

Feb. 22, 1949.

E. L. SCHULMAN ET AL

2,462,228

INSULATING MATERIAL

Filed May 24, 1944

Fig. 1.

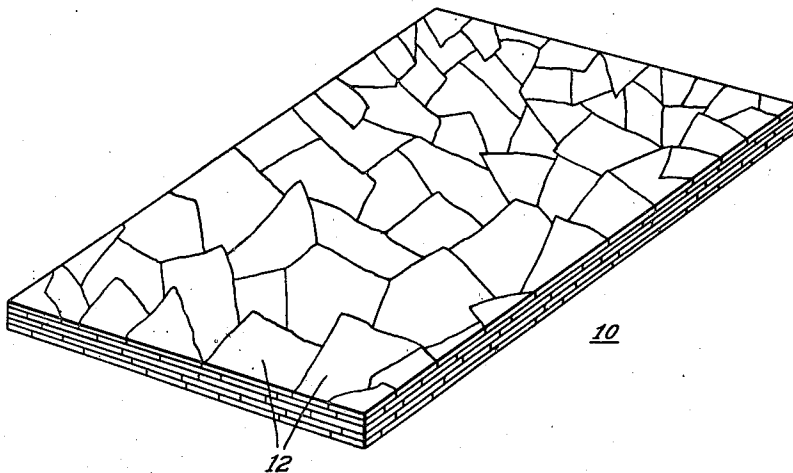
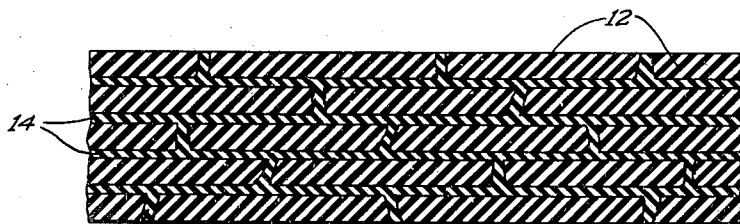
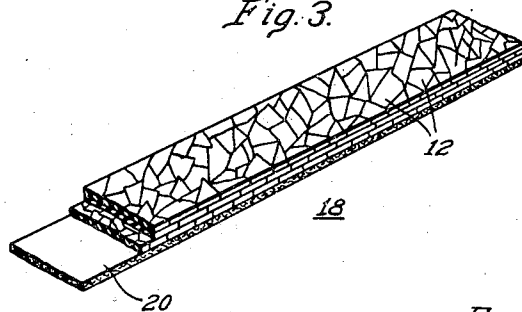


Fig. 2.



*Bonding Agent Comprising Extracted Pine Wood
Pitch and Castor Oil.*

Fig. 3.



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2,462,228

INSULATING MATERIAL

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Application May 24, 1944, Serial No. 537,032

2 Claims. (Cl. 154—2.6)

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This invention relates to insulating compositions, and more particularly to flexible laminated insulating compositions suitable for use in electrical apparatus.

In the construction of electrical apparatus large amounts of laminated electrically insulating material of all kinds are required. In certain applications the electrically insulating material is applied by winding or shaping to some predetermined form in order to accommodate coils or other electrical conductors. In order to achieve flexibility it is common to employ laminated insulating materials bonded with a binder containing a portion of an evaporable solvent to soften the binder. Employing this latter type of material, the prepared flexible laminated insulating material must be carefully stored, as in airtight containers, and handled rapidly in order to prevent undesirable evaporation of the solvent, to avoid hardening of the material before application.

The electrical industry requires insulating material that is flexible for prolonged periods of time whereby it has sufficient flexibility facilitating application to members and remains flexible even when put into service. Flexible insulation of this kind permits the distribution of stresses during manufacturing and accommodates stresses developed during use. Undesirable hardening effects, accordingly, would be avoided.

The object of this invention is to provide flexible insulation embodying mica flakes and a binder, the binder resisting hardening on drying and ageing.

A further object of the invention is to provide a permanently flexible binder for preparing composite electrical insulation, the binder having good electrical properties and being insoluble in petroleum oils.

For a fuller description, reference should be had to the following detailed description and drawing wherein:

Fig. 1 is a perspective view of a laminated body;

Fig. 2 is a greatly enlarged, fragmentary cross-section view; and

Fig. 3 is a perspective view, partly in section of a tape.

According to the present invention a flexible binder capable of uniting mica flakes into composite insulation is prepared by combining extracted pine wood pitch with castor oil. The combination of ingredients when mixed together has good adhesion for mica flakes while permit-

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ting flexing and binding of the laminated product.

The extracted pine wood pitch employed in the present invention is a complex resinous material whose exact composition is not known but comprises the residue remaining after the separation of rosin, turpentine, pine oil and other products from the mixture produced by a practically complete extraction of pine wood with a solvent. In the process of producing the residue, pine wood in the form of chips is subjected to the action of a powerful solvent, such as benzol, with or without the application of steam to increase the amount of extract obtained. The solvent is then removed from the resinous matter so extracted from the pine wood chips and the solute is fractionated by subjecting it to the action of specific solvents and heat to separate turpentine, rosin, pine oil and other constituents. The final residue is a hard brittle complex organic substance which is hereafter described as extracted pine wood pitch. Such a material is produced and sold at the present time under the trade name "Vinsol."

The extracted pine wood pitch by itself is so brittle and relatively non-adherent to mica that its use as a binder in making laminated mica products is unsatisfactory. We have found that when combined with castor oil in the proportions of about 100 parts of extracted pine wood pitch to from about 60 to 100 parts by weight of castor oil, that the combination possesses highly satisfactory properties as a binder for mica flakes.

In preparing the composition, a satisfactory process comprises dissolving the extracted pine wood pitch in a large volume of a solvent therefor. It has been found among many suitable organic liquids, that ethyl alcohol, methyl alcohol and acetone may be used for this purpose. Denatured alcohol will generally be preferred, both on account of its low cost as well as its low order of toxicity. Thereafter the castor oil is added to the solution of the extracted pine wood pitch in the solvent.

A small amount of pine tar may be added, for example, up to 5 parts by weight per 100 parts of extracted pine wood pitch.

In preparing the solution of the binder, the requirements for a satisfactory solution for application to mica flakes had been found to be somewhat critical. The best manufacturing results have been obtained when the solids content of the solution has been maintained within the limits of from 34% to 36% solids. The solids content may be varied considerably from this

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proportion, but the percentage of binder deposited on the mica flakes and other factors change accordingly.

The following examples of various compositions according to the present invention have been found to be highly successful in practice:

EXAMPLE 1

A solution composed of

Extracted pine wood pitch-----	pounds--	325
Castor oil-----	do----	315
Pine tar-----	do----	9
Ethyl alcohol-----	gallons--	177

was prepared by dissolving the first three ingredients in the ethyl alcohol in the order given. The solution so prepared was employed in the conventional mica plate building machines in the same manner that shellac solutions are applied.

A flexible mica sheet, such as shown in Figs. 1 and 2 of the drawing, was produced after evaporating the solvent and pressing at a temperature of say 125° C. The plate 10 is composed of a plurality of mica flakes 12 with the extracted pine wood pitch and castor oil binder 14 applied thereto.

The electrical properties of the mica sheet 10 are as follows:

Breakdown	Insulation Resistance	Arc Resistance
507 volts per mill (step-by-step).	Infinity megohms.	210 seconds (A. S. T. M.).

Power factor

Volts	Temperature		
	25° C.	50° C.	100° C.
	Percent	Percent	Percent
500-----	2.33	2.97	11.00
1,000-----	1.93	3.07	11.80
1,500-----	2.43	4.97	16.2
2,000-----	12.60	17.23	26.00

The binder in sheet 10 is insoluble in transformer oil and other petroleum products. The sheet remained flexible for nearly a year when exposed to the air without any indication of increase in stiffness. The sheet is quite flexible and may be bent without fracturing or rupturing about relatively sharp radii considering its thickness.

EXAMPLE 2

A composition suitable for making mica tapes and wrappers of various kinds was composed as follows:

Extracted pine wood pitch-----	pounds--	382
Castor oil-----	do----	270
Ethyl alcohol-----	gallons--	177

The solution was applied to mica flakes laid upon a fabric. The fabric and mica flakes were well bonded upon evaporating the solvent and pressing the combined materials while warm.

As shown in Fig. 3 of the drawing, the tape 18 consists of the sheet fibrous material 20 having applied thereto mica flakes 12. The sheet fibrous material 20 may consist of cambric, glass cloth, fish paper, Jap paper, cement paper, asbestos paper, asbestos cloth and other fibrous materials known to those in the art. Excellent adhesion has been obtained between these sheet fibrous materials and the mica flakes when the binder of

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the present invention is applied thereto. Not only the backing of the tape but the face likewise may consist of the same, or a different sheet material. In making slot insulation, for instance, one face of the mica flake body may carry glass fiber cloth to form the interior surface to come in contact with the conductors or winding, and the other face may consist of a smooth, tough paper, such as fish paper, to permit easy insertion within the slots in magnetic cores.

The properties of the composition of Example 2 comprise a high degree of flexibility even when exposed to the atmosphere for prolonged periods of time. The tape 18, for example, may be wrapped about fine conductors or coils with good conformation characterized by lack of wrinkles and bulging. The electrical properties are similar to those given for the composition of Example 1.

EXAMPLE 3

A composition of intermediate flexibility comprised the following ingredients:

Extracted pine pitch-----	pounds--	335
Castor oil-----	do----	228
Pine tar-----	do----	9
Ethyl alcohol-----	gallons--	177

Mica tape prepared with the composition of this example was sufficiently flexible for application by means of taping machines.

A further advantage of the extracted pine wood pitch and castor oil bonding agents, when solvent free, resides in the lack of adhesion to kraft paper. After a mica sheet, for example, has been heated in an oven to evaporate most of the solvent therefrom, the warm sheet is placed in a press having a sheet of kraft paper between the platens and the mica sheet. After pressing at pressures of 100 pounds per square inch and higher, the mica sheet may be separated from the kraft paper liner without any difficulty. This characteristic has value since it facilitates manufacturing of the mica sheets.

It will be appreciated that the fibrous sheet material, such as glass cloth and the like, may be pretreated with other resinous materials in order to impart thereto other predetermined requirements, such as increased tear resistance. Thereafter the treated fibrous sheet material may be employed as a base to be combined with the mica flakes and the binder of this invention into a suitable insulating material.

Since certain changes in carrying out the above processes and certain modifications in the articles which embody the invention may be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. A flexible electrically insulating material comprising mica flakes and a binder therefor composed essentially of 100 parts by weight of extracted pine wood pitch obtained by first extracting pine wood with a coal tar solvent and, second, removing the volatile constituents from said extract and, third, extracting from the residual resin petroleum hydrocarbon soluble components, and from about 60 to 100 parts by weight of castor oil.

2. Insulating material comprising, in combination, a fibrous sheet, mica flakes applied to the fibrous sheet, and a flexible bonding agent composed of 100 parts by weight of extracted pine wood pitch obtained by first extracting pine wood

with a coal tar solvent and, second, removing the volatile constituents from said extract and, third, extracting from the residual resin petroleum hydrocarbon soluble components, and from about 60 to 100 parts by weight of castor oil to bind the sheet and the mica flakes into a whole.

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