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PROTECTIVE COATING MATERIAL

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4 Claims. (Cl. 260—23)

This is a continuation-in-part of application Serial No. 140,794, entitled Carbon Film Resistor, and filed January 27, 1950.

This invention relates to protective coating materials and, more particularly, to an air-impervious protective coating material and to its method of manufacture.

Electrical components such as capacitors, transformers, coils, insulators, resistors, and others, are frequently subjected, in operational use, to the effects of injurious atmospheres, or other injurious external conditions. It has been proposed to protect such electrical elements by coating such elements with a protective coating material. The protective coating material constituting a part of the subject matter of this invention is ideally suited for such use, offering protection to such electrical components of a degree never enjoyed before.

Furthermore, this protective coating material is particularly adapted for use in the protection of film type resistors having resistive material which is subject to oxidation, such as carbon-film resistors. Such carbon-film resistors previously had been inoperable at high temperatures, such as those in the vicinity of 200° C. Carbon-film resistors which were exposed to such temperatures in an oxidizing or other injurious atmosphere very rapidly deteriorated, usually due to oxidation, and failed to serve their useful purpose. Obviously, a protective coating material applied to such a resistor, and which would be air-impervious at such high temperatures, might serve to prevent such breakdown of the carbon film. However, protective coatings of the prior art are unsatisfactory for such purposes because they either fail to protect the carbon film at such an operating temperature, or even if they initially offer some protection to the carbon film, after a short period of operational time, they break down, thereby exposing the carbon film to high temperature and injurious atmospheres which cause the carbon film to oxidize or otherwise deteriorate. Where it is desired to use a carbon-film resistor at a temperature of at least 200° C., for a period of time as long as 400 hrs., with a percent variation in resistance of the resistor of 10% or less, protective coating materials of the prior art have proven unsatisfactory.

It is, therefore, one object of this invention to provide an improved protective coating for a film type resistor.

It is another object of this invention to provide a protective coating material for a carbon-film resistor which will enable such a resistor to be

operated at a temperature of 200° C. for a period of 400 hrs., without having the resistance of such a resistor vary more than 10% in value.

It is still another object of this invention to provide a protective coating material which may be used to protect any electrical component from injurious, external action.

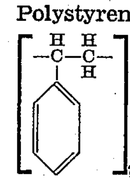
It is a further object of this invention to provide an improved method of making such a protective coating material.

Various additional objects and advantages of this invention will become apparent from the following description.

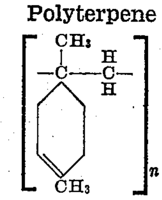
There has been discovered that a protective coating material prepared from a cyclic, hydrocarbon resin is extremely satisfactory for coating carbon-film resistors, or other readily oxidizable film resistors, where such resistors are to be used in injurious or oxidizing atmospheres and at high temperatures.

By cyclic, hydrocarbon resins is meant the following representative compounds:

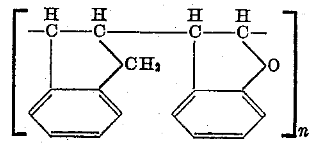
Polystyrene



Polyterpene



Coumarone indene



Such cyclic, hydrocarbon resins may be used in conjunction with a drying oil to provide a varnish which is useful as a protective coating material, or which after admixture with certain ingredients may be made into a protective coating material which can be used to coat an oxidizable film resistor.

The degree of polymerization of the various cyclic, hydrocarbon resins constitutes a limit on the scope of this invention only when the resins are not soluble in a drying oil. Moreover, all known grades of the above-mentioned resins, that are soluble in a drying oil, may be used. Furthermore, any quantity of resin may be combined with any quantity of drying oil to provide a varnish, as long as all of the resin can be dissolved in the drying oil. However, because of the difficulty encountered in forming a varnish when extremes of the two ingredients are used, it is preferred to use from 35% to 60% of the resin on a weight basis, and the balance drying oil, in the preparation of the varnish. While these percentages of resin will produce a superior varnish, the ideal quantity is approximately 51% resin, by weight, the balance a drying oil.

The varnish is formed by heating the drying oil and the resin at a temperature between approximately 225° C. and 250° C. until a varnish is obtained. The standard pill test is used to determine when the varnish has been obtained. This test is performed by placing a drop of the varnish on a sheet of clean cold glass to form a pill and then forming a string from that pill. When a three-foot string can be formed, the varnish is considered completed.

The varnish thus formed then has added thereto a quantity of thinner sufficient to make the varnish workable. The quantity added will depend upon the particular varnish. It is preferred to combine approximately equal weights of thinner and varnish non-volatile. The thinner should be volatile and its primary function is well known in the art, namely, to reduce the viscosity of the previous mixture to a workable state. Thinners which may be used include xylene, toluene, and benzene. Petroleum products such as aliphatic napthas may also be used. The preferred thinner is xylene.

The protective coating material thus formed may then be applied to an electrical component. If desired, it may first be further thinned.

While such a thinned varnish is a good protective coating material, it is preferred to add to the thinned varnish a quantity of mica, preferably leafing-type mica. The particle size of this material is not critical and does not materially affect the quality of the resultant product. Based on the non-volatile weight, i. e., the weight prior to the addition of a thinner, sufficient mica may be added to the varnish to create a protective coating material containing approximately 50% mica. The preferred composition, however, comprises 72% varnish and the balance mica, on a non-volatile basis. The resultant protective coating material, which may be further thinned if necessary, and which is one embodiment of the protective coating material, may be applied to an electrical component by brushing, spraying, dipping, or other satisfactory method.

In addition to leafing-type mica, such materials as titanium dioxide and ground barytes are also useful additives. Here again the particle size of these materials is not critical. A preferred protective coating material comprises, based on the non-volatile weight, from approximately 35% to 85% by weight of varnish, the balance being from 20% to 90% by weight of mica, and from 80% to 10% by weight of titanium dioxide. A preferred exact composition comprises 65% varnish, 10% titanium dioxide, and 25% mica, on a non-volatile basis. Such protective coating material may be applied by brushing, spraying, dipping, etc.

It is to be understood that this protective coating material may be further modified by the ad-

dition of ground barytes. It is preferred not to add in excess of approximately 25% barytes, and a preferred composition of a protective coating material containing barytes would comprise 65% varnish, 12½% mica, 12½% barytes, and 10% titanium dioxide, on a non-volatile basis.

To illustrate the method of making such a protective coating material and to enable one skilled in the art to perform this invention, the following examples are given. It is to be understood that these examples are merely illustrative and should in no way be construed as limitations on the scope of the disclosure herein.

Example I

17 gallons of China-wood oil and 100 pounds of polyterpene resin were heated at a temperature of approximately 235° C. until a satisfactory varnish was obtained by means of the pill test. This varnish then had added thereto 225 pounds of xylene. The thinned varnish then had leafing-type mica and titanium dioxide dispersed therein, in the following proportions, based on the non-volatile weight:

	Percent
Varnish	65
Titanium dioxide	10
Mica	25

This mixture was further thinned by the addition of 50 pounds of xylene.

The particular polyterpene resin used had a ball and ring melting point of 100° C., acid number and saponification number less than 4, and was composed essentially of polymers of pinenes.

The resultant protective coating material was placed on a carbon-film resistor by dipping the carbon-film resistor in the protective coating material, and then baking the coated resistor in air at 350° F. for 30 minutes. This dipping and baking was repeated twice, to make three successive dips with baking periods following each dip. A resistor so protected withstood more than 400 hrs. of operation, in air, at 200° C. under a one-watt load without changing more than 10% in resistance.

Example II

15 gallons of tung oil and 100 pounds of coumarone-indene resin were heated at a temperature of 242° C. until a varnish was obtained by the standard pill test. This varnish had added thereto 220 pounds of xylene. The thinned varnish then had added thereto leafing-type mica, titanium dioxide, and ground barytes, in the following proportions, based on the non-volatile weight:

	Percent
Varnish	65
Mica	12½
Barytes	12½
Titanium dioxide	10

This mixture was further thinned by the addition of 45 pounds of xylene.

The particular coumarone-indene resin used had a ball and ring melting point between 110° C. and 120° C., acid number and saponification number of approximately zero, and was composed essentially of para-coumarone-indene-polymer.

This protective coating material was applied to a carbon-film resistor by means of dipping the carbon-film resistor in the protective coating three successive times and baking the coated resistor in air at 350 F. for 30 minutes after each such dipping. A resistor so protected withstood at least 100 hours of operation in air at 200° C. under a one-watt load without changing more than 10% in resistance.

It should be apparent from the above description that there has been devised a novel, air impervious, protective coating material, and a novel method of manufacturing such a material. Such a protective coating material, when used to coat a carbon-film resistor, or any other easily-oxidizable resistor, materially increases the useful life of such a resistor at high-operating, temperatures in oxidizing or other injurious atmospheres. Such a protective coating material may also be effectively used to protect and prolong the life of other electrical components.

In its commercial form the finished material may include small quantities of driers, such as cobalt napthenate, manganese napthenate and lead napthenate, either singly or in combination, as would be well known to those skilled in the art.

While this invention has been described in its preferred embodiment it is to be understood that the words used are words of description rather than words of limitation and that changes within the purview of the appended claims may be made without departing from the true scope and spirit of the invention.

What is claimed is:

1. The method of making a protective coating material which comprises heating from 65% to 40% of a China-wood oil and from 35% to 60% of polyterpene resin to a temperature between 230° C. and 245° C. to form a varnish; thinning said varnish with a suitable solvent; and thereafter mixing from 35% to 85% of said thinned varnish, based on the non-volatile weight, with a material comprising from 20% to 90% mica and the balance titanium dioxide.

2. The method of making a protective coating material which comprises heating from 65% to 40% of a China-wood oil and from 35% to 60% of polyterpene resin to a temperature between 230° C. and 245° C. to form a varnish; adding sufficient xylene to said varnish to make said

varnish workable; and mixing said thinned varnish with leafing-type mica and titanium dioxide in the following proportions, based on the non-volatile weight:

	Percent
Varnish	65
Mica	25
Titanium dioxide	10

3. The method of making a protective coating material which comprises heating from 65% to 40% of a China-wood oil and from 35% to 60% of polyterpene resin to a temperature between 230° C. and 245° C. to form a varnish; adding to said varnish a quantity of xylene approximately equal in weight to the weight of said varnish; and thereafter mixing said thinned varnish with leafing-type mica and titanium dioxide in the following proportions, based on the non-volatile weight:

	Percent
Varnish	65
Mica	25
Titanium dioxide	10

4. A protective coating material for an electrical component, said coating material having been made by heating from 65% to 40% of a China-wood oil and from 35% to 60% of polyterpene resin until a varnish was formed; thinning said varnish with a suitable thinner; and mixing from 35% to 85% of said thinned varnish, based on the nonvolatile weight, with a material comprising from 20% to 90% leafing-type mica and the balance titanium dioxide.

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