and 10 parts ethyl lactate around said cotton strands.

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