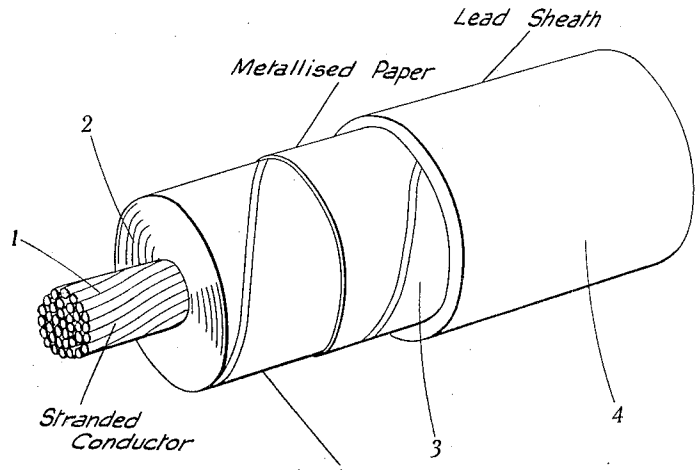
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MANUFACTURE OF ELECTRIC CABLES

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Laminated dielectric comprising paper dried under vacuum and in the presence of rosin and subsequently impregnated with a cable impregnating compound containing rosin.

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MANUFACTURE OF ELECTRIC CABLES

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This invention is concerned with the manufacture of electric cables insulated with impregnated paper and it is based on the discovery that when paper is subjected to a vacuum and heat in the presence of rosin it undergoes a chemical change on the surface which appears to be an esterification, cellulose-rosinate being produced. This reaction, which is accompanied by the production of water, may be employed, as described and claimed in the specification of United States Patent No. 2,203,231, issued on a co-pending United States application Serial No. 207,299 of Thomas L. Osborne, filed on the same date as the present application, for the purpose of making the paper resistant to water. In the specification of our copending application No. 207,301 (Patent No. 2,203,232) there is described and claimed a corrosion resistant protective covering for electric cable sheaths, pipes, rods and like articles, comprising one or more wrappings of paper made resistant to water by subjecting it to the treatment described in Patent No. 2,203,231 and sealing the passages between the cellulose rosinate coated fibres by a water-excluding compound such as pitch, tar, bitumen, and oil compounds. The present invention is not primarily concerned with making the paper constituting the solid part of the cable dielectric resistant to water but its object is to modify the process of treating the paper insulation with a cable impregnating compound which contains rosin in such a way as to avoid the production of water in the insulation of the cable by the reaction referred to. By the term cable impregnating compound is meant a liquid or readily liquefiable insulating medium employed to fill the fibrous structure of the solid part of the dielectric of an impregnated paper insulated cable.

In our improved method of manufacturing an impregnated paper insulated cable, the paper is dried by subjecting it to heat and a vacuum in the presence of rosin prior to the impregnating process and the vacuum dried paper is subsequently impregnated with a cable impregnating compound containing rosin. During this drying process the surfaces of the fibres of the paper are subjected to the reaction with rosin and any resulting water is removed. The drying process is preferably continued until the absolute pressure has fallen to about 1 mm. of mercury and is carried out at a temperature above normal atmospheric temperatures. Conveniently a temperature of about 120° C. is employed. The resulting coating on the fibres prevents the reaction from taking place or at least very considerably minimises the extent to which it can occur, during the impregnating treatment.

The accompanying drawing shows in perspective an example of a cable manufactured in accordance with the invention. The cable comprises a stranded conductor 1 surrounded by a dielectric 2 consisting of a laminated body of paper which has been dried by subjecting it to heat and a vacuum in the presence of rosin and subsequently impregnated with a cable impregnating compound containing rosin. This dielectric 2 is surrounded by a covering 3 of metallised paper and the whole is enclosed within a lead sheath 4.

The rosin should be introduced into the paper in such a way that it is in intimate contact with the fibres thereof. To this end it may be added during the process of manufacture of the paper or at some later stage in the form of a solution of rosin in trichlorethylene, alcohol or other organic solvent for rosin, which can be removed by evaporation at temperatures that do not impair the electrical properties of the paper. The use of a solution of rosin permits of the rosin being introduced while the paper is in reels or even after it has been lapped on the conductor. It is preferable however to apply the rosin to the paper before it is lapped on the conductor and to treat it with vacuum and heat at that stage also. One advantage of this is that generally the removal of the solvent and of the water of reaction is more readily effected and a second advantage is that the vacuum treated paper is left in a very dry and less hygroscopic state and will take up much less moisture from the atmosphere than ordinary insulating paper in the subsequent stages of manufacture of the cable prior to the impregnation process, which may proceed in the usual manner; hence the amount of moisture to be removed in the drying process which immediately precedes evacuation will be less than in present practice and the well known trouble of shrinkage of the paper during drying will be almost eliminated.

With regard to the quantity of rosin to be introduced into the paper, it is considered that the subsequent production of moisture by reaction between the rosin in the cable impregnating compound and the paper is practically inhibited if the amount of rosin introduced prior to the vacuum treatment is such that each 100 parts by weight of paper contain about 5 parts by weight of rosin. When the rosin is incorporated in the paper subsequent to its manufacture, solutions of rosin containing from 2 to 20

parts by weight of rosin in 100 parts by weight of solvent may be used. The actual strength of solution used will depend upon the type of paper, the time of immersion of the paper and the conditions under which the solvent is removed. It is here explained that the process by which the paper takes rosin from the solution appears to be one of adsorption. For this reason the amount adsorbed by the paper depends not only on the concentration of the rosin solution but also on the time of soaking. Thus the requisite amount of rosin can be got into the paper or fabric by soaking in a weak solution for a long time or by soaking it in a stronger solution for a shorter time. Preferably, the strength of the solution used will be such that after treatment with the solution for a convenient period of time the paper will contain about 5% of rosin.

A satisfactory pre-esterification of the paper sufficient to avoid any appreciable esterification during or after the process of impregnating it with cable compound containing rosin, can be obtained by drying the paper containing rosin in the above described proportions for a period of about 50 hours at a temperature of about 120° C. under vacuum, the absolute pressure being not greater than 1 mm. of mercury at the end of the drying period.

What we claim as our invention is:

1. In a method of manufacturing an insulated cable having a dielectric comprising paper impregnated with a compound containing rosin, the successive steps of forming a film of cellulose rosinate on the fibres of a paper initially containing in each 100 parts by weight of paper about five parts of rosin by subjecting the paper to a prolonged heat treatment under vacuum, of applying the heat treated paper to the cable conductor, and of impregnating said paper on the conductor with said impregnating compound, whereby to preclude a chemical reaction between the paper and the rosin in said compound and the liberation of water thereby within the impregnated cable.

2. In a method of manufacturing an insulated electric cable having a dielectric comprising paper impregnated with a compound containing rosin, the step of heating the paper under vacuum and in the presence of rosin superficially to convert the cellulose fibres of the paper into cellulose rosinate and the subsequent step of impregnating the superficially esterified paper with said compound, whereby to preclude a chemical reaction between the paper and the rosin in said compound and the liberation of water thereby within the impregnated cable.

3. In a method of manufacturing an insulated electric cable having an impregnated paper dielectric, the step of forming a film of cellulose rosinate on the fibres of the paper by subjecting them to prolonged heat under vacuum while they are in intimate contact with rosin and the subsequent step of impregnating the paper insulated conductor with impregnating compound containing rosin, whereby to preclude a chemical reaction between the paper and the rosin in said compound and the liberation of water thereby within the impregnated cable.

4. In a method of manufacturing an insulated electric cable having an impregnated paper dielectric, the successive steps of forming a film of cellulose rosinate on the surfaces of the fibres of the paper by subjecting it to prolonged heat under vacuum and in the presence of rosin, of applying the heat-treated paper to the cable conductor, and of impregnating said paper on the conductor with impregnating compound containing rosin, whereby to preclude a chemical reaction between the paper and the rosin in said compound and the liberation of water thereby within the impregnated cable.

5. In a method of manufacturing an insulated cable having a conductor with a dielectric comprising paper impregnated with a compound containing rosin, the successive steps of superficially rosin-esterifying the fibres of a paper by subjecting the paper to a prolonged heat treatment under vacuum and of impregnating the superficially rosin-esterified paper on the conductor with said impregnating compound, whereby to preclude a chemical reaction between the paper and the rosin in said compound and the liberation of water within the impregnated cable.

6. In a method of manufacturing an insulated electric cable having a dielectric comprising paper impregnated with a compound containing rosin, the successive steps of applying the paper to the cable conductor, of saturating the paper insulated conductor with a solution of rosin in an organic solvent, of subjecting the paper insulated conductor to a prolonged heat treatment under vacuum to remove the solvent and form a film of cellulose rosinate on the fibres of the paper, and of impregnating the heat treated paper with impregnating compound containing rosin, whereby to preclude a chemical reaction between the paper and the rosin in said compound and the liberation of water thereby within the impregnated cable.

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