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2,013,686

PROCESS OF MAKING INSULATED WIRE

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FIG. 1

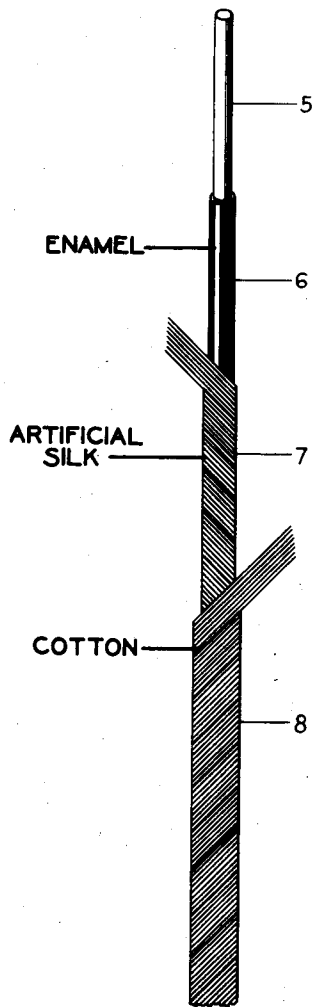
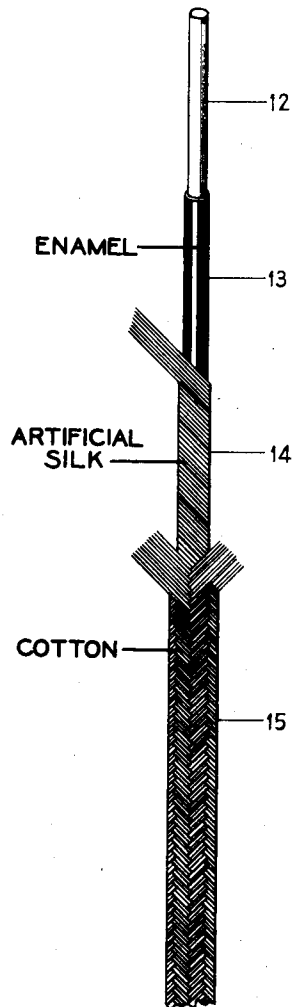


FIG. 2



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PROCESS OF MAKING INSULATED WIRE

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mesne assignments, to Associated Electric
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of Delaware

Application July 5, 1933, Serial No. 679,927

5 Claims. (Cl. 117—53)

This invention relates in general to insulated wires or conductors such as are used for telephone switchboard wiring or for similar purposes; and the object of the invention is a new and improved process of insulating such wire, resulting in a cheaper and better insulated wire than has hitherto been available.

In U. S. application S. N. 475,235, filed August 14, 1930, a process of insulating wire is described which consists in applying a serving of some material such as rayon, after which the wire is passed through a bath of acetone. This partly dissolves the rayon and causes the separate fibers to run together somewhat and form a more or less homogeneous layer. The application referred to also contemplates adding successive layers of rayon, treating each layer in the same way, so as to build up the insulation to any desired thickness.

An insulated wire made in this way is good for certain purposes, but there are other situations where it is not so satisfactory. In the case of switchboard wire and jumper wire, for example, considerable dielectric strength is required and at the same time the insulation must have mechanical strength and durability. In order to obtain the desired insulating qualities, a number of layers of rayon would have to be applied, resulting in an expensive wire. Moreover, the finished wire hardly has the durability required for this class of service.

Cotton is a desirable insulating material, being cheap and durable. It has been much used, but the ends of wires insulated with cotton are subject to fraying or unraveling of the insulation. Efforts have been made to treat a cotton serving with some solvent which acts on cotton like acetone acts on rayon, but it is found that such solvents leave undesirable by-products. These attempts therefore have not resulted in anything practical.

The problem outlined in the foregoing has been solved by using a combination of rayon, or similar synthetic textile material, and cotton applied and treated according to a novel process, with the result that an inexpensive and durable insulated wire is produced, having a number of highly desirable qualities. A synthetic textile material which has been successfully used is a product made from cellulose triacetate, sometimes known simply as cellulose acetate. This is a variety of artificial silk and for convenience will be so referred to.

The invention will be described hereinafter, reference being made to the accompanying drawing, comprising Figs. 1 and 2, which will be used to describe several processes of manufacturing

insulated wire in accordance with the invention.

Referring to Fig. 1, the wire 5 may, if desired, be first given a coating of enamel 6. This is usually done to improve the dielectric strength of the insulation. In addition, the enamel gives a better foundation for the application of the artificial silk and enables the latter to adhere better to the wire than is the case with a bare wire.

The wire is then run through a machine which applies a serving 7 of artificial silk. This material consists of a number of strands, not twisted, and may be laid on so as to form a uniform layer entirely covering the wire. However, a partial covering will to some extent accomplish the main object for which the artificial silk is applied.

The wire is now passed to a second machine which applies a heavy serving 8 of cotton over the artificial silk. Thus the wire is given a double layer covering, the inner layer 7 of silk and the outer layer 8 of cotton.

If desired, two serving heads may be used on a single insulating machine, one applying the layer of artificial silk and the other the layer of cotton. This is an advantage of the process herein described as against those processes which require a treatment of each layer or serving before the next is applied. Such processes necessarily require a separate operation for applying each layer.

The covered wire is now passed through a bath of acetone. This is a continuous operation, the wire being unwound from one spool, drawn through the bath, and rewound on another spool. The latter spool should be about ten or twelve feet from the bath so that the insulated wire will have a chance to dry in the air before it is wound up. The rate at which the wire passes through the bath must be regulated so that the proper length of exposure to the solvent is obtained. The considerations necessary for a proper regulation will be described.

The acetone in the bath is penetrating and saturates both the outer layer of cotton and the inner layer of artificial silk. On the former it has no effect, but it is a solvent for the silk and causes the fibers to coalesce or run together, reducing the material to a plastic jelly-like state. This action is progressive, beginning with the outer portion of the layer, which is reached first by the solvent. The cotton serving is tightly wound and the artificial silk material in its plastic condition intrudes between and around the fibers of cotton. The cotton layer is thus impregnated to some extent with the artificial silk in its changed condition

due to the action of the acetone. The result is that when the solvent evaporates the fibers of the cotton layer are tightly bound together.

Now the time of immersion in the bath is regulated so that it is just sufficient to insure that a substantial portion of the artificial silk is reduced to the proper condition to enable it to impregnate the cotton. For switchboard wire insulated as described herein it is found that between one-half and three-fourths of a minute gives good results. If the immersion is less than this, too small a portion of the silk layer is reduced to the proper consistency, while if the time is much longer, it is found that all of the artificial silk is reduced and the inner layer practically disappears, some of the silk being entirely dissolved and lost in the bath. Much depends on the thickness and texture of the outer layer, which must be penetrated by the solvent before it can act on the material beneath. A change in the outer layer therefore must ordinarily be accompanied by a corresponding change in the time of immersion.

In a properly insulated wire the separate strands of the cotton layer will be found to be firmly bound together so that it can be unwound only with difficulty. It is entirely free from fraying or unraveling in ordinary usage. If the serving is forcibly unwound by tearing of the binding, it is found that a large part of the layer of artificial silk has gone into the cotton. That which remains still has a more or less stranded texture but is thin and irregular because of the forcible separation from the cotton. It is impossible to show all this in the drawing.

The drawing is intended therefore as an aid in describing the process rather than as an illustration of the details of the finished wire.

Fig. 1 shows certain steps in the process of making an insulated wire according to this invention.

Fig. 2 shows certain steps in the process of making a somewhat different type of insulated wire, having a braided cotton covering instead of a plain serving of cotton. This insulated wire is especially designed for use as jumper wire.

Wire insulated with enamel, silk, rayon and other materials has heretofore been given an outer covering of braided cotton for protection against mechanical injury and some very good wire of this type has been produced and sold. It is found, however, that when a smooth surfaced inner insulation is used such as results from the use of artificial silk treated with acetone, the outer braiding has a tendency to slip along the inner layer of insulation. At points where the insulation is cut away for the purpose of making connections, the outer braid tends to slip back along the wire, leaving the inner layer of insulation exposed for some distance. This is objectional.

I have found that by a similar process to that which has been described, an excellent quality of jumper wire can be manufactured which is not subject to the defect above pointed out.

The wire 12 may be given a coating of enamel 13 according to the usual practice, and is then given a serving of stranded artificial silk 14 described in the preceding process. The wire is then run through a braider which puts on a braided covering of cotton 15.

The wire with its artificial silk and braided cotton covering is then run through a bath of acetone. It is found that owing to the greater thickness of the braided cotton covering and the greater difficulty of penetrating it, the wire has to be

immersed in the bath for about twice as long as is the case when a plain serving of cotton is used. The treatment in the bath results in the artificial silk being partially reduced to a jelly-like state as described previously, in which condition it oozes out into the braided covering to some extent and thus effectually unites the two coverings. Thus slipping of the outer braided covering is entirely prevented.

Since jumper wire is required to be flame-proof, the wire is impregnated with chlorinated naphthalene in order to give the desired protection. The spools of wire are soaked in the hot melted chlorinated naphthalene contained in a heated tank. After the requisite saturation has been obtained, each spool is transferred as quickly as possible to a heated centrifugal dryer by means of which any excess of chlorinated naphthalene is gotten rid of. The resulting product is an excellent jumper wire, flame-proof, and having a tough braided cotton covering which is not subject to fraying and which adheres tightly to the inner covering of artificial silk.

While I have described the use of certain specific materials herein, the invention is capable of being practical with other materials so long as they act in the same way. I do not therefore wish to be limited to the exact details of the processes described herein but desire to include and have protected by letters patent all variations thereof which come within the scope of the appended claims.

What I claim is:

1. The process of insulating a conductor which consists in applying an inner layer of yarn made of some cellulose ester, in applying thereover an outer layer of different textile material, and in passing the conductor through a bath containing a liquid which is a solvent for the cellulose ester of the inner layer but not for the material of the outer layer, whereby the fibers of the outer layer are penetrated and are bound together by the action of the solvent on the cellulose ester underneath.

2. The process of insulating a wire which consists in applying a layer of yarn made of some cellulose ester, in applying thereover a layer of cotton or other textile material, in passing the conductor through a bath containing a penetrating liquid which is a solvent for the material of the inner layer but not for the material of the outer layer, and in regulating the rate at which the conductor moves through the bath so that a sufficient amount of the material of the inner layer is reduced to bind together the fibers of the outer layer.

3. The process of insulating a conductor which consists in applying a layer of fibrous material which is capable of being rendered plastic by the application of a solvent, in applying a layer of different fibrous material under tension which is not acted on by such solvent, in saturating both layers with the solvent, thereby causing a portion of the inner layer to become plastic and intrude between the fibers of the outer layer, and in evaporating the solvent.

4. The process of insulating a conductor, which consists in spirally wrapping a continuous length of cellulose material around the conductor to form a covering, in applying over said covering an outer covering of fibrous material which is not dissolved by a particular liquid which is a solvent for the material of the inner covering, and in passing the conductor through a bath

containing such liquid, whereby a portion of the material of the inner covering is reduced to a plastic condition in which it intrudes between and binds together the fibres of the outer covering.

5 5. The process of insulating a conductor which consists in applying to the conductor a serving of stranded material which is soluble in acetone, in

applying a serving of cotton over the serving of stranded material, and in then passing the conductor through a bath of acetone which saturates both layers but dissolves the inner layer only, causing it to bind together the fibers of cotton.

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