Oct. 31, 1939. D. R. BROBST 2,178,365

ELECTRIC CONDUCTOR

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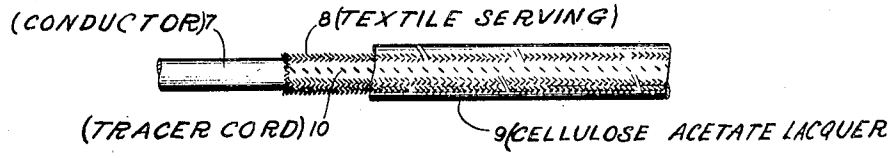
FIG. 1

FIG. 2



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ELECTRIC CONDUCTOR

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4 Claims. (Cl. 174—121)

This invention relates to insulating materials and more particularly to insulating material for insulating electrical conductors.

Heretofore, cellulose acetate has been found to have valuable insulating properties and it is particularly adaptable on account of its electrical and flame-proofing characteristics as insulation for conductors. However, owing to its inherent brittleness and tendency to contract, which stiffens the wire, some difficulty has been experienced in handling the wire during manufacturing and installation operations. Furthermore, the cellulose acetate coating frequently cracks and chips off when the conductor is wound into rolls or bent during installation. It has also been found that under certain conditions a flame resistivity greater than that possessed by cellulose acetate is desirable. It is also desirable in the event that the conductor is covered with a textile serving, having color identifying marks thereon, to coat the conductor with a suitable insulating compound which is transparent so that these identifying marks can be seen.

An object, therefore, of the present invention is an improved flame-proof insulating material having good electrical characteristics with satisfactory flexibility.

Another object of this invention is a textile served conductor with a transparent flexible flame-proof insulating coating thereupon.

In accordance with this invention these and other objects are attained by coating the conductor with a composition comprising one or more cellulose derivatives such as cellulose esters or ethers mixed in solution with high and low boiling solvents and plasticizing agents. It has been found that such a composition has electrical characteristics approaching those of cellulose acetate, and has superior flame-proofing and physical characteristics. Furthermore, this composition, if made under controlled temperature conditions is transparent.

The invention will be more clearly understood from the accompanying detailed description and the drawing in which:

Fig. 1 is a view of a conductor coated with a layer of insulating material embodied in the invention; and

Fig. 2 is a view of a conductor provided with a textile covering having an identifying tracer therein and coated with a transparent coating of insulating material of this invention.

Suitable cellulose ester materials for use in the lacquer are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate. Suitable cellulose ether materials are ethyl cellulose, methyl cellulose and benzyl cellulose. It has been found that of these materials cellulose acetate is in general preferable for use in the lacquer for insulating conductors.

Among the plasticizers suitable for use in this insulating lacquer are phenol phosphates and alkyl phthalates such as triphenyl phosphate, tricresyl phosphate, dimethyl phthalate and diethyl phthalate. It is preferable to use acetone as the low boiling solvent material. The alkyl phthalates in addition to serving as plasticizers also are the preferred high boiling solvents.

The plasticized cellulose insulating lacquer may be made by forming in a low boiling solvent such as acetone a solution containing a cellulose derivative such as cellulose acetate, one or more phenol plasticizers such as triphenyl phosphate and tricresyl phosphate, and a high boiling plasticizer and solvent preferably a dialkyl phthalate such as dimethyl phthalate.

While the amounts of the various ingredients in this lacquer may be varied somewhat, the preferred composition for insulating electrical conductors is the following:

	Parts
Cellulose acetate	100
Triphenyl phosphate	35
Tricresyl phosphate	40
Dimethyl phthalate	40

This preferred lacquer composition is suitable for insulating electrical apparatus and is particularly suited owing to its physical and electrical characteristics for insulating conductors being flexible and flame and moisture resistant. In certain instances a more or less flexible material may be desired in which case the ratio of the total amount of plasticizing agents to the cellulose derivative may be increased or decreased. However, to maintain a good flame resistivity the ratio of the phosphate plasticizers to the cellulose derivative should be maintained within a range of from 60 to 90 parts to 100 parts of cellulose derivative. The flexibility may be modified somewhat by increasing the amount of one of the phosphate plasticizers and decreasing the other phosphate plasticizer without impairing the flame resistivity of the lacquer. In general the minimum amount of either of the phosphate plasticizers should not be less than 30 parts to 100 parts of cellulose derivative. The flexibility of the lacquer may also be varied by increasing or decreasing the amount of ester phthalate plasticizer over a range of from 30 to

45 parts per 100 parts of cellulose derivative and a satisfactory product will result.

If another of the above-mentioned cellulose derivatives is employed instead of cellulose acetate it may be desirable to vary the amounts of the different ingredients from those of the preferred composition, however maintaining the proportions within the above-mentioned limits.

In forming the preferred lacquer, the cellulose acetate is dissolved in approximately 700 parts of acetone and the phenol phosphate plasticizers are added to the solution, followed by the dimethyl phthalate. It is obvious that the amounts of solvent to be used will vary depending upon the working conditions and type of material being coated.

It has been found that the triphenyl and tricresyl phosphates increase the flame resistivity of the lacquer to a considerable extent without serious impairment of the electrical insulating properties. It also appears that the presence of both triphenyl and tricresyl phosphates in the lacquer produces a more flexible composition than does an equivalent amount of either of them alone. The dimethyl phthalate serves to further plasticize the composition and render it sufficiently plastic so as to withstand severe bending. The dimethyl phthalate owing to its high boiling point also serves to retain the cellulose acetate in solution while the composition is being dried, and if the drying is conducted at the proper temperatures, will permit the formation of a transparent composition. By reducing the temperature of the drying and preferably reducing the amount of dimethyl phthalate an opaque coating can be formed due to the precipitation of cellulose acetate from the solution.

To insulate a conductor with this material the lacquer solution is placed in a suitable coating bath which may be at room temperature and the conductor to be coated is drawn therethrough. After leaving the coating bath the thickness of the lacquer coating may be regulated by passing the coated wire through dies or other suitable means. If a transparent coated wire is desired the wire is passed through a baking oven which is preferably maintained at a temperature of approximately 175° F. and the lacquer is thus dried on the conductor. This drying temperature should not be below 120° F. and satisfactory results can be obtained up to 350° F.

As shown in Fig. 1, a metal conductor 5 is coated with a thin lacquer coating 6 of the plasticized cellulose acetate composition; or as shown in Fig. 2 the conductor 7 which is covered with a textile serving 8 is coated with the plasticized cellulose lacquer 9. A particular advantage of using the transparent lacquer is that the textile serving can be viewed therethrough. Hence if the serving is colored or has a tracer such as indicated at 10 it may be easily identified for making connections thereto.

While the plasticized cellulose composition is especially suitable for insulating wire, it may be used to coat other objects or may be formed into flexible filaments, ribbons, sheets or other convenient forms by any suitable methods known in the art.

What is claimed is:

1. An electrical conductor insulated with a covering of fibrous insulating material surrounded by a transparent coating containing approximately 100 parts of cellulose acetate, 35 parts triphenyl phosphate, 40 parts tricresyl phosphate and 40 parts dimethyl phthalate.

2. In an electrical conductor, a conducting core, a textile serving thereon and a coating of insulating material thereover comprising approximately 100 parts of cellulose acetate, 35 parts triphenyl phosphate, 40 parts tricresyl phosphate and 40 parts dimethyl phthalate, said coating being transparent.

3. An electric conductor insulated with a covering of fibrous insulating material surrounded by a transparent coating consisting essentially of approximately 100 parts of cellulose ester of an organic acid, 60 to 90 parts of a mixture of triphenyl phosphate and tricresyl phosphate, the amount of said triphenyl phosphate or tricresyl phosphate being not less than 30 parts, and 30 to 45 parts of dimethyl phthalate.

4. An electric conductor covered with a layer of fibrous insulating material surrounded by a transparent coating consisting essentially of approximately 100 parts of cellulose acetate, 60 to 90 parts of a mixture of triphenyl phosphate and tricresyl phosphate, the amount of said tricresyl phosphate or triphenyl phosphate being not less than 30 parts, and 30 to 45 parts of dimethyl phthalate

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