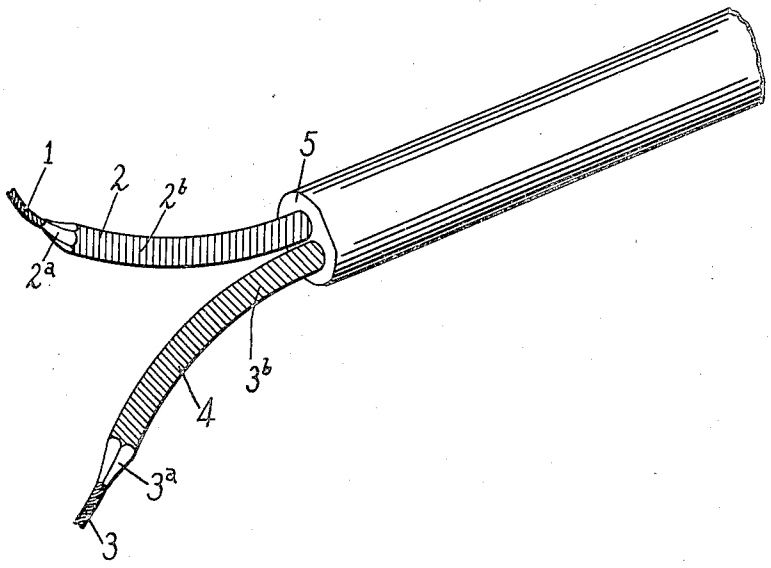
Aug. 7, 1934. R. B. NORTON 1,968,903

INSULATED ELECTRICAL CONDUCTOR AND METHOD OF MAKING THE SAME

Filed Jan. 21, 1931



Inventor

Ralph B. Norton

By Pickering & Marshall

Attorneys

Patented Aug. 7, 1934

1,968,903

UNITED STATES PATENT OFFICE

1,968,903

INSULATED ELECTRICAL CONDUCTOR AND METHOD OF MAKING THE SAME

Ralph B. Norton, Seymour, Conn., assignor to The Kerite Insulated Wire & Cable Company, Incorporated, Seymour, Conn.

Application January 21, 1931, Serial No. 510,092

11 Claims. (Cl. 173—264)

This invention relates to electrical conductors and it has special reference to electrical conductors in which rubber or similar insulation is used. The invention also relates more particularly to conductors of the type where two or more metallic elements which carry current are insulated from each other, and in the preferred practice of the invention these metallic conductor elements have insulating covers made of a suitable rubber compound vulcanized subsequently to its application to the metallic elements, although it is not essential in all aspects of the invention that the insulating material be a rubber compound.

Where rubber and similar compounds have been used for the insulation of conductors cabled together very satisfactory results have been obtained, but certain difficulties have arisen as regards the identification in the cable of the individual conductors or wires. For identifying purposes it is of assistance to have the individual wires or conductors differently colored (sometimes in accordance with a color code) so that splicing or other work will be expedited. Where, however, it is necessary to insulate one wire with a rubber or like body of a given color and to insulate another wire with a body of another color, and so on, there are, obviously, manufacturing drawbacks and inconveniences, together with additional expense. Further, the pigments customarily used for giving the desired colors to the several batches of insulating compound applicable to the respective wires have a detrimental effect upon the compound in many cases. It is well known that the addition of certain pigments or coloring materials to a rubber compound are deleterious to the aging qualities of the compound.

One object of my invention is to overcome these drawbacks and provide in an effective manner for the use of a color code in cables where the wires are individually insulated with rubber or like insulation.

Another object is to provide for the convenient and economical application of different colors to the individual electrical conductors.

Another object is to provide a process of manufacture whereby all of the individual wires can be coated or covered with material taken from the same source, and in which the main body of insulation on each wire is not specially colored and is devoid of pigment or other substances which would injuriously affect the aging properties of the insulation, the distinguishing color of the wire being applied solely or principally at the outer surface of the insulating body.

Still another object of the invention is to provide an improved method of coloring an individual conductor comprising a metallic core and a surrounding body of rubber or like plastic material.

To these and other ends the invention consists in the novel features and steps to be hereinafter described and claimed.

In the accompanying drawing the single view shows in perspective a portion of an electric cable constructed in accordance with my invention, the outer cover or jacket being omitted.

In the drawing, I have shown a cable with two conductors, but this is merely by way of example, as there may be considerable variation in the number of individual conductors. I have also shown for illustrative purposes a cable in which the individually insulated conductors are embedded in parallel relation in a common insulating body or sleeve of rubber, but there may be variation in this respect also. Furthermore, I have shown in the drawing a cable in which each metallic core is stranded for imparting additional flexibility, but it will be apparent that the core may consist of a single large wire rather than a plurality of fine wires.

In the drawing, one of the metal cores is shown at 1, and it will be observed that this core or wire is covered with a layer or body of insulation 2, which in this instance is constituted by a vulcanized rubber compound. The body of the insulation is in this particular case of a dark color, approaching a black, but the outer surface is red, as indicated by the shading of the drawing. The dark interior of the insulating body is visible at 2^a, where such body is cut away to disclose the core 1, and the red surface of the insulation is indicated at 2^b. The other conductor shown comprises a core 3 similar to core 1, and an insulating body or layer 4 similar to body or layer 2, except that its outer surface 3^b is green. These particular colors are, of course, given merely by way of example. The inner and principal part of the insulation of core 3, which is visible at 3^a, is dark colored and is identical in constituency to the inner body of insulation for member 1 and can be taken from the same batch of rubber compound. The common insulating body for the individually insulated conductors is shown in the drawing at 5, and in this particular instance is constituted by a dark-colored body of rubber compound the same or similar in constituency

to the bodies of insulation used for the two core members.

While in practice the surface coloration of the insulation of all of the individual wires of a cable will as a matter of convenience usually be effected by carrying through the same coloring process with respect to all, I shall in this description assume that the insulation of core member 1 is colored by one process and that the insulation of core member 3 is colored by a somewhat different process.

After the rubber insulating compound has been placed upon the core 1 by the usual or any preferred method, and before the insulating body is vulcanized, the wire is caused to run through a suitable trough containing in the bottom thereof a quantity of powdered coloring pigment, which in this case is red. Because of the somewhat sticky nature of the surface of the insulating compound following its very recent application to the core, an appreciable amount of this red pigment adheres to the surface of the compound so that on the dark-colored body of rubber of considerable thickness surrounding the core there is a thin surface layer of coloring powder which clings tenaciously. The wire then passes immediately to the vulcanizer, where the covering is vulcanized and where the surface coloring is made permanent. It will be found that after vulcanization the surface of the insulating compound is well colored, but, on the other hand, the outer colored layer is very thin so as to be nothing more than a coloring skin, and all or practically all of the insulating body remains of the original constituency and color and unaffected by the coloring of the outer surface, and the insulating body is devoid of pigment except for the outer skin above mentioned.

By proceeding in this manner a distinctly red surface coloration can be imparted to the insulation of core member 1 so that this particular conductor element can always be readily identified.

In coloring the core member 3 by a somewhat modified process, the procedure is as follows:

After the insulation has been applied to core member 3, and while the rubber compound on said core member is still sticky, the wire is run through a trough similar to that above mentioned containing in the bottom thereof a quantity of soapstone or similar light-colored material in powdered form. This powder adheres to the outer surface of the insulation and forms an outer layer. The wire is then vulcanized in the usual manner, and after vulcanization there is a thin light-colored layer or skin on the dark-colored insulation. The product is then passed through a dye bath of the desired final color, which in this case is green. For obtaining a green surface I prefer to make up the dye bath of malachite green dissolved in alcohol, as this gives a very satisfactory result, but obviously many changes may be made in the constituency of the liquid dye and its method of application to the insulation. The dye applied to the insulation dyes the powdered soapstone or other light-colored material vulcanized upon the surface of the insulation, and in this manner the surface can be given the green or other color desired. The insulation will be well colored so as to be distinctive for identifying purposes and the color will be permanent. At the same time, it will be understood that while the dye passes into and colors the thin adhering powder layer, it does not penetrate the main body of the insulation constituted by the rubber compound.

The insulating body 5 is placed upon the completed conductors in the usual manner. The rubber of which it may be composed may be taken from the same supply as that used for the insulation of the individual wires.

By this invention it is possible to use the same batch of insulating compound for insulating the several conductors of a cable where the individual conductors are to exhibit different colors for identifying purposes. The procedure in applying color to the insulation of the several conductor elements is simple and economical, and the insulating bodies of the respective individual conductors are substantially devoid of pigment or special coloring material such as required for conformity with a color code, so that the insulating body for each conductor can be made of the best material available for the purpose, especially with reference to its aging properties.

Various changes may be made in the details of the conductor structure and in the procedure for coloring one or more individual conductors without departing from the scope of my invention as set forth in the claims. Modifications of the features herein particularly described will suggest themselves to those skilled in the art, and I have not attempted to describe all modifications which fall within the claims.

What I claim is:

1. In an electrical conductor, core members, a body of insulation for each core member made of dark colored plastic material, and a permanent thin coloring layer or skin for each body comprising powder adhering to the outer surface of said body, said coloring layers being of contrasting colors.

2. In an electric cable, a plurality of metallic conductor elements, a body of rubber compound insulating each element independently, and a surface layer of colored powder for each of said bodies vulcanized thereto, one of said surface layers being of a contrasting color to another.

3. The method of making an electric conductor which comprises forming a body of plastic material about a suitable core and applying light colored powder to the surface of the plastic material while it is sticky, vulcanizing the article, and then dyeing its outer surface.

4. The method of making an electric conductor which comprises forming a body of plastic material about a suitable core and applying light colored powder to the surface of the plastic material while it is sticky, vulcanizing the article, and then passing it through a dye bath.

5. The method of making an insulated electric cable comprising a plurality of conductors, each having a distinct surface coloration for identifying purposes, which comprises the application to a suitable metallic core of a body of rubber compound, the application of powdered pigment of the required color to the surface of the insulation while the latter is still sticky, the vulcanization of the product while the powder clings to the rubber body so as to cause the pigment to be held permanently to the body, and the assembly of the conductor thus formed in the same jacket with a similar conductor of contrasting surface coloration.

6. The method of making an insulated electrical conductor having a distinct surface coloration for identifying purposes, which comprises the application to a suitable core of a body of dark-colored rubber compound, the application of a

light-colored powder to the insulation as an outer layer, the vulcanization of the product, and the dyeing of the light-colored outer layer so that it is changed to a darker color contrasting with that of the insulating compound.

7. An insulated electrical conductor comprising a metallic core member and an insulating body surrounding the core member and composed of a rubber compound of high dielectric strength, said body having a thin skin of surface coloration contrasting with the coloration of the major portion of the body, said body being homogeneous and of a dark color throughout the zone extending from said core member to said skin, and said skin being composed of colored powder vulcanized to the surface of the body.

8. The method of making an electric conductor which comprises forming a body of dark-colored rubber compound about a suitable metallic core, applying a light-colored color vehicle to the surface of the compound while the latter is sticky, then vulcanizing the article to produe a thin skin of material extending uniformly over the exterior of the compound, said color vehicle as applied being in dry comminuted form, and applying coloring material, contrasting in color to the rubber compound, to the color vehicle.

9. In an electric cable, a plurality of metallic conductor elements, a body of rubber compound surrounding each of said elements independently, said bodies each containing coloring material in the form of colored powder in a thin skin at its outer surface vulcanized in the body, the color of the skin of one body contrasting with that of another.

10. In an electric cable, a plurality of metallic conductor elements, a body of plastic insulating material formed about each element, and coloring material in the form of colored powder of contrasting color retained on each body at the exterior, the powder of one body being of a different color from that of another.

11. The method of making an insulated conductor which comprises forming a body of rubber compound about a metallic conductor core, and then imparting a permanent distinctive color for identifying purposes to the outer surface only of the rubber compound by steps which include passing the conductor through a body of powdered color vehicle contrasting in color to the rubber compound while such compound remains sticky so that the powder adheres superficially to the compound, and vulcanizing the conductor while the powder layer is in the loosely adherent state so as to cause the powder to adhere closely and permanently.

RALPH B. NORTON.