March 28, 1950 F. B. HODGDON 2,501,868

DIELECTRIC MATERIAL

Filed Feb. 10, 1949

FIG. 1

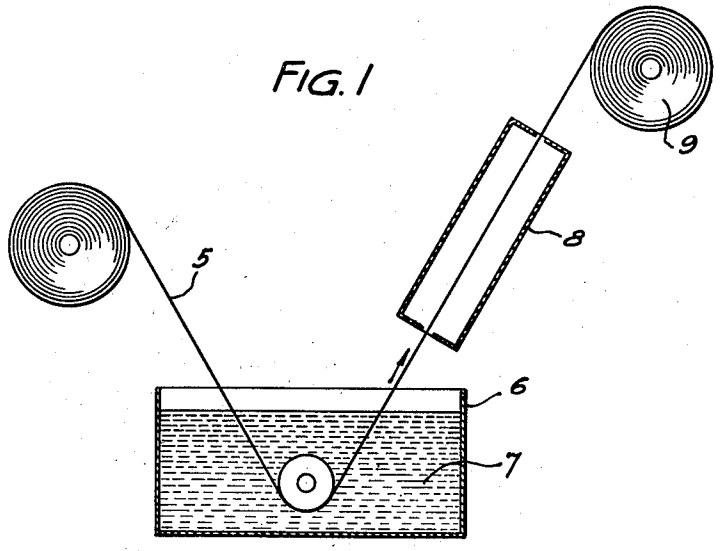
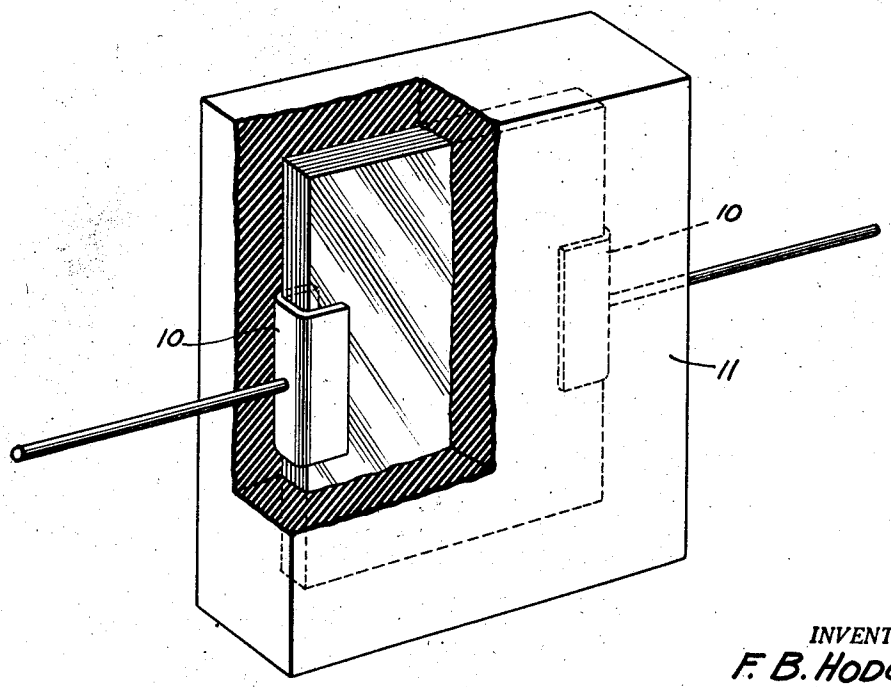


FIG. 2



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Patented Mar. 28, 1950

2,501,868

UNITED STATES PATENT OFFICE

2,501,868

DIELECTRIC MATERIAL

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Application February 10, 1949, Serial No. 75,723

14 Claims. (Cl. 117—138.8)

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This invention relates to dielectric materials and to a method of making the same.

Heretofore, mica and other similar materials have been commonly used as the dielectric body in many types of electrical condensers. However, high quality mica suitable for use as the dielectric body in electrical condensers is now difficult to obtain and its preparation for use as a dielectric body entails considerable work.

Objects of the present invention are to provide an effective and efficient dielectric material and a method of making the same.

In accordance with one embodiment of this invention, polystyrene is mixed with a comminuted inorganic dielectric material under sufficient heat and pressure to liquefy the polystyrene and a liquid which will wet but not dissolve the polystyrene is then added to obtain a coating composition of the required viscosity. A film of a material such as polystyrene may then be coated with this composition.

Other objects and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the following drawings, wherein

Fig. 1 is a diagrammatic view of a coating apparatus, and

Fig. 2 is a perspective view, partly in section, of an electrical condenser made in accordance with this invention.

In order to provide a dielectric body which will have satisfactory electrical and physical properties, a high dielectric constant material, having a suitable low loss characteristic, such as titanium dioxide or various titanates of the alkaline earths, may be coated on a suitable film and the particles of the dielectric material held together and held to the basic film by a suitable binder. Polystyrene, because of its exceptionally low loss characteristic, provides a desirable base material, and, in addition, in accordance with the present invention, may also be used as a binder material. While polystyrene has been recognized as an excellent dielectric material, it has been difficult to incorporate materials of high dielectric constants, such as certain inorganic materials, therewith.

Titanates and other similar inorganic dielectric materials are not readily coated by polystyrene solutions because the polystyrene solution does not wet the surface of the dielectric material and consequently it is difficult to obtain a good bond between the particles and the base. However, it has been found that if polystyrene is heated and mixed with particles of dielectric material under suitable pressure until the polystyrene is suitably liquefied, the molten polystyrene readily wets and coats dielectric particles such as those noted. In practice, 5% of polystyrene and 95% of a dielectric material, such as titanium dioxide or various titanates of the alkaline earths, may be placed in a Banbury type mixer and sufficient pressure exerted on the materials in the mixer during the mixing to cause the materials to heat sufficiently to melt the polystyrene. Hot water may at first be circulated through the walls of the mixing apparatus to expedite the heating and sufficient pressure is used to develop a temperature of about 400° F. in the materials during the mixing operation.

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Since adequate coating of the dielectric particles by the polystyrene is obtained by the mixing under heat and pressure, no solvent is required. The particles with the coating of still liquefied polystyrene may, however, be then transferred to and ground in a ball mill with a non-solvent liquid, such as ethyl alcohol or butyl alcohol, which will wet the coating of liquefied polystyrene without dissolving it, sufficient liquid being used to obtain a coating composition of the required consistency for coating.

A film 5 of polystyrene, as shown in Fig. 1, may then be passed through a tank 6 containing this coating composition 7, the coated film passed through an oven 8 to dry, and finally wound on a drum 9.

The coated film so obtained may then be calendered, cut into sheets and assembled between sheets of foil. A pair of terminal clamps 10, as shown in Fig. 2, may then be clamped to either end of the assembly. Sometimes it is then desirable to mold a casing 11 of a material such as a phenolic condensation product about the assembly. This is done under considerable heat and pressure. Many thermoplastic materials, and particularly polystyrene, when heated, lose their shape. For example, ordinarily, if a film of polystyrene is heated to 180° F., as it may be when a casing is molded around it, it will shrivel and shrink almost into the form of a pellet. When a casing is molded about a condenser assembly comprising alternate laminations of coated polystyrene film and foil, the shrinkage of the film may sometimes cause ruptures which will short circuit the condenser.

As stated in my Patent No. 2,446,928, dated August 8, 1948, a polystyrene film coated with the dielectric coating composition hereinbefore described may be calendered and then heated to a temperature on the order of 350° F. to relieve

the strains in the polystyrene film. The coating serves as a mold and prevents the polystyrene film from changing shape while heated. Thereafter, the coated film may be heated, as required, as, for example, in molding a casing around a condenser assembly containing the coated polystyrene film. The film has high tensile strength and will retain its shape during the molding operation at ordinary molding temperatures.

What is claimed is:

1. A dielectric coating composition for a polystyrene base comprising particles of an inorganic dielectric material coated with a polystyrene film and suspended in a liquid which will wet the film without dissolving it.

2. A dielectric coating composition for a polystyrene base comprising particles of titanium dioxide coated with a polystyrene film and suspended in a liquid which will wet the film without dissolving it.

3. A dielectric coating composition for a polystyrene base comprising particles of a titanate of an alkaline earth coated with a polystyrene film and suspended in a liquid which will wet the film without dissolving it.

4. A method of making a dielectric coating composition comprising incorporating a comminuted inorganic dielectric material with polystyrene by mixing them under such heat and pressure as to liquefy the polystyrene and coat the dielectric material with polystyrene and then, while the polystyrene is liquid, adding a liquid to the mixture which will wet the polystyrene, but which is a non-solvent for polystyrene to obtain a coating composition of the required viscosity.

5. A method of making a dielectric coating composition comprising incorporating a comminuted inorganic dielectric material with polystyrene by mixing them under such heat and pressure as to liquefy the polystyrene and coat the dielectric material with polystyrene, and then, while the polystyrene is liquid, adding butyl alcohol to the mixture to obtain a coating composition of the required viscosity.

6. A method of making a dielectric coating composition comprising incorporating a comminuted inorganic dielectric material with polystyrene by mixing them under such heat and pressure as to liquefy the polystyrene and coat the dielectric material with polystyrene, and then, while the polystyrene is liquid, adding ethyl alcohol to the mixture to obtain a coating composition of the required viscosity.

7. A method of making a dielectric coating composition comprising incorporating approximately one part polystyrene with 19 parts of a comminuted inorganic dielectric material by mixing them under such heat and pressure as to liquefy the polystyrene and to cause the polystyrene to coat the dielectric material, and then, while the polystyrene is liquid, adding a liquid which will wet the polystyrene without dissolving it to obtain a coating composition of the required viscosity.

8. A method of making a dielectric coating composition comprising incorporating approximately one part polystyrene with 19 parts of a comminuted titanium dioxide by mixing them under such heat and pressure as to liquefy the polystyrene and to cause the polystyrene to coat the titanium dioxide and then, while the polystyrene is liquid, adding a liquid which will wet the polystyrene without dissolving it to obtain a coating composition of the required viscosity.

9. A method of making a dielectric coating composition comprising incorporating approximately one part polystyrene with 19 parts of a comminuted titanate of an alkaline earth by mixing them under such heat and pressure as to liquefy the polystyrene and to cause the polystyrene to coat the titanate of an alkaline earth, and then, while the polystyrene is liquid, adding a liquid which will wet the polystyrene without dissolving it to obtain a coating composition of the required viscosity.

10. A method of making a dielectric material comprising incorporating approximately one part polystyrene with 19 parts of a comminuted inorganic dielectric material by mixing them under such heat and pressure as to cause the polystyrene to coat the dielectric material, adding a liquid which will wet the polystyrene without dissolving it to obtain a coating composition of the required viscosity, and coating this composition on a film of polystyrene.

11. A method of making a dielectric material comprising incorporating approximately one part polystyrene with 19 parts of comminuted titanium dioxide by mixing them under such heat and pressure as to cause the polystyrene to coat the titanium dioxide, adding a liquid which will wet the polystyrene without dissolving it to obtain a coating composition of the required viscosity, and coating this composition on a film of polystyrene.

12. A method of making a dielectric material comprising incorporating approximately one part polystyrene with 19 parts of a comminuted titanate of an alkaline earth by mixing them under such heat and pressure as to cause the polystyrene to coat the titanate of an alkaline earth, adding a liquid which will wet the polystyrene without dissolving it to obtain a coating composition of the required viscosity, and coating this composition on a film of polystyrene.

13. A method of making a dielectric material comprising incorporating polystyrene with a comminuted inorganic dielectric material by mixing them under such heat and pressure as to liquefy the polystyrene and cause the polystyrene to coat the dielectric material, while the polystyrene is still liquid adding to the mixture a liquid which will wet the polystyrene but which is a non-solvent for polystyrene to obtain a dielectric coating composition of the required viscosity, and applying this composition to a film.

14. A method of making a dielectric material comprising incorporating polystyrene with a comminuted inorganic dielectric material by mixing them under such heat and pressure as to liquefy the polystyrene and cause the polystyrene to coat the dielectric material, while the polystyrene is still liquid, adding to the mixture a liquid which will wet the polystyrene but which is a non-solvent for polystyrene to obtain a dielectric coating composition of the required viscosity, applying this composition to a film of polystyrene, drying and calendering the coated film, and heating the film to relieve the strains in the film.

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No references cited.