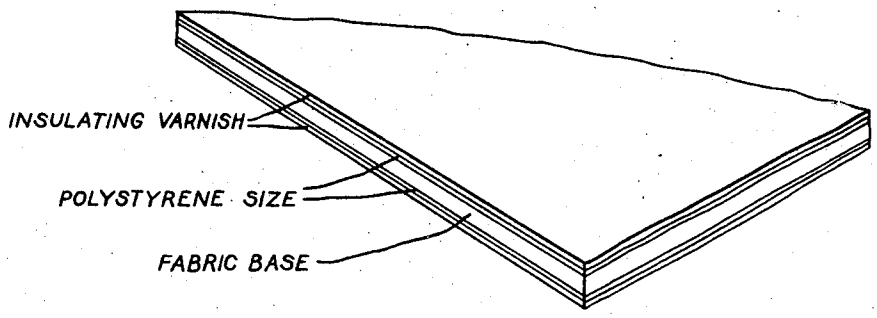
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ELECTRICALLY INSULATING VARNISHED CAMBRIC

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ELECTRICALLY INSULATING VARNISHED CAMBRIC

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3 Claims. (Cl. 154—2.6)

This invention relates to electrically insulating materials and specifically to insulating materials of the varnished cambric type comprising a fabric base sized with a small amount of polystyrene and coated with a resinous varnish.

Electrically insulating sheet materials previously have been prepared in which all or part of the insulation is made up of varnished fabrics, as for example, fabrics coated with the usual alkyd resins composed of the product of reaction of glycerine, phthalic anhydride, and fatty oils or acids. The fabric base used in preparing such materials may be composed of any of the ordinary fibrous materials, as for example, cotton, silk, linen, etc., sized with the usual sizing materials such as starch and the like. Also, cloth and other sheet material previously has been coated with polystyrene and attempts have been made to use such coated products as electrical insulation. However, polystyrene is a hard material and when enough polystyrene is used to impregnate and coat the fibrous backing material thoroughly, the product is stiff and non-flexible with the result that tapes, etc., formed from the coated material cannot be suitably wrapped onto cables or the like. As polystyrene is compatible with ordinary plasticizers such as tricresyl phosphate, dibutyl phthalate and the like, its flexibility may be improved by such additions but the electrical properties of the product are seriously impaired when the plasticizers are present in the amount necessary to impart the desired flexibility to the product.

I have found that varnished cambrics which possess those electrical properties characterizing unplasticized polystyrene coated products combined with the flexibility of ordinary varnished sheet materials may be obtained if raw cloth first is sized with from 5 to 20 per cent, preferably from 5 to 10 per cent, by weight of polystyrene based on the weight of the raw cloth, and then is coated and impregnated with the usual varnishes. An outstanding characteristic of my product is its low and more uniform power factor at room and elevated temperatures. Further because it is less susceptible to moisture and varying humidity conditions, its electrical properties as a whole are more stable. One embodiment of my invention is illustrated in the accompanying drawing, wherein is shown a fabric base sized with polystyrene and coated and impregnated with an insulating varnish.

The improvement in power factor at various temperatures obtained by using polystyrene as a sizing material is shown in Table I in which the power factors at 60 cycles of varnished cambrics sized with starch and polystyrene are compared.

Table I

	P. F. @ 30° C.	P. F. @ 60° C.	P. F. @ 100° C.
Varnish No. 1 on cloth sized with starch	.034	.028	.145
Varnish No. 1 on cloth sized with stryene	.035	.021	.093
Varnish No. 2 on cloth sized with starch	.036	.053	.079
Varnish No. 2 on cloth sized with styrene	.024	.018	.028
Varnish No. 3 on cloth sized with starch	.049	.066	.122
Varnish No. 3 on cloth sized with styrene	.031	.018	.031
Varnish No. 4 on cloth sized with starch	.060	.086	.435
Varnish No. 4 on cloth sized with styrene	.034	.015	.094

It will be noted that the power factor of the styrene-sized material is unusually low at the higher temperatures. The styrene-sized cloth contained 8 per cent styrene. The varnishes used in making the above comparisons were alkyd resin solutions containing resin, solvents and driers; the resins being prepared in the following manner from the ingredients set forth in Table II.

Table II

	No. 1	No. 2	No. 3	No. 4
	Per-cent	*Per-cent*	*Per-cent*	*Per-cent*
Neofat No. 3-R	46.1			
Coconut fatty acids	15.4			
Cottonseed fatty acids		70.9	69.2	68.6
Glycerine				13.5
Pentaerythritol	18.7	18.4	15.1	
Phthalic anhydride	17.6		13.3	10.8
Maleic anhydride	2.2	10.7	2.4	7.1
	100.0	100.0	100.0	100.0

All of the materials except the maleic anhydride are heated together at 190° C. for about one hour or until a homogeneous melt is obtained. At this point, the maleic anhydride is added and the cooking continued at 250° C. for about two hours until a cure of about 18 seconds at 200° C. and an acid number of about 13 are reached. The resin then is mixed with mineral spirits and the usual driers to obtain the varnish suitable for coating the fabric base. The Neofat 3—R is a mixture of fatty acids similar to soya bean fatty acids obtained from Armour and Company.

It is, of course, understood that the present invention is not limited to the production of sheet

materials varnished with resinous compositions formed of the specific ingredients named in the illustrative examples. For instance, as polybasic carboxylic acids or anhydrides I may use in forming the alkyd resin, in addition to those mentioned above, such acids or anhydrides as, for example, malonic, succinic, glutaric, adipic, pimelic, suberic, sebacic, fumaric, etc., or mixtures of such acids or anhydrides. Polyhydric alcohols other than petaerythritol and glycerine may also be used as, for example, ethylene glycol, diethylene glycol, and mannitol. Various drying, semi-drying or non-drying oils may be used in place of the coconut fatty acids or cottonseed fatty acids. Such oils or acids include soya, walnut, tung, linseed, perilla, castor oil, cottonseed stearin and the like.

In making the varnish, the resinous composition may be thinned with any suitable solvent, for example turpentine, coal tar solvents, petroleum hydrocarbon solvents, etc. Any suitable drier in any convenient form may be used, for example the naphthenates, linoleates or resinates of metals such as calcium, manganese, lead, cobalt, zinc and iron. The percentage of drier required may be varied to suit manufacturing requirements for producing dry cloth or other material in a minimum of time. In some cases the drier may be omitted.

The method of combining the various ingredients may be varied in many ways. For example, the temperature and time of heating required for obtaining a particular resinous composition may be varied in accordance with the differences in the properties of the starting materials.

In carrying out my invention, I prepare a solution of polystyrene or styrene in solvent naphtha or other suitable solvent of such proportions that the solution contains from 10 to 25 per cent of the styrene. The raw cloth, which may be of cotton, wool, linen, silk, glass fibers or the like, is passed through this solution at such a rate and for such a time as to deposit the required quantity of styrene onto the fibers. The best combination of physical and electrical properties is obtained if the styrene content of the sized cloth product is between 5 and 10 per cent based on the weight of the raw cloth. The sized material is dried for about two minutes at about 150° C. to remove the solvent and is calendered by passing it through rolls heated to 100° to 130° C. The styrene is an excellent sizing material from the standpoint of ease of handling. As it is a thermoplastic material, it softens enough between the hot calendering rolls to allow the thread ends and lint to become firmly embedded in the size and by proper adjustment of the temperature of the rolls, an extremely smooth cloth may be obtained.

In making the sheet electrical insulation, the liquid coating composition or varnish is applied to the sized material by brushing, sprinkling, spraying or preferably by immersion means and under temperature and other conditions well known to those skilled in the art. Upon heating the coated and impregnated material at a temperature of about 110° C. or thereabove, the solvent is evaporated and an insulating material of low power factor at normal and elevated temperatures is produced. This material is permanently flexible, is highly resistant to oil, moisture and aging and has a high dielectric strength and a high tear strength.

Particularly low power factors are obtained if varnishes similar to varnishes No. 2 or No. 3 set forth in Table II are used on the styrene-sized cloth. Insulating materials comprising such pentaerythritol-resin varnishes are described and claimed in a copending application Serial No. 306,520, filed November 28, 1939, in the names of James R. Patterson, James R. Reid and Henry A. Letteron, and assigned to the same assignee as the present invention. The use of varnishes containing resins having a high content of fatty acids or oils of low iodine number, such as coconut fatty acids, cottonseed stearin and the like, imparts to the finished material a degree of flexibility not obtained with ordinary oils and acids. Flexible varnished cambric in which the varnish comprises resins prepared from such low iodine number fatty oils or acids are described more fully and claimed in my copending application Serial No. 306,521, filed November 28, 1939 and assigned to the same assignee as the present invention.

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

1. An electrically insulating sheet material comprising a fabric base sized with from 5 to 20 per cent by weight of polystyrene based on the weight of the fabric base, and coated and impregnated with an insulating varnish.

2. An electrically insulating varnished cambric comprising a fibrous sheet sized with from 5 to 10 per cent by weight of polystyrene and coated and impregnated with an alkyd resin varnish.

3. An electrically insulating material comprising a sized and varnish-treated fibrous sheet wherein the sizing material comprises heat-treated styrene and the varnish comprises an oil-modified alkyd resin.

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