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ELECTRICAL CONDUCTOR COATED WITH SEPARATOR STRIP AND METHOD OF MANUFACTURE

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Fig. 1

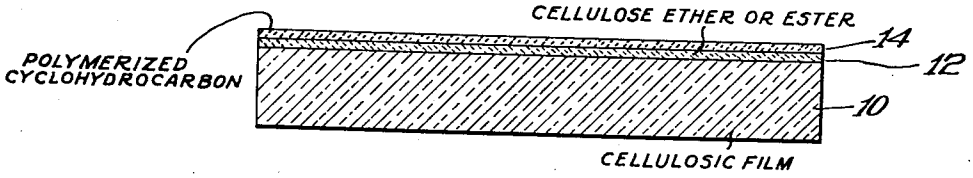
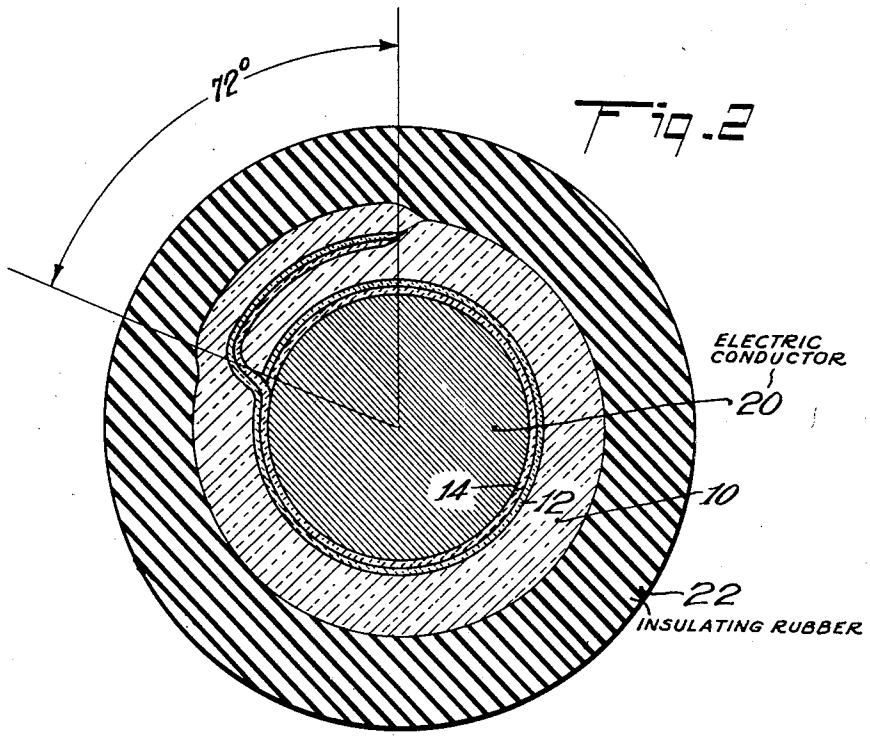


Fig. 2



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ELECTRICAL CONDUCTOR COATED WITH SEPARATOR STRIP AND METHOD OF MANUFACTURE

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3 Claims. (Cl. 174—120)

This invention relates to a new and improved method for coating a wire conductor with a separator strip adhesively bonded to the conductor, to the product of the said method, and to a coated strip for use in the practice of the said method.

An object of the invention is to provide a strip of a cellulosic material, for example regenerated cellulose or Cellophane, coated with a thermoplastic adhesive adapted to bond said strip to a wire conductor, such for example as a copper wire.

A further object of the invention is to provide a process wherein a coated strip of cellulosic material of the character described is wrapped or folded about a conductor in intimate contact therewith, and wherein the said strip is bonded to the conductor at temperatures below those employed in vulcanizing rubber insulation for the said conductor.

A still further object of the invention is to provide a wire conductor, and more specifically a copper wire, having in intimate contact therewith and bonded thereto a separator strip of Cellophane or cellulosic material, the whole being encased in suitable insulation.

A still further object of the invention is to provide a separator strip of the character described wherein the bonding material comprises a plurality of adhesive layers.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the article possessing the features, properties, and the relation of elements which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature of the invention, reference should be had to the accompanying drawing, in which:

Figure 1 represents diagrammatically and in elevation a separator strip embodying the features of the present invention; and

Fig. 2 represents diagrammatically and in section a conductor coated with the said separator strip and with suitable insulation.

It has been found desirable to supply a separator strip between a wire conductor and the insulation therefor, and to supply such a separator strip which may be readily and cleanly severed by the tools in use as wire cutters and trimmers. In forming a connection, for example, between the conductors and outlet plug, it is necessary to remove a section of the insulation and the separator from the wire to expose a length of base copper wire. With the form of structure now commonly employed, for example, individual wire conductors with cotton or worsted identification thread or threads applied longitudinally under a cotton serving and an overall insulating layer of rubber, it has been found difficult to remove the cotton thread or threads in the wire-stripping operation. It has therefore been suggested that the serving of cotton and identification thread or threads commonly employed be eliminated and a strip of cellulosic material used as a separator which should also carry manufacturer identification as described below. It has been found that if a strip of uncoated Cellophane is applied around the conductor and the whole then encased in rubber insulation, the entire coating, including the Cellophane strip and the rubber insulation, tends to slide along the wire if, for example, the coating is grasped and pulled.

This invention contemplates the provision of an improved separator coating which is adapted to be firmly bonded to the wire conductor during the vulcanization of the rubber insulating coating. To that end the cellulosic separator strip is coated on its inner face with one or more layers of adhesive compounds which are thermoplastic at temperatures slightly below those employed in vulcanizing the rubber insulation and which adhere satisfactorily to the wire conductor.

In the practice of the present invention, the separator strip preferably comprises a cellulosic film, such for example as a film 10 of ethyl cellulose or cellulose acetate, or regenerated cellulose, such as Cellophane, to which there is applied one or more coatings 12, 14 to effect a bond between the separator strip and the wire conductor about which it is wrapped.

In the preferred embodiment of the invention, two coats are applied to the separator strip itself. The first coat, i. e., the coat shown as an intermediate film 12 in Fig. 1, may comprise either an ether or an ester of cellulose plasticized with a compatible solvent plasticizer. Suitable materials for use in the formation of this coating are ethyl cellulose, cellulose acetate, and cellulose nitrate, as well as mixtures comprising said materials. A suitable plasticizer which acts as a solvent for the cellulose ether or ester employed is methyl-phthallyl-ethyl-glycollate. Any similar compatible solvent plasticizer may be em-

ployed, and any other cellulosic ethers or esters may be used. A suitable coating may comprise 100 parts by weight of the cellulose derivative and from 25 to 75 parts by weight of the solvent plasticizer. It is, however, to be understood that these proportions may be departed from within the scope of the present invention.

The first or intermediate coating 12 may alternatively comprise a low viscosity vinyl acetate polymer, a polymerized methyl methacrylate, or any polymerized acrylic or methacrylic acid derivative plasticized with the same compatible solvent plasticizers. Under these circumstances the plasticizer should comprise from 5 to 50 parts by weight to 100 parts by weight of the plastic.

The second or outer coating 14 may comprise any polymerized cyclohydrocarbon, such for example as the polymerized indene, clear, water-white hydrocarbon permanently thermoplastic resin sold as "Nevillite." This resin, classified as paracoumarone indene, may if desired be plasticized with any heavy solvent oil plasticizer, such for example, as a high boiling fraction of a coal tar distillate, or the Nevillite and the heavy solvent oil plasticizer may be dissolved in any petroleum hydrocarbon which may act under these circumstances as a diluent. If desired, as much as 25 parts by weight of the heavy solvent oil to 100 parts by weight of the cyclohydrocarbon may be used. The heavy solvent oil need not, however, be employed.

The second or outer coating 14 may alternatively comprise a condensation product of formaldehyde and aromatic sulphonamide, such for example as "Santolite," plasticized with an ester or ketone type solvent plasticizer. The same diluent may, if desired, be employed.

So also the outer coating 14 may alternatively comprise a natural resin, such for example as damar gum or W. W. grade resin, or cumar or cumarone resins generally. Such resins may be substituted for the Nevillite in the formula given above.

So also the second or outer coating may comprise alternatively a polymerized straight chain hydrocarbon, such for example as "Vistanex," which is an isobutylene polymer and which may, if desired, be plasticized with a synthetic or natural wax, such for example as beeswax, paraffin, or ceresin wax. The wax may be employed in quantities up to 50 parts by weight of wax to 100 parts by weight of the Vistanex.

It should be noted that with the use of an oil compatible solvent, it is possible to mix the coatings 12 and 14 and to make a single coating conforming to the requirements of the invention. Such a structure is to be deemed to fall within the scope of the invention.

In the practice of the invention a Cellophane strip 10 having a thickness of approximately .0009 inch may be satisfactorily employed and the films 12 and 14 may together have an over-all thickness of approximately .0001 inch. As shown in Fig. 2, this coated strip may be wrapped or folded around a wire conductor 20 which may be of copper, iron or other conducting metal. As shown in Fig. 2, there may be a 20% overlap in wrapping or folding the strip about the electrical conductor. The usual cotton thread coating may be eliminated and the wire coated with the separator strip may in turn be covered with insulating rubber 22 of the usual thickness, and the rubber may then be vulcanized at the usual temperature, for example at a temperature of approximately 287° F. At this temperature the adhesives comprising the coatings 12 and 14 become thermoplastic and upon cooling the strip 10 is firmly bonded to the conductor. The over-all diameter of the conductor, separator strip and rubber insulation may be somewhat less than the over-all diameter of a comparable commercial conductor, for the thickness of the separator strip of the present invention is somewhat less than the thickness of the cotton thread coating now commonly employed.

With the use of an adhering separator strip, such as that hereinbefore described, there is no tendency for the insulation to pull away from the conductor, but the insulation may be nevertheless quickly and cleanly removed when desired. Furthermore, the Cellophane or other separator strip employed, or the coatings thereon, may be printed, or impregnated with a pigment, or otherwise treated, so that the product of any particular manufacturer may be readily identified by cutting away the insulation. This identification may be added at very little cost.

Furthermore, the coatings provided in connection with the separator layer of the present invention increase the moisture-resistance of the layer and also its insulating properties. While the separator strip should preferably be an insulator, this is not necessary, as its function is primarily that of a separator.

While the insulation employed in connection with the conductors embodying the present invention has been referred to as a rubber insulation, it is to be understood that any suitable insulation may be used, such for example as a felted asbestos or asbestos treated with a hot saturant, or the like. So also the process of the present invention is admirably adapted for use with a plurality of conductors within a single cable or insulating coating. All such modifications of the invention are to be deemed within its scope.

Since certain changes in carrying out the above process, and certain modifications in the article which embody the invention may be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. An insulated electrical conductor comprising a metallic core, an insulation layer, said layer comprising rubber vulcanized in place on said conductor and separator layer comprising regenerated cellulose which has a low coefficient of friction with respect to said core and which is bonded to the metallic core by an adhesive, whereby said separator layer is prevented from slipping along said core; said adhesive being plastic only at temperatures having a lower limit slightly below 300° F., whereby said adhesive may be caused to give the bond originally when said rubber is vulcanized in place by said entire conductor being subjected to a temperature higher than slightly below 300° F.

2. A process of forming an insulated electrical conductor comprising applying to a metallic wire a separator strip which is of a material which when uncoated slides easily along wire and which is coated with a thermoplastic adhesive on a face thereof, said adhesive being in contact with said wire and being of a material which becomes plastic only at temperatures which are high enough to vulcanize rubber, covering said strip with an

insulating layer of rubber, and heating said wire, said strip and said insulating layer to vulcanize said rubber and to render plastic said adhesive, whereby a bond is effected between said strip and said wire.

3. An insulated electrical conductor comprising a metallic, central, conducting portion, an outer, generally cylindrical layer of insulation which contains rubber which has been vulcanized after said layer has been placed in position as an element of said conductor, a separator layer between said outer layer and said central conducting portion and comprising regenerated cellulose which, if uncoated, has a tendency to slip along said central, metallic conducting portion, and an adhesive coating on and between said regenerated cellulose layer and said metallic central portion and fixing said regenerated cellulose layer to said metallic central portion, said adhesive being plastic only at temperatures as high and higher than the temperature of vulcanization of rubber, whereby said cellulose layer and said metallic portion are fixed to each other by heat from the vulcanization of said rubber.

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