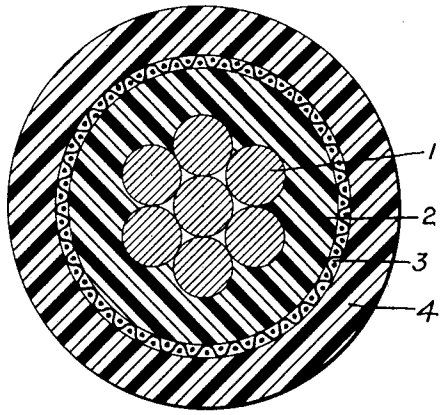
Dec. 15, 1953 A. J. WARNER 2,662,932

SYNTHETIC CABLE JACKETING COMPOSITIONS

Filed Dec. 1, 1951



INVENTOR
ARTHUR J. WARNER
BY Percy P. Lantzy
ATTORNEY

Patented Dec. 15, 1953

2,662,932

UNITED STATES PATENT OFFICE

2,662,932

SYNTHETIC CABLE JACKETING COMPOSITIONS

Arthur J. Warner, Glen Ridge, N. J., assignor to Federal Telecommunication Laboratories, Inc., Nutley, N. J., a corporation of Delaware

Application December 1, 1951, Serial No. 259,343

4 Claims. (Cl. 174—107)

1

This invention relates generally to improvements in electric cables and more specifically to an improvement in synthetic jacketing compositions therefor that will retain their desired physical properties over a wide temperature range, which under conditions of use does not adversely affect the cable dielectric and which can be processed with relative ease.

In the transmission of electrical energy, it has been found that many dielectric materials, satisfactory at low frequencies, are unsuitable for use at higher frequencies with the result that most of the cables intended for such use are now insulated with polymerized alkenes and in particular with polyethylene. The present invention is concerned with a protective jacketing composition intended for use with this type of insulated cable.

The figure of the drawing shows in cross section a typical electric cable comprising a stranded inner conductor 1, a polymerized alkene cable insulation 2 surrounding the inner conductor 1, a braided outer conductor 3, and a protective jacket 4; and the figure is referred to for explanation of the advantages of the present invention over cable jacketing of the prior art.

Polymerized vinyl chloride or copolymers of vinyl chloride and vinyl acetate, when plasticized to insure satisfactory flexibility in the composition while maintaining adequate physical properties at elevated temperatures, have been found useful as protective jacketing materials for electrical apparatus, particularly cables, and especially cables used in the transmission of high frequency energy. However, it has been found that with time, especially at elevated operating temperatures, plasticizing agents commonly used for this purpose tend to migrate from the jacketing composition 4 through the outer braided conductor 3 into the cable insulation 2 with resultant loss of flexibility of the jacket and, because of the polar nature of the plasticizing agent, to cause deterioration of the electrical insulating properties of the cable insulation 2 leading to an increase in the electrical losses thereof.

It is known in the prior art that polyvinyl chloride or copolymers thereof with vinyl acetate may be plasticized by the addition of a polyester of a specific composition and molecular weight, such as for example the sebacic acid ester of propylene glycol of molecular weight approximately 2000, to give compositions which are free from this migration problem. Such compositions are limited in their application to cable structures, however, by virtue of their lack of low temperature flexibility. It is also known that improvement in flexibility of these compositions at low temperatures, without affecting adversely the polyalkene primary dielectric, may be accomplished by the addition of a solid rubbery copolymer of acrylonitrile and butadiene, such as a copolymer of about 26 per cent by weight of acrylonitrile and about 74 per cent by weight of butadiene. It is to be understood that when reference is made herein to a copolymer of acrylonitrile and butadiene, it means a copolymer of these materials which at room temperature is a solid or rubbery mass and furthermore that this copolymer, prior to being incorporated with other components of the invented mixture, is cold milled with a minor proportion, say less than about 5 per cent by weight of the copolymer, of an antioxidant such as phenyl-beta-naphthylamine and/or an alkyl-substituted phenol such as a ditertiarybutyl phenol, for example, 2,6-ditertiarybutyl-p-cresol, sold under the trade name of Deenax. The acrylonitrile-butadiene copolymer is incorporated into the mixture of plasticized vinyl chloride or plasticized copolymer of vinyl chloride and vinyl acetate by milling or equivalent operations conventional in this art to produce a homogeneous mass. Such a prior art jacketing composition will improve the flexibility of the composition at lower temperatures over cables protected with a polymerized vinyl chloride or copolymerized vinyl chloride and vinyl acetate, plasticized solely with a polyester, but the process of manufacture, particularly as regards temperature of mixing, is extremely critical. These limitations make it difficult to meet the desired high temperature performance while consistently maintaining low temperature flexibility of —40° C.

2

It is to be clearly understood that throughout the specification and subjoined claims all temperature and flexibility measurements referred to were made as described in the exceptions to Specification Jan C–17–A dated January 9, 1950, especially paragraph F–6 (cold bending test).

An object of this invention, therefore, is to provide a cable jacketing composition which will retain its flexibility without cracking or shattering at lower temperatures than compositions heretofore available, i. e., to temperatures of the order of —45° C., and which will not adversely affect the electrical properties of the cable insulation during operation at the ordinary or elevated temperatures normally encountered in use and which can be processed without critical limitations as to temperature.

Pursuant to this invention, a jacketing material having the desired properties is produced by

incorporating into the aforesaid prior art composition of polymerized vinyl chloride or copolymers of vinyl chloride with vinyl acetate, containing approximately 5 per cent by weight of the vinyl acetate, plasticized by the addition of a polydicarboxylic acid ester of a glycol, such as the sebacic acid ester of propylene glycol having a molecular weight of approximately 2000, and a copolymer of acrylonitrile and butadiene such as a copolymer of about 26 per cent by weight of acrylonitrile with about 74 per cent by weight of butadiene, a small per cent of low molecular weight polybutene, i. e., polybutene having a molecular weight of 10,000 to 12,000 and dibasic lead phosphite and basic silicate of white lead. The low molecular polybutene may be present in the mixture in a proportion within the range of 2 to 5 per cent by weight based on the total weight, the optimum proportion being about 4 per cent by weight. This amount is highly critical as an excess of low molecular weight polybutene will cause an excess of softening of the jacketing composition at high temperatures. The dibasic lead phosphite may be present in the mixture in a proportion within the range of 2 to 4 per cent by weight based on the total weight, the optimum proportion being about 3 per cent. The basic silicate of white lead may be present in the mixture in a proportion within the range of 2 to 5 per cent by weight based on the total weight, the optimum proportion being about 4 per cent by weight. A typical composition embodying the principles of this invention is a homogeneous mixture of the following materials in substantially the indicated proportions by weight, based on the total weight of the mixture.

	Parts
Copolymer of vinyl chloride and vinyl acetate	33
Copolymer of acrylonitrile and butadiene	33
Polyester of propylene glycol and sebacic acid	23
Basic silicate of white lead	3.7
Dibasic lead phosphite	3.0
Low molecular weight polybutene	4.0
Lubricant (stearic acid)	0.3
Pigment (micronex beads)	0.3
Anti-oxidant (Deenax)	0.3

The composition formulated as above retains its flexibility at temperatures down to —45° C. without shattering or cracking under normal flexure at such temperatures, and, when applied as a jacketing material to polyethylene insulated cable, no detectable migration occurs of components of the jacketing composition into the cable either at ordinary operating temperatures or higher temperatures normally encountered in use.

While the above specifically described composition represents a material having optimum properties, the principles of this invention may be embodied by formulating compositions in which the components are present in any proportion lying within the ranges indicated below:

	Parts
Copolymer of vinyl chloride and vinyl acetate	30–35
Copolymer of acrylonitrile and butadiene	30–35
Polyester of propylene glycol and sebacic acid	20–25
Basic silicate of white lead	2½–5
Dibasic lead phosphite	2–4
Low molecular weight polybutene	2–5

The remaining components of this mixture, i. e., the lubricant, pigment, and anti-oxidant may be present in proportions slightly different from those given in the specific example above or may be entirely eliminated from the mixture as will be understood by those versed in this art.

It is to be understood particularly that the acrylonitrile-butadiene copolymer, the basic silicate of white lead, the dibasic lead phosphite, and the low molecular weight polybutene are present only within the range of proportions indicated in mixtures embodying the principles of this invention. These limitations are critical limitations in the sense that if the amount of these components in the mixture exceed the limits specified above, its resistance to elevated temperatures is deteriorated without any advantage being gained with respect to low temperature flexibility, and the processing becomes more critical.

I claim:

1. An electrical cable for use in the transmission of high frequency electrical energy that includes conductors and a polyalkylene dielectric, characterized in that the cable includes a protective jacketing composition which retains its flexibility at operating temperatures down to —45° C., does not by migratory effects adversely alter the electrical properties of the cable dielectric, and may be processed without critical temperature limitations, said jacketing composition being comprised of a substantially homogeneous mixture of the following materials in approximately the proportions by weight indicated:

	Parts
Copolymer of vinyl chloride and vinyl acetate	30–35
Copolymer of acrylonitrile and butadiene	30–35
Polyester of propylene glycol and sebacic acid	20–25
Basic silicate of white lead	2½–5
Dibasic lead phosphite	2–4
Low molecular weight polybutene	2–5

2. An electrical cable for use in the transmission of high frequency electrical energy that includes conductors and a polyalkylene dielectric, characterized in that the cable includes a protective jacketing composition which retains its flexibility at operating temperatures down to —45° C., does not by migratory effects adversely alter the electrical properties of the cable dielectric, and may be processed without critical temperature limitations, said jacketing composition being comprised of a substantially homogeneous mixture of the following materials in approximately the proportions by weight indicated:

	Parts
Copolymer of vinyl chloride and vinyl acetate	33
Copolymer of acrylonitrile and butadiene	33
Polyester of propylene glycol and sebacic acid	23
Basic silicate of white lead	3.7
Dibasic lead phosphite	3.0
Low molecular weight polybutene	4.0
Lubricant	0.3
Pigment	0.3
Anti-oxidant	0.3

3. A synthetic jacketing composition for cables comprising a homogeneous mixture of the following materials in approximately the proportions by weight indicated:

	Parts
Copolymer of vinyl chloride and vinyl acetate	30 –35

	Parts
Coplymer of acrylonitrile and butadiene	30 –35
Polyester of propylene glycol and sebacic acid	20 –25
Basic silicate of white lead	2½–5
Dibasic lead phosphite	2 –4
Low molecular weight polybutene	2 –5

4. A synthetic jacketing composition for cables comprising a homogeneous mixture of the following materials in approximately the proportions by weight indicated:

	Parts
Copolymer of vinyl chloride and vinyl acetate	33
Copolymer of acrylonitrile and butadiene	33

	Parts
Polyester of propylene glycol and sebacic acid	23
Basic silicate of white lead	3.7
Dibasic lead phosphite	3.0
Low molecular weight polybutene	4.0
Lubricant	0.3
Pigment	0.3
Anti-oxidant	0.3

ARTHUR J. WARNER.

References Cited in the file of this patent

FOREIGN PATENTS

Number	Country	Date
640,558	Great Britain	July 19, 1950