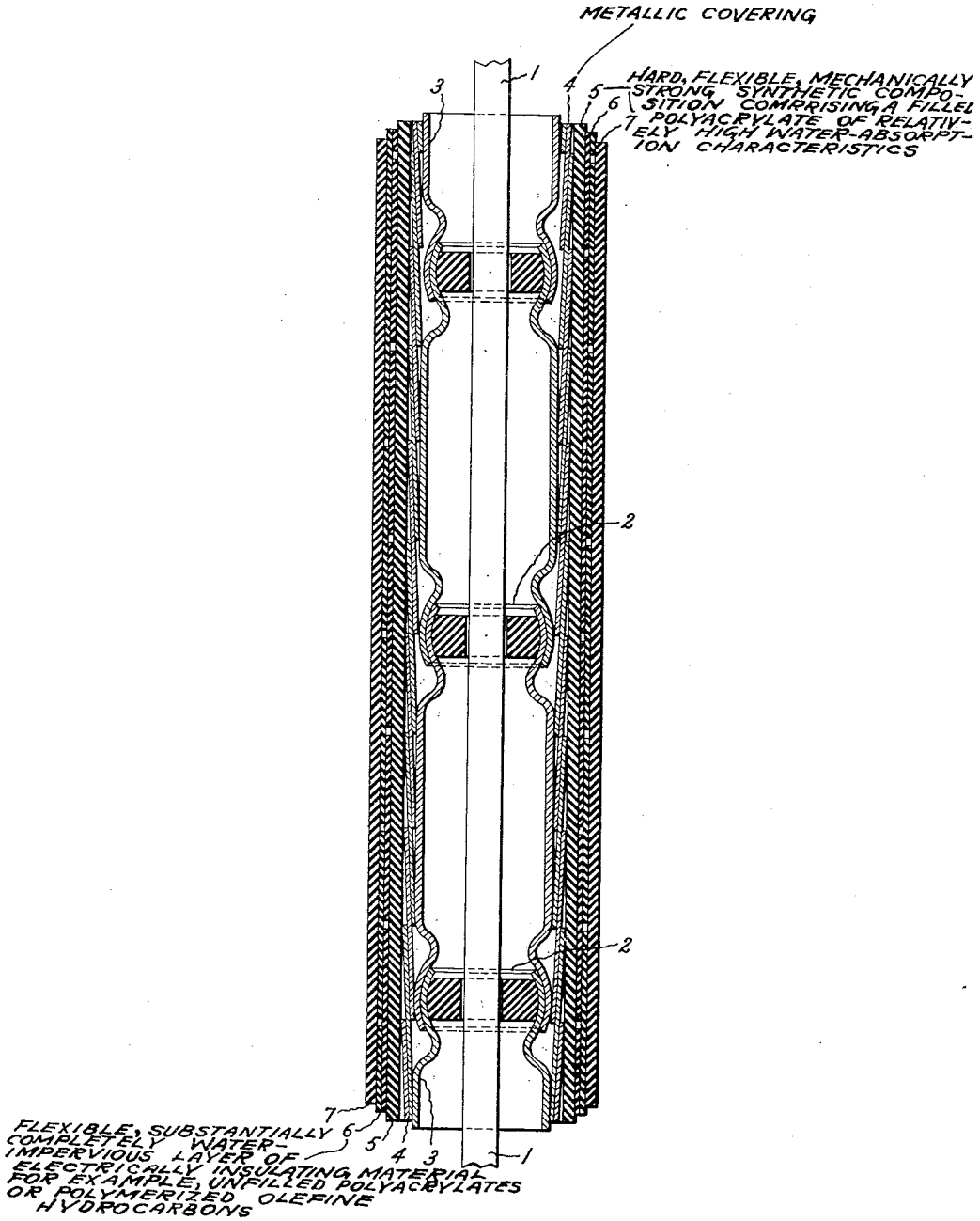
Aug. 8, 1939. G. MEYBAUER 2,169,108

ELECTRIC CABLE

Filed Oct. 5, 1937



Inventor:
Gustav Meybauer,
by Harry E. Dunham
His Attorney.

Patented Aug. 8, 1939

2,169,108

UNITED STATES PATENT OFFICE

2,169,108

ELECTRIC CABLE

Gustav Meybauer, Berlin-Friedrichshagen, Germany, assignor to General Electric Company, a corporation of New York

Application October 5, 1937, Serial No. 167,454
In Germany October 24, 1936

5 Claims. (Cl. 174—123)

The present invention relates to electric cables and more particularly is concerned with a new and improved sheath for such cables.

Various synthetic compositions heretofore have been suggested for use in place of lead as sheaths for electric cables. One such composition is described, for example, in copending application Serial No. 44,251, Nowak and Hofmeier, filed October 9, 1935, now Patent No. 2,105,363, dated January 11, 1938, and assigned to the same assignee as the present invention. In accordance with the invention therein disclosed and claimed a composition for sheathing cables is composed of plasticized, filled and vulcanized acetone-insoluble polymerized acrylic acid ethyl ester. Practical tests have shown that sheathing formed of synthetic compositions of the polyacrylate type or kind, however, are not adapted ideally for all service applications of cables. For example under conditions where the cable is, or may be immersed in water, such sheathing for the cable is not sufficiently protective.

It is an object of the present invention to provide an electric cable having a sheath which is flexible, comparatively light in weight, highly impervious to water, and of good electrically insulating properties both before and after immersion in water.

The stated object is attained by forming the sheath of several superposed layers comprising filled, preferably filled and vulcanized, polyacrylate in combination with a substantially completely water-impervious layer such, for example, as unfilled polyacrylate or unfilled polymerized olefine hydrocarbons.

The novel features which are characteristic of my invention are set forth in the appended claims. The invention itself, however, will best be understood by reference to the following specifications when considered in connection with the accompanying drawing in which the single figure is a longitudinal sectional view of a cable embodying this invention and illustrative thereof.

With further reference to the drawing: On a conductor 1, the spacing elements 2 are arranged. Around these spacing elements is placed the ball and socket bushing 3. The space between conductor 1 and bushing 3 may be filled with conventional electrically insulating material. Bushing 3 is surrounded by a relatively thin metallic covering 4. This metallic covering serves to prevent any damage to the insulating layers which otherwise might occur by reason of the abrading action at the joints of the bushing 3. Superposed on the metallic covering 4 is an insulating sheath formed of a particular combination of synthetic insulating materials. Preferably this sheath consists of an inner layer 5, an intermediate layer 6 and an outer layer 7.

The inner and outer layers 5 and 7 are composed of synthetic compositions which are hard, flexible and mechanically strong, but which may be relatively high in water-absorption characteristics. Examples of such compositions are filled polyacrylates such, for instance, as polymerized acrylic acid, polymerized methyl and ethyl esters of acrylic acid, alone or mixed one with another; or mixtures of one or another, or two or more such compounds with other acrylic compounds, for example, polymerized propyl or butyl esters of acrylic acid, polymerized acrylonitrile or polymerized methyl ester of methacrylic acid (methyl methacrylate); or mixtures of such polyacrylates (within which term is included polymerized acrylic acid), as above mentioned, with other polymerized compounds, such for instance, as polyvinyl acetate, polystyrol, etc. Preferably the inner and outer layers 5 and 7 are formed of a composition comprising a filled polymerized ethyl ester of acrylic acid. These layers may be formed, if desired, of compositions comprising filled, plasticized and vulcanized acetone-insoluble polymerized ethyl acrylate such as disclosed and claimed in the aforesaid Nowak and Hofmeier Patent No. 2,105,363.

The intermediate layer 6 is formed of a flexible synthetic composition which is substantially completely impervious to water. This layer consists, for example, of unfilled polyacrylates, alone or mixed with each other, or with other unfilled water-impervious synthetic compositions, more specific examples of which substances were given above with reference to the filled materials forming the layers 5 and 7. If desired, instead of unfilled polyacrylates, the layer 6 may be formed of other water-impervious materials such as polymerized synthetic hydrocarbons obtained, for instance, by the polymerization of olefine hydrocarbons. Polymerized isobutylene and polymerized butadiene are examples of such polymerized olefine hydrocarbons.

If the layer 6 is applied in the form of a band or tape, preferably it is placed upon the layer 5 either in one layer with 50% overlap, or in two layers so applied that each turn of the tape that forms the second layer lies over the joints of the tape forming the first layer. The tape for both wrappings may be coated with a water-resisting adhesive thereby to obtain a closer bond between

the individual wrappings, and between the layer 6 and those layers (viz., 5 and 7) with which it is in contact.

When the layer 6 is formed of unfilled polyacrylate applied as a tape, an adhesive thereon is not necessary if the cable is placed under pressure and heat as by being drawn through a heated die whereby the individual tapes melt or fuse together at their joints. In this manner a layer having the surface characteristics of a seamless tube is formed. The layer 6 also may be made by spraying on the layer 5 a solution of the composition of which the layer 6 is to be formed, and thereafter heating the structure to evaporate the solvent before applying the layer 7. This method also provides a surface without seams. The layer 7 protects the water-impervious layer 6 from mechanical damage. The layer 5 cushions the layer 6, and protects it from any abrading action of the metallic covering 4. The layer 6, in turn, prevents the infiltration of water into the layer 5.

A cable sheath made as above-described is, when the mechanical properties are the same, not substantially thicker than the usual single sheath of filled synthetic composition which now finds use as a substitute for lead sheathing. This is because the individual layers can be made comparatively thin. It has the advantage over synthetic sheathing materials heretofore used in place of lead in that water is prevented from entering the inner portions of the cable structure.

The following test results show the improvement that is obtained by the present invention:

A cable shell with sheath made of synthetic material, without the aforedescribed water-tight layer 6, was placed in water with 5 meters of the sheath immersed. A direct voltage of 180 volts was applied. The insulation resistance was found to drop from 0.7 megohm on the first day to 0.08 megohm on the twenty-fifth day. Using the same test arrangement, a cable sheathed in accordance with the present invention showed an insulation resistance of 700 megohms on the first day and up to the sixty-ninth day did not go below 400 megohms. The temperature of the water in which both cables were immersed ranged from 20° to 25° C.

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

1. In an electric cable, a sheath formed of layers of hard, flexible, mechanically strong synthetic composition comprising a filled polyacrylate possessing relatively high water-absorption characteristics, said layers having interposed therebetween and in contact therewith a flexible, substantially completely water-impervious layer of electrically insulating material.

2. In an electric cable, a sheath comprising layers of hard, flexible, mechanically strong synthetic composition possessing relatively high water-absorption characteristics, said composition comprising filled, polymerized acrylic acid ester, and said layers having interposed therebetween and in contact therewith a flexible layer of substantially completely water-impervious composition comprising unfilled, polymerized acrylic acid ester.

3. A sheath for electric cables adapted for service use in contact with water, said sheath consisting of inner and outer layers of a hard, flexible, mechanically strong composition comprising a filled polymerized ethyl acrylate possessing relatively high water-absorption characteristics and, in contact with said layers, an intervening substantially completely water-impervious, flexible layer of polymerized olefine hydrocarbon.

4. An electric cable comprising a conducting core, a ball and socket bushing surrounding said core, spacing elements separating said core from said bushing, a relatively thin metallic covering over said bushing, and an external sheath over said covering, said sheath being formed of inner and outer layers of hard, flexible, mechanically strong synthetic composition comprising a filled polyacrylate possessing relatively high water-absorption characteristics, and said layers having interposed therebetween and in contact therewith a flexible layer of electrical insulation which is substantially completely impervious to water.

5. A sheath for electric cables adapted for service use in contact with water, said sheath consisting of inner and outer layers of a hard, flexible, mechanically strong synthetic composition comprising a filled polymerized ethyl acrylate characterized by its relatively high water-absorption properties, and an intermediate, flexible, substantially completely water-impervious layer of a synthetic composition comprising unfilled polymerized ethyl acrylate, said inner layer acting as a cushion and said outer layer protecting the said intermediate water-impervious layer from mechanical damage.

GUSTAV MEYBAUER.