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P. NOWAK ET AL

2,209,928

ELECTRICALLY INSULATING COMPOSITION

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Fig. 1.

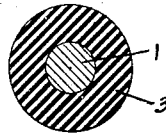


Fig. 2.

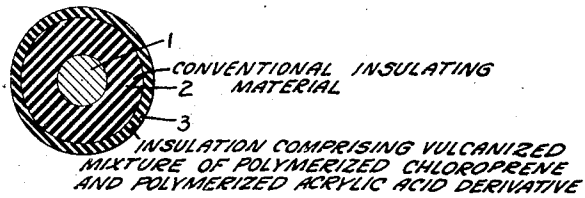
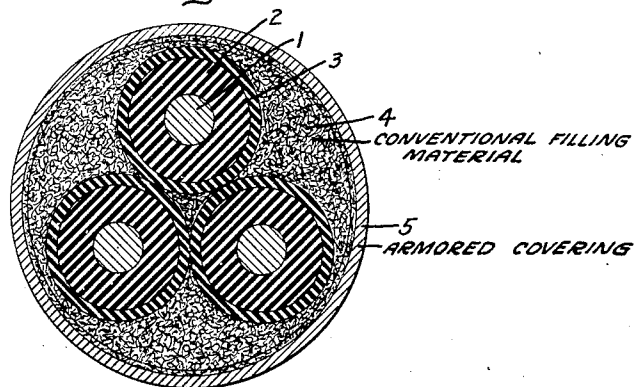


Fig. 3.



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UNITED STATES PATENT OFFICE

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ELECTRICALLY INSULATING COMPOSITION

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In Germany December 10, 1936

5 Claims. (Cl. 260-42)

The present invention relates to electrical cables. It is more particularly concerned with cables comprising a conductor insulated with a composition comprising vulcanized polymerized acrylic acid or its homologues, or vulcanized polymerized derivatives of acrylic acid or homologues thereof. Compositions of this kind are described in the co-pending application of Paul Nowak, Serial No. 749,476, filed October 22, 1934, now Patent No. 2,105,361, and in our co-pending application, Serial No. 33,898, filed July 30, 1935, now Patent No. 2,105,362, both of which patents are assigned to the same assignee as the present invention. In the following description of the invention and in the appended claims, the class of polymers above mentioned is designated, generally, as "polymerized acrylic acid derivative."

In accordance with the present invention compositions comprising vulcanized polymerized acrylic acid derivatives are modified to improve their physical characteristics. More particularly, it may be stated that compositions produced as described in the aforementioned applications are given increased compressive strength both at normal and at elevated temperatures, without sacrificing any of their other desirable characteristics, by incorporating therewith polymerized chloroprene (polymerized chloro-2-butadiene-1,3).

In the accompanying drawing, Figs. 1 and 2 represent cross-sectional views of single-conductor cables enclosed in a sheath of our improved insulating composition; and Fig. 3 shows a similar view of a multi-conductor cable comprising three single-conductor cables insulated as shown in Fig. 2.

The reference numeral 1 designates the metallic conductor; 2, conventional electrically insulating material such, for example, as paper, rubber, asbestos, spun glass, varnished cambric, etc.; 3, the insulating composition of the present invention; 4, conventional filling material, such as jute, asbestos or the like, for bringing a multi-conductor cable to uniform cross-section; and 5, an armored covering. Like numerals designate like parts in all figures.

In Fig. 1 the new insulating material is shown as being superposed directly on a metallic conducting core. In Fig. 2 conventional insulating material is shown as being superposed directly on the conductor and the composition of this invention constitutes the external sheath. Fig. 3 shows three individual conductors insulated as shown in Fig. 2, and the whole surrounded by an armored covering, with filling material in

the intervening space between the individual conductors and the armored covering.

The following specific examples illustrate how the new electrically insulating compositions of this invention may be prepared:

Example 1

	Parts by weight	
Polymerized ethyl ester of acrylic acid	500	
Powdered adsorbent (surface-active) material	200	10
Powdered inert (non-active) inorganic filling material	230	
Sulfur	5	
Polymerized chloroprene	50 to 500	15

Preferably the polymerized ethyl acrylate is plasticized prior to mixing with the other ingredients, for example, by incorporating therewith a suitable amount of dibutyl phthalate. The specified components may be kneaded together at about 80° to 90° C. in a suitable mixing apparatus, for example, a Banbury mixer, followed by working on heated mixing rolls. A small amount, for instance, about 15 parts by weight, of an anti-oxidant such as beta naphthol may be incorporated in the above-described mass during the kneading operation.

If desired, the polyacrylate, adsorbent and filler, with or without the sulfur, may be separately mixed, after which the polymerized chloroprene or the chloroprene and the sulfur (if the sulfur was not previously added) may be incorporated with the said mixed or reacted components. Under certain conditions it may be preferred to mix first the polyacrylate and polymerized chloroprene, and then to incorporate therewith the adsorbent, inert filler and sulfur. Or, the polymerized chloroprene may be mixed first with a part of the total adsorbent and inert filling material employed, and eventually also with plasticizer, anti-oxidant and sulfur, and the resulting mixture then compounded on hot rolls or the like with a separately produced mixture of polyacrylate containing the remaining adsorbent and inert filling material.

In the foregoing formula active magnesium silicate is the preferred adsorbent, although other adsorbents also may be used, for example, active carbon, silica gel, activated alumina, fuller's earth, activated bleaching clay, activated bauxite, and the like. Talcum, French chalk or other powdered filling materials may be used. By selecting polymerized chloroprene of different hardnesses, it is possible to produce compositions

of a harder or softer nature, as desired or as conditions may require.

Example 2

	Parts by weight
Polymerized ethyl ester of acrylic acid	318
Powdered adsorbent (surface-active) material	195
Powdered, inert (non-active) inorganic filling material	467
Sulfur	2
Polymerized chloroprene	32 to 320

The powdered adsorbent in the foregoing formula preferably is active carbon (for example, active gas soot). A small amount, for instance, about 18 parts by weight, of an anti-oxidant such as beth-naphthol may be incorporated with the above-mentioned components. The description given under Example 1 with respect to plasticizing the polyacrylate, to methods and temperatures of combining or mixing the components, and to the adsorbent material, filling material and polymerized chloroprene employed, is also applicable to this example.

Compositions produced in a manner such as described under the foregoing illustrative examples are soft and yielding, and after the mixing operation readily may be extruded upon a metallic conducting core (for example, solid or stranded copper wire) at an elevated temperature, for instance, at about 100° to 120° C. The insulated conductor ordinarily is given a vulcanizing heat treatment in order to effect or to complete vulcanization of the applied insulating composition and particularly vulcanization of the polymerized acrylic acid derivative in the composition. The vulcanized product is an oil-, water- and ozone-resistant composition comprising the reaction product of a mixture containing polymerized chloroprene, polymerized acrylic acid derivative and a vulcanizing agent, the polymerized chloroprene substantially increasing the compressive strength of the composition. More particularly the vulcanized insulating materials of Examples 1 and 2 may be described as compositions containing polymerized chloroprene and polymerized ester of acrylic acid co-reacted with sulfur in the presence of an adsorbent. The advantage of vulcanizing polymerized acrylic acid derivative in the presence of surface-active materials (adsorbents), as is done in making the compositions of this invention, is fully described in the aforementioned Nowak application, Serial No. 749,476, now Patent No. 2,105,361.

The compositions used in making the insulated conductors or cables of the present invention preferably comprise vulcanized polymerized acrylic acid ethyl ester and polymerized chloroprene in an amount by weight corresponding to from about 10 to 100 per cent that of the said ester.

Specific examples of acrylic compounds that may be employed in practicing this invention are, for instance, polymerized acrylic acid, polymerized methyl, ethyl, propyl, butyl and higher alkyl esters of acrylic and methacrylic acids, polymerized acrylonitrile, or mixtures of two or more such substances.

Our improved insulating composition is characterized by its high compressive strength both at normal and elevated temperatures, and by its excellent resistance to oil, water, ozone, aging and inflammability, which characteristics are reflected in the improved electrical cables of this invention.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. An insulating material adapted for insulating an electric cable, said material consisting of an oil-, water- and ozone-resistant composition comprising the reaction product of a mixture containing polymerized chloroprene, polymerized acrylic acid derivative and a vulcanizing agent, said polymerized chloroprene increasing substantially the compressive strength of the said composition.

2. An insulating material adapted for insulating a metallic conductor, said material consisting of an oil-, water- and ozone-resistant composition containing polymerized chloroprene and polymerized ester of acrylic acid co-reacted with sulfur in the presence of an adsorbent, said polymerized chloroprene increasing substantially the compressive strength of the said composition both at normal and at elevated temperatures.

3. An electrically insulating composition comprising polymerized ethyl ester of acrylic acid, polymerized chloroprene in an amount by weight corresponding to from about 10 to 100 per cent that of the said ester, sulfur and an adsorbent, the said polymerized materials being conjointly reacted with the sulfur in the presence of the adsorbent, and the said composition being oil-, water- and ozone-resistant and having a higher compressive strength both at normal and elevated temperatures than a composition containing no polymerized chloroprene but with all other components and proportions thereof substantially the same.

4. An electrically insulating composition comprising a filler and the reaction product of a vulcanizing agent with a mixture containing polymerized chloroprene and polymerized acrylic acid derivative, said polymerized chloroprene increasing substantially the compressive strength of the said composition both at normal and at elevated temperatures.

5. An oil-, water- and ozone-resistant electrically insulating composition comprising the product of vulcanization of a mixture containing approximately

	Parts by weight
Polymerized ethyl ester of acrylic acid	500
Powdered adsorbent material	200
Powdered inert inorganic filling material	280
Sulfur	5
Polymerized chloroprene	50 to 500

said composition having a higher compressive strength both at normal and at elevated temperatures than a composition containing no polymerized chloroprene but with all other components and proportions thereof substantially the same.

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