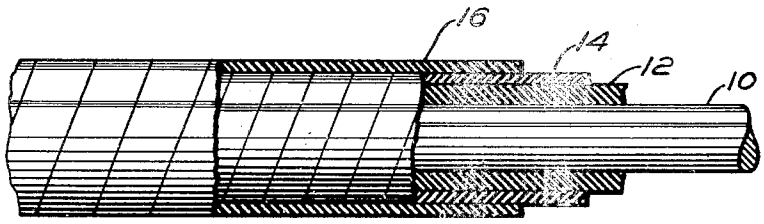
Dec. 28, 1937. J. F. CALVERT 2,103,841

METHOD OF INSULATING CONDUCTORS

Filed Jan. 30, 1937



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Patented Dec. 28, 1937

2,103,841

UNITED STATES PATENT OFFICE

2,103,841

METHOD OF INSULATING CONDUCTORS

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Application January 30, 1937, Serial No. 123,243

8 Claims. (Cl. 173—264)

This invention relates generally to insulated electrical conductors and particularly to a method of insulating electrical conductors.

Where self-polymerizing materials have been employed in impregnating taped electrical conductors to insulate them, it has been found quite difficult to effect a uniform insulation of the conductor. This is because in heating the impregnated taped electrical conductors to polymerize the insulating material, a part of the bonding material is lost in the form of a vapor before the material is sufficiently polymerized to the non-volatile state. The escaping vapor tends to leave voids in the insulation. Such non-uniformly insulated conductors are dangerous.

An object of this invention is to provide a method of insulating electric conductors whereby the conductors will have a uniform insulating coating.

A further object of this invention is to provide a method for preventing loss of insulating material by vaporization while insulating an electrical conductor.

Other objects of this invention will become apparent from the following description when taken in conjunction with the accompanying drawing, in which the single figure, partly in section and partly in side elevation, illustrates a conductor which is insulated in accordance with the teachings of this invention.

According to this invention, tape coverings or wrappings for electrical conductors are impregnated with self-polymerizing material and the covered conductors are subjected to a treatment for polymerizing the material in the tape whereby a uniform insulating coating is provided for the conductor.

In order to secure a satisfactory impregnation of the tape usually employed in the insulating conductors, it has been found to be desirable to thoroughly cleanse the tape of resin and deleterious material before the self-polymerizing material is applied. In practice, tape comprising paper, mica flakes and asphaltic "sticking" varnish may be cleansed by treating the tape with benzol to extract the asphaltic varnish. Since benzol is quite volatile, it is easily removed by drying the tape.

The cleansed mica tape is impregnated with an insulating medium of the self-polymerizing tape which may be satisfactorily hardened. Self-polymerizing materials which may be satisfactorily employed as the insulating medium comprise styrol, such as monostyrene or a low viscosity or fluid product of styrol such as a mixture of polymerized products of styrene in liquid styrene. Other self-polymerizing materials which may also be employed are derivatives of acrylic acid or alpha methyl acrylic acid or derivatives of acrylic acid or alpha methyl acrylic acid which are only slightly polymerized and fluid or have a low viscosity.

In preparing the conductor to be insulated, the tape is impregnated in any suitable manner such as dipping or brushing with one of the self-polymerizing materials hereinbefore mentioned. In order to stabilize the impregnant and to prevent the polymerization of the material until desired, an inhibitor such as hydroquinone is mixed in the self-polymerizing material. As illustrated in the drawing, tape impregnated with the self-polymerizing material containing the inhibitor is wrapped around the conductor **10** constituting an inner layer or covering **12**, the reason of which will be explained more fully hereinafter.

Since the impregnant is volatile and it is desired to prevent loss of the insulating material by vaporization, additional tape is impregnated with the self-polymerizing material to form an outer layer or covering **14** when wrapped on the conductor **10**, as illustrated in the drawing. In order to accelerate the polymerization of the insulating material in the outer layer **14** to obtain the polymerization thereof without excessive losses by volatilization of the material, a catalyst such as benzoyl peroxide is added to the self-polymerizing material before the tape is impregnated.

In order to harden the outer layer **14**, to prevent losses of the impregnant of the layer **12** when heat treated, as described hereinafter, the tape wrapped conductor is heated to a sufficient temperature to cause the polymerization of the impregnant containing the catalyst in the outer layer **14**. Through experience, it is found that where the tape wrapped conductor is exposed to room temperature for a period of time of a few hours, the self-polymerizing material in the outer layer **14** becomes hardened. The polymerization of the insulating material in the outer layer **14** may be further accelerated by heating briefly at slightly higher temperatures than room temperature.

In order to protect the wrappings of tape around the conductor **10** when subjected to heat and pressure to cause the polymerization of the insulating material of the inner layer of tape, a protective covering **16** of some suitable material such as cotton tape or cotton tape with a clay or powder on the surface adjacent the outer layer **14** of tape is wrapped around the exposed surface

of the hardened outer layer 14. Other soft and pliable sheet material which may be easily wrapped around the conductor or applied to the conductor surface and held in place may be employed as the protective covering.

In order to polymerize and harden the insulating material containing the inhibitor in the inner layer of tape, the wrapped conductor in its protective covering is immersed in hot asphalt or other hot fluid in an autoclave and then subjected to heat and pressure for a predetermined period of time sufficient to polymerize the impregnant. As a result of hardening the outer layer of the tape around the conductor before immersing the conductor in the hot asphalt and subjecting it to heat and pressure, the full hydrostatic pressure developed in the autoclave is exerted with equal force throughout the entire outer surface of the windings of the conductor, producing a dense and uniform insulating structure around the conductor. When removed from the autoclave, the protective covering may be removed from the insulated conductor where desired.

In practicing this invention, the tape comprising the different layers around the conductor may be thoroughly impregnated with the self-polymerizing materials containing the inhibitor or catalyst as hereinbefore described and then wound around the conductor. Instead of impregnating the tape prior to winding the conductor, the conductor may be wound with an unimpregnated layer of tape and then the taped conductor may be brushed with or dipped into the self-polymerizing material containing the inhibitor to thoroughly impregnate it. An outer layer of unimpregnated tape may then be wrapped around the impregnated layer, after which the wrapped conductor may be brushed with or dipped into the self-polymerizing material containing the catalyst to impregnate the outer layer of tape.

In practicing this method, it is found that there is very little loss of the volatile self-polymerizing material by vaporization during the polymerization process. This is because the hardened outer layer of the tape prevents the escape of the impregnating material in the inner layer of the tape when heat and pressure are applied thereto. Conductors which have been wrapped with tape impregnated with self-polymerizing materials containing inhibitors and catalysts and polymerized, as hereinbefore described, have been found to be uniformly insulated. Further, this type of insulation has been found to have a very low power factor and to be quite hard at temperatures ranging between 90° C. and 120° C.

While a specific method has been described embodying this invention, it is to be understood that this invention is not to be limited thereto except as is necessitated by the prior art and the scope of the appended claims.

I claim as my invention:

1. In the method of insulating conductors, in combination, covering the conductor with a layer of self-polymerizing material containing an inhibitor, covering the layer of self-polymerizing material containing the inhibitor with a layer of self-polymerizing material containing a catalyst, exposing the covered conductor to sufficient heat to cause the layer of material containing the catalyst to harden without causing polymerization of the material containing the inhibitor, and subjecting the covered conductor to heat and pressure to cause the material containing the inhibitor to harden, the layer of material hardened before the polymerization of the material containing the inhibitor preventing vaporization of the materal polymerized under the heat and pressure.

2. In the method of insulating conductors, in combination, covering the conductor with a plurality of layers of self-polymerizing material, the inner layer of the self-polymerizing material containing an inhibitor and the outer layer containing a catalyst, exposing the covered conductor to sufficient heat to harden the outer layer of material without causing polymerization of the inner layer of material, and subjecting the conductor in the hardened outer layer of material to heat and pressure to cause the polymerization of the inner layer of material, the outer layer of hardened material preventing losses of the material of the inner layer by vaporization during the polymerization of the inner layer.

3. In the method of insulating conductors, in combination, wrapping the conductor with a plurality of layers of tape, the inner layer of the tape having a self-polymerizing material containing an inhibitor associated therewith and the outer layer of the tape having a self-polymerizing material containing a catalyst associated therewith, subjecting the wrapped conductor to a temperature of at least room temperature to harden the material containing the catalyst in the outer layer of tape without causing polymerization of the material containing the inhibitor in the inner layer of the tape, and subjecting the conductor in the hardened outer layer of tape to heat and pressure to cause the polymerization of the material containing the inhibitor, the outer layer of tape and its associated hardened material preventing loss of the material containing the inhibitor by vaporization during its polymerization.

4. In the method of insulating conductors, in combination, wrapping a layer of tape on the conductor, impregnating the tape with a self-polymerizing material containing an inhibitor, wrapping an outer layer of tape on the tape impregnated with the self-polymerizing material containing the inhibitor, impregnating the outer layer of tape with a self-polymerizing material containing a catalyst, subjecting the wrapped conductor to a temperature of at least room temperature to harden the material containing the catalyst in the outer layer of tape without causing polymerization of the material containing the inhibitor in the inner layer of the tape, and subjecting the conductor wrapped in the hardened outer layer of tape to heat and pressure to cause the polymerization of the material containing the inhibitor, the hardened outer layer of tape preventing loss of the material containing the inhibitor by vaporization during its polymerization.

5. In the method of insulating conductors, in combination, wrapping the conductor with a plurality of layers of tape, the inner layer of the tape having a self-polymerizing material containing an inhibitor associated therewith and the outer layer of the tape having a self-polymerizing material containing a catalyst associated therewith, subjecting the wrapped conductor to a temperature of at least room temperature to harden the material containing the catalyst in the outer layer of tape without causing polymerization of the material containing the inhibitor in the inner layer of the tape,

wrapping a protective covering over the hardened outer layer of tape, immersing the conductor in the protective wrapping in a hot resin and applying pressure thereto to cause the polymerization of the material containing the inhibitor, the hardened outer layer of tape preventing loss of the material containing the inhibitor by vaporization during its polymerization, removing the conductor from the hot resin when the material containing the inhibitor is polymerized, and removing the protective covering from the insulated conductor.

6. In the method of insulating conductors, in combination, wrapping a layer of tape on the conductor, impregnating the tape with a self-polymerizing material containing an inhibitor, wrapping an outer layer of tape on the tape impregnated with the self-polymerizing material containing the inhibitor, impregnating the outer layer of tape with a self-polymerizing material containing a catalyst, subjecting the wrapped conductor to a temperature of at least room temperature to harden the material containing the catalyst in the outer layer of tape without causing polymerization of the material containing the inhibitor in the inner layer of the tape, wrapping a protective covering over the hardened outer layer of tape, immersing the conductor in the protective wrapping in a hot resin and applying pressure thereto to cause the polymerization of the material containing the inhibitor, the hardened outer layer of tape preventing loss of the material containing the inhibitor by vaporization during its polymerization, removing the conductor from the hot resin when the material containing the inhibitor is polymerized, and removing the protective covering from the insulated conductor.

7. In the method of insulating conductors, in combination, impregnating tape with a self-polymerizing material containing an inhibitor, wrapping the impregnated tape on the conductor, covering the wrapped conductor with an outer layer of self-polymerizing material containing a catalyst, subjecting the covered conductor to a temperature of at least room temperature for a period of time sufficient to harden the outer layer of self-polymerizing material without causing polymerization of the self-polymerizing material in the tape wrapping, and subjecting the conductor in the hardened cover to heat and pressure to cause the polymerization of the material containing the inhibitor in the tape, the hardened outer covering on the conductor preventing loss of the impregnating material of the tape by vaporization during its polymerization.

8. In the method of insulating conductors, in combination, impregnating tape with a self-polymerizing material containing an inhibitor, wrapping the impregnated tape on the conductor, covering the wrapped conductor with an outer layer of self-polymerizing material containing a catalyst, subjecting the covered conductor to a temperature of at least room temperature for a period of time sufficient to harden the outer layer of self-polymerizing material without causing polymerization of the self-polymerizing material in the tape wrapping, wrapping a protective covering over the hardened outer layer to protect it, immersing the conductor wrapped in the protective covering in a hot resin and applying pressure thereto to cause the polymerization of the material containing the inhibitor in the tape, the hardened outer layer of material preventing loss of the impregnating material of the tape by vaporization during its polymerization, removing the conductor from the hot resin when the impregnant of the tape is polymerized, and removing the protective covering from the insulated conductor.

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