Aug. 26, 1958 L. B. PALMER 2,849,335

BACKING FOR SMOOTH SURFACE COVERINGS AND PROCESS THEREFOR

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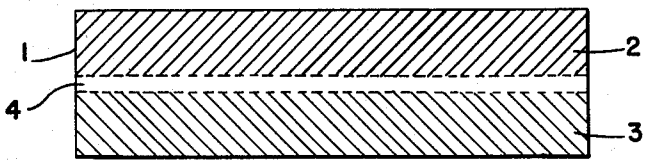


FIG. 1

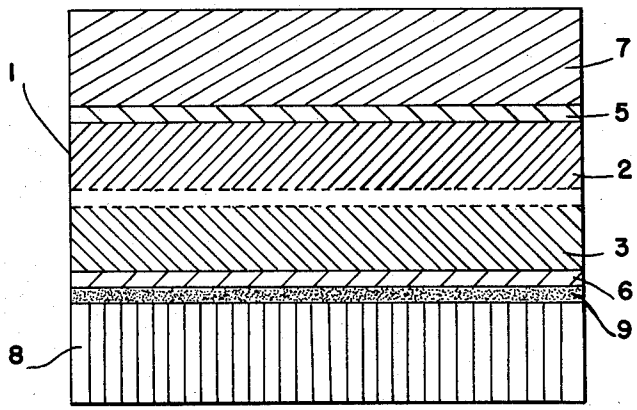


FIG. 2

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AGENT

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2,849,335

BACKING FOR SMOOTH SURFACE COVERINGS AND PROCESS THEREFOR

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Application September 17, 1956, Serial No. 610,238

33 Claims. (Cl. 117—68)

This invention relates to smooth surface coverings for floors, walls, and the like. In particular, it relates to fibrous sheets suitable as backings for such coverings and to methods of producing them.

Smooth surface coverings such as linoleum, printed felt base and the like are made up of a decorative layer applied to a sheet of fibrous backing material. The decorative layer may have wear-resistant properties or a transparent wear-resistant coating may be applied thereto. The product is then adhesively bonded to the surface to be covered. According to conventional practice, the fibrous back is uniformly impregnated throughout with a binder, such as a bituminous material, thereby providing a satisfactory backing sheet for the product from the standpoint of strength, water resistance, and resistance to indentation.

A product comprising such a uniformly impregnated backing is characterized, however, by requiring an excessively long time for setting the adhesive when it is installed. The decorative and wear-resistant layer tends to develop cracks caused by lateral shifting of the base to which the product is bonded. Such shifting is commonly due to varying conditions of humidity in the surrounding atmosphere. Furthermore, if replacement is desired, removal of the product is difficult due to the inherent strength of the backing in resisting delamination.

Consequently, it has been proposed that a nonuniformly impregnated backing be used. Such a backing comprises a sized zone having a relatively small amount of binder and an impregnated zone having a greater amount of binder. A backing sheet of this type is disclosed in U. S. Patent 2,295,070.

In the production of a surface covering comprising such a backing, the decorative layer is applied to the side of the backing bearing the impregnated zone. During installation, the side bearing the sized zone is adhesively bonded to the surface to be covered. A product of this type is characterized by rapid setup of the adhesive when it is bonded to a surface, ability to withstand lateral shifting of the surface upon which it is installed without cracking of the wear layer, and ease of removal from the surface if replacement is desired.

There is, unfortunately, a disadvantage which tends to offset these advantages. The fibers in the sized zone of the backing sheet tend to swell while the adhesive is becoming set. This leads to growth of the whole backing sheet, causing the edges of the sheet to curl upwards, a phenomenon called "tenting." Tenting of the seams in a surface covering installation is objectionable since the location and presence of the seams is emphasized and also since the seams are then areas of potential weakness in the installation.

The cure for tenting which has been used in the past has been to increase the thickness of paint applied to the side of the backing sheet which is bonded to the surface to be covered. This heavy backing paint, however, has drawbacks, including increased material cost, increased tendency of the painted back to develop cracks,

thus detracting from the salability of the product, greatly increased setup time for the adhesive, and poorer adhesion of the adhesive due to the slicker, smoother back surface of the product.

It is an object of the invention to provide a surface covering comprising a fibrous backing and a decorative layer characterized by the ability to be quickly and firmly bonded to a surface without objectionable tenting of seams. It is a further object of the invention to provide a surface covering with a fibrous backing which can be quickly and firmly bonded to a surface without tenting of the seams characterized by ease of removal for replacement purposes. Other objects and the advantages of the invention will appear hereinafter.

In accordance with the invention, a fibrous sheet is sized from one side with a sizing solution comprising a binder and a small amount of an organopolysiloxane. The sheet is impregnated from the other side with a greater amount of binder so that no dry felt remains within the sheet to produce a product which comprises a sized zone and an impregnated zone. The sized and impregnated sheet is a suitable backing for a decorative surface covering product.

With reference to the drawing,

Fig. 1 is a cross-sectional view of a fibrous sheet impregnated according to the invention;

Fig. 2 is a cross-sectional view of a surface covering installation formed by laminating a wear layer to the sheet of Fig. 1 and bonding the product to a surface.

A fibrous sheet 1 is impregnated and sized with binder so as to create an impregnated zone 2 with greater binder content and a sized zone 3 of lesser binder content. The zone 3 contains a small amount of an organopolysiloxane. An overlap zone 4 comprising binders used in both the impregnated and sized zones and organopolysiloxane is between the sized and impregnated zones within the sheet. A seal coat 5 is applied to the surface of the zone 2 and a coat 6 of backing paint is applied to the surface of the zone 3. A layer 7 of decorative wear-resistant composition is laminated to the seal coat. The product is bonded to a surface 8 by means of an adhesive layer 9.

The fibrous sheet is preferably a web of felted fibers. The felt is generally produced using a Fourdrinier or cylinder paper machine with the thickness of the resulting sheet normally falling in the range of from 0.02 to 0.08 inch. The fibrous material used for making the felt is normally cellulose in origin although other fibers can be used including those of mineral and animal origin. The sources of cellulose material can include cotton or other rag stock, wood pulp, including both ground wood and chemical wood pulp, paper, boxes, or mixtures thereof in any proportion. The sheet can also contain fillers such as wood flour.

The density of the fibrous sheet useful as a backing for a surface covering is lower than that of paper. The physical characteristics of a sheet of this type are commonly defined by the ratio of the thickness of the sheet to the weight of a specified area. This ratio is often referred to as the gauge to weight ratio. It is preferred that the fibrous sheet used as a backing according to the invention have a gauge to weight ratio in excess of 0.8 as defined by the formula:

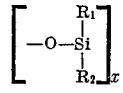
$$\frac{\text{Thickness of felt (thousandths of an inch)}}{\text{Weight of 480 sq. ft. of dry sheet (pounds)}}$$

A particularly effective range of gauge to weight ratios is from 0.8 to 1.2. These values are to be contrasted with the gauge to weight ratio of paper which is normally about 0.4 and rarely exceeds 0.8.

In accordance with the invention, one side of the fibrous sheet is sized to a controlled depth with a dispersion of

sizing binder in the presence of a small amount of a soluble organopolysiloxane. The binder used in the sizing solution is any of the well-known binders which are commonly used for imparting strength and water resistance to a fibrous sheet. Such resinous binders as urea-formaldehyde and phenol-formaldehyde resins, polyvinyl chloride, polyvinyl actate, vinyl chloride-vinyl acetate copolymer, butadiene-acrylonitrile copolymer, butadiene-styrene copolymer, polymers and copolymers of acrylic acid and the like can be used. The preferred binder, for reasons of low cost and the desirable properties which it imparts to the fibrous sheet, is a bituminous material and is usually an asphalt of either petroleum or natural origin or blends of the two. The preferred bituminous binder can be crude, blown or steam distilled and can, in addition to asphalts, be tar or pitch residues of vegetable and animal origin. Normally, the bituminous binder used in the sizing solution has a softening point of between about 130° F. and about 200° F.; preferably, the softening point is between 170° F. and 190° F.

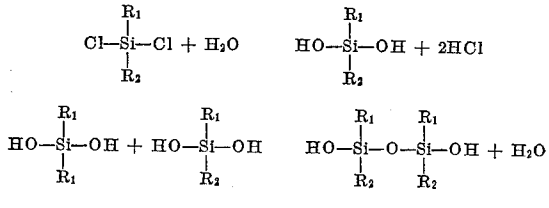
The organopolysiloxanes effective in the invention are characterized by having a plurality of silicon atoms linked together through oxygen atoms with at least one hydrocarbon radical attached to each silicon atom. Such hydrocarbon radicals include alkyl, such as methyl, ethyl, propyl, isobutyl, isoamyl, amyl, hexyl, heptyl, octyl and the like; aryl, such as phenyl and the like; alkaryl, such as tolyl, xylyl and the like; aralkyl, such as benzyl, phenylethyl and the like; and cycloalkyl, such as cyclopentyl, cyclohexyl and the like. The repeating structure in the molecule is:



where R_1 is a hydrocarbon radical having from 1 to 8 carbon atoms and R_2 is either a hydrocarbon radical having from 1 to 8 carbon atoms or hydrogen.

Organopolysiloxanes wherein at least one of the radicals attached to each silicon atom is a methyl group are particularly effective in the invention. These preferred polymers include dimethyl polysiloxane, methyl phenyl polysiloxane, methyl hydrogen polysiloxane, methyl ethyl polysiloxane and the like.

The organopolysiloxanes effective in the invention are prepared by any of the well-known methods of preparation of such materials. For example, the hydrolysis of a disubstituted silicon dichloride produces a disubstituted silicon compound with two —OH groups. Two or more of these molecules can join, splitting out water to form the siloxane bonding.



and so on.

The condensation of molecules containing Si bonded to —OH groups can continue to any degree to produce products of varying viscosity. The polymerization can be influenced by catalysts such as sulfuric acid, sodium hydroxide, copper hydroxide, fennic sulfate, sodium sulfate and the like. The products can be linear polymers or cross-linking can take place during the polymerization.

To be effective in the invention, the organopolysiloxanes should either themselves or their concentrated solutions be of sufficient fluidity so that they be readily dispersed in the sizing solution, and so that their presence does not impart to the sizing solution so high a viscosity that absorption of the solution by the fibrous sheet becomes difficult. It is preferred that the viscosity at 77° F. of a dispersion comprising 90 percent organopolysiloxane and 10 percent xylene be from about 5 to about 5000 centistokes. A particularly effective range of viscosities at 77° F. of the dispersion is from 10 to 100 contistokes.

The organopolysiloxanes effective according to the invention should be very low in free acidity, as any appreciable free acid tends to promote the formation of sludge in the sizing solution. It is preferred that the acid number of the organopolysiloxane (defined as the number of milligrams of potassium hydroxide required to neutralize 1 gram of polymer) be less than 0.4. In addition, the solvents used to prepare the sizing solution should be dry since organopolysiloxanes tend to react with water with the formation of a flocculent precipitate.

The effective organopolysiloxanes are further characterized by being heat hardenable; that is, they are adapted to be cured by heat to a tough solid form. The cure of these effective organopolysiloxanes can proceed at varying rates at ordinary temperatures, but the application of heat accelerates the curing process. In the curing process, cross-linking and polymerization takes place within the organopolysiloxane molecule.

In producing the polysiloxane containing sizing solution for use in the invention, a dispersion of binder in solvent is first prepared. Such solvents as kerosene, naphtha, methyl ethyl ketone, methyl isobutyl ketone, carbon tetrachloride, toluene, xylene, turpentine, diethyl ether, perchloroethylene, Stoddard solvent and the like can be used. The binder can be in solution in the solvent or as an emulsion in the presence of conventional emulsifying agents.

Organopolysiloxane, preferably also dispersed in a solvent that is miscible with the solvent used for dispersing the binder, is added to the dispersing of binder. A common solvent for dispersing the organopolysiloxane is xylene, but other solvents such as those listed above can be used.

The sizing solution normally contains about 0.2 to about 10 percent organopolysiloxane and about 10 to about 50 percent sizing binder with the balance being made up of solvent. The presence of organopolysiloxane in higher concentrations than 10 percent results in an unstable dispersion of the sizing solution from which impregnant has a tendency to be displaced from solution. A particularly effective range of composition for the sizing solution is 0.5 to 1.25 percent organopolysiloxane, 20 to 40 percent sizing binder and the balance solvent.

The depth of penetration of the fibrous sheet by the sizing solution is controlled by varying the time of contact of the sheet with the solution and by the pressure exerted by the squeeze rolls between which the sheet passes for the purpose of removing surplus sizing solution. The depth of sizing is normally from about 20 percent to about 70 percent of the thickness of the sheet. A particularly effective range is from 30 percent to 60 percent of the thickness of the sheet.

The fibrous sheet, after being dried for removal of the solvents used for dispersing the impregnant, is then impregnated from the side opposite to that which has been sized. The impregnating binder can be any of the resinous binders disclosed as useful as sizing binders. For reasons of cost and the desirable properties which it imparts to a fibrous sheet, a bituminous impregnating binder is preferred. The preferred binder is conventionally an asphalt of either petroleum or natural origin or blends of the two. The bituminous binder can be crude, blown or steam distilled and, in addition to asphalts, can be tar or pitch residues of vegetable and animal origin. Normally the bituminous impregnating binder has a softening point of between about 100° F. and about 160° F.; preferably, the softening point is between 140° F. and 150° F.

The impregnation step in the case of use of the preferred bituminous binders is normally carried out by hot

melt application; that is, a molten bath of impregnating binder is maintained and the fibrous sheet is passed in contact with it so that only the side which is to be impregnated is wetted. Depth of impregnation is controlled by the temperature of the bath and time of contact of the fibrous sheet with the impregnant. With impregnating binders of the preferred type, the bath temperature is normally between about 440° F. and about 460° F. When resinous binders are used, the impregnating binder can be dispersed or dissolved in a suitable solvent and the fibrous sheet brought into contact with the dispersion to effect impregnation. The depth of impregnation is such that the impregnating binder at least contacts the sizing binder within the sheet but is less than 90 percent, and preferably less than 80 percent, of the thickness of the sheet.

The sized and impregnated fibrous sheet comprises a sized zone extending inward from one surface of the sheet and an impregnated zone extending inward from the other surface of the sheet. These zones are either contiguous within the sheet or preferably are separated by a middle or overlap zone. It is particularly undesirable for there to be dry (unimpregnated or unsized) felt within the sheet. The sized zone normally contains from about 5 to about 40 parts sizing binder and from about 0.1 to about 5 parts cured organopolysiloxane per 100 parts dry felt in the sized zone. Preferably, the sized zone contains from 15 to 35 parts sizing binder and from 0.25 to 1 part organopolysiloxane per 100 parts dry felt.

The middle or overlap zone contains sizing binder and organopolysiloxane in the same proportion based on the dry felt in the zone as are present in the sized zone. The combination of sized zone and middle zone represents from 20 to 70 percent of the thickness of the sheet with a range of 30 to 60 percent of the thickness of the sheet being particularly effective. The thickness of the combination of sized zone and middle zone is equal to the depth of penetration of the sizing solution as described hereinabove.

The impregnated zone in the case of use of a preferred bituminous impregnating binder normally contains at least 40 parts impregnating binder per 100 parts dry felt and preferably contains from 65 to 150 parts per 100 part dry felt. When resinous binders are used, the impregnated zone can contain less binder, but in any case, the proportion of binder in the impregnated zone expressed as parts binder per 100 parts dry felt in the impregnated zone must be at least 10 percent greater than the proportion of binder in the sized zone expressed as parts sizing binder per 100 parts dry felt in the sized zone. The impregnated zone represents the zone in the felt sheet which is uniformly impregnated with the impregnating binder and which contains no sizing binder or organopolysiloxane. The impregnated zone extends from the surface of the sheet opposite to that which has been sized to contact the sizing binder and organopolysiloxane within the sheet.

Although the depth of impregnation can be carefully controlled so that the impregnating binder does not penetrate into the zone which has been sized, it is preferred that a middle or overlap zone be present in the product. This middle zone can range in thickness up to about 25 percent of the sheet but is preferably from 10 percent to 20 percent of the thickness of the sheet. The presence of the organopolysiloxane tends to decrease the ease of penetration of impregnating binder into the zone, thereby causing the overlap zone to have progressively decreasing amounts of impregnating binder in the direction of the sized zone. The presence of the organopolysiloxane also inhibits the migration of impregnating binder into the sized zone during subsequent processing steps.

To the fibrous sheet containing the two or three zones as described above, there are usually applied conventional seal and backing coats. When a seal coat is used, it is applied to the surface of the impregnated zone in such an amount that the dried coat weighs from about 0.10 to about 0.15 pound per square yard of fibrous sheet. The seal coat is commonly of either the oleoresinous or the latex types. In the case of a seal coat of the oleoresinous type, the vehicle may contain any of the drying oils or compatible resins which, after application, dry to a hard, tough consistency. For example, such drying oils as linseed oil, soy bean oil, Chinawood oil, tung oil, oiticica oil and the like and such resins as rosin, ester gum, coumarone-indene resin and the like can be used. Suitable solvents such as mineral spirits, turpentine, kerosene, naphtha and the like are usually present.

In the case of a seal coat of the latex type, the vehicle comprises an aqueous emulsion of a rubber latex, such as natural rubber, butadiene-styrene copolymer, butadiene-acrylonitrile copolymer and the like. The rubber is emulsified and held dispersed by the presence of suitable dispersing agents and stabilizers.

The seal coat contains any of the conventionally used fillers, such as whiting, clay, slate flour, ground limestone, pigments and the like. Normally, the percentage of filler is between about 70 percent and about 80 percent of the weight of the dry seal coat. The seal coat is applied by such means as a flexible steel doctor blade or a roll coater.

The backing coat is formulated and applied to the surface of the sized zone in the same manner as already described in connection with the seal coat. The coat should be high in percentage of filler, in the same manner as the seal coat. The weight of the dry backing coat is normally less than about 0.25 pound per square yard of fibrous base and preferably is between 0.1 and 0.2 pound per square yard. The surface of the backing coat should be such that good adhesion with linoleum cement adhesive is provided.

After the fibrouse base has been prepared comprising a sized zone or a sized zone and a middle zone, an impregnated zone, a seal coat applied to the impregnated zone and a backing coat applied to the sized zone, a layer of decorative and wear-resistant composition is applied to the side bearing the seal coat. This layer may comprise any of the well-known types used in the surface covering art. For example, a preformed sheet of linoleum composition comprising drying oil, resins and fillers can be bonded to the seal coat. Alternately, linoleum composition can be calendered directly to the felt. In this case, the seal coat is customarily omitted. Alternately, a thermoplastic resinous composition comprising such resins as polyvinyl chloride, vinyl chloride-vinyl acetate copolymer, vinylidene chloride- vinyl chloride copolymer and the like, plasticizers therefor and fillers can be bonded to the base. The decorative and wear-resistant composition can be bonded to the fibrous base without an adhesive, but an adhesive tackifier can be used if desired. The decorative layer can comprise conventional printing enamels applied by block printing, rotary or similar techniques either directly to the seal coat or to another sheet which in turn is laminated to the impregnated and sized fibrous base sheet. The printed decoration can be protected if desired by a clear wear layer comprising urea-alkyd resins, vinyl resins or the like.

When a linoleum composition is formed to a fibrous base, the product is seasoned by holding it at a temperature of between about 160° F. and 180° F. for from about two to about six weeks. When a printed decoration is applied directly to the seal coat of the fibrous base, the product is dried to remove the solvent from the printing enamels. These heating steps, in addition to insuring optimum quality in the wear layer, bring about polymerization and cross-linking to the organopolysiloxane molecule, thus producing the desirable properties in the sized zone of the fibrous base.

The fibrous base can be subjected to heat prior to application of the decorative layer to effect cure of the

organopolysiloxane. This is particularly desirable when the product receives no heat treatment after the decorative layer is applied, as in the case of a thermoplastic resinous product.

During installation, the decorative and wear-resistant product is applied to a surface to be covered by means of a suitable adhesive. Such adhesives are conventional and are preferably applied as an aqueous dispersion. The adhesive comprises a binder, such as rosin, urea-formaldehyde resin, phenol-formaldehyde resin, coumarone-indene resin, lignin, casein, synthetic or natural rubber and the like or mixtures thereof. A filler such as Portland cement, wood flour, clay and the like can also be present.

EXAMPLE 1

Thirty-four and seven-tenths parts of asphaltic bitumen having a softening point temperature of 182° F. were dissolved in 52.1 parts of naphtha (boiling range 203° F.—290° F.)

A solution[1] of dimethylpolysiloxane consisting of 90 percent polymer and 10 percent xylene was prepared to meet the following specifications:

Specific gravity (77° F.)	1.10
Viscosity (77° F.) centistokes	45
Acid number *	0.1

* Defined as the number of milligrams of potassium hydroxide required to react with 1 gram of solution.

Eighty-three hundredth parts of the polymer solution were mixed with 12.4 parts of naphtha and the resulting mixture was added to the asphalt-naphtha solution with vigorous agitation.

A sizing solution with the following composition was obtained:

	Parts
Asphalt	34.7
Naphtha	64.5
Xylene	0.08
Siloxane polymer	0.75
	100.03

EXAMPLE 2

One side of a felt consisting of 42 percent rag fiber, 35 percent wood pulp and 20 percent waste newsprint with a thickness of 0.045 inch was contacted with the sizing solution of Example 1 until a penetration of the solution to a depth of 0.020 inch was attained.

The felt was dried and the sized zone had the following composition:

	Parts per 100 parts dry felt
Felt	100
Asphalt	28
Siloxane polymer	0.6

The unsized side of the felt was passed in contact with a molten bath of an asphalt with a softening point of 145° F. maintained at a temperature of 450° F. The felt was impregnated a depth of 0.030 inch (.005 inch overlap zone). The impregnated zone had a composition of 100 parts of asphalt to 100 parts dry felt.

The sized and impregnated felt was coated front and back with oleoresinous seal and backing paints of conventional formulation and dried. The dry seal coat weight was 0.10 pound per square yard of felt and the backing paint weight was 0.15 pound per square yard of felt.

To the seal coat was laminated a sheet of linoleum composition consisting of 37.9 parts binder, 52.5 parts inert filler and 9.6 parts pigment. The binder consisted of 84 parts oxidized and polymerized linseed oil, 1 part lead naphthenate drier and 15 percent rosin. The filler consisted of 51 parts wood flour and 49 parts calcium carbonate. The product was cured by heat treatment at 170° F. for three weeks.

A covering of the linoleum type characterized by rapidity of adhesive set when bonded to a surface, freedom from tenting of seams, ability to withstand lateral shifting of the surface to which it is bonded without cracking of the wear layer, and ease of removal for replacement is produced.

EXAMPLE 3

One side of a felt similar to that used in Example 2 was contacted with a sizing solution of the following composition:

	Percent by weight
Asphalt	35
Naphtha	65
	100

The felt was dried and the sized zone had the following composition:

	Parts
Felt	100
Asphalt	28

The depth of penetration of the sizing solution into the 0.045 inch thick felt sheet was 0.020 inch.

The unsized side of the felt was passed in contact with a molten bath of asphalt maintained at a temperature of 450° F. The felt was impregnated to a depth of 0.030 inch (0.005 inch overlap zone). The impregnated zone contained 100 parts asphalt per 100 parts dry felt.

The sized and impregnated felt was coated front and back with oleoresinous seal and backing paints of conventional formulation and dried. The dry seal coat thickness was 0.10 pound per square yard of felt and the thickness of the backing paint was 0.15 pound per square yard.

A sheet of linoleum composition similar to that of Example 2 was laminated to the seal coat and the product was cured by heat treatment at 170° F. for three weeks.

A linoleum product is produced.

EXAMPLE 4

To the backing coat of the sized and impregnated felt of Example 3 was applied a second backing coat. The felt was dried. The total dried backing coat weight was 0.32 pound per square yard of felt.

A sheet of linoleum composition similar to that of Example 2 was laminated to the seal coat and the product was cured by heat treatment at 170° F. for three weeks.

A linoleum product is produced.

Samples of the linoleums produced according to Examples 2, 3 and 4 were tested to determine the rate of adhesive setup when the product is bonded to a surface and growth when exposed to water (measure of "tenting").

The rate of adhesive setup is a qualitative test in which the adhesive is spread and the goods laid on the adhesive coated surface in the conventional manner. The linoleum is pulled up by a corner at the end of 14 hours and the degree of adhesive set estimated by observation and experience.

In the growth test, a sample of goods is laid back down loosely on a water-soaked felt pad. The growth of an 8 inch section measured across the machine direction of the felt is measured after 24 hours.

Table 1

Example No.	Siloxane polymer present	Backing paint weight (lbs./sq. yd.)	Percent adhesive set in 14 hours	Growth, inches per 8 inches per 24 hours
2	Yes	0.15	90–100	0.010 in.
3	No	0.15	100	Above 0.025 in. and extreme curling tendency.
4	No	0.32	20	0.018 in.

[1] XR–920 from Dow Corning Corporation, Midland, Michigan.

These results indicate that the presence of organosiloxane polymer in the sized zone of a sized and impregnated felt results in greatly reduced growth and tenting tendency and no loss in speed of adhesive setup as compared to felt without the polymer in the sized zone. Further, when compared with felt with two backing coats, which the prior art has found necessary, the felt was siloxane polymer in the sized zone exhibits much more rapid adhesive setup and even some improvement in rate of growth.

EXAMPLE 5

Twenty-four parts of asphalt having a softening point temperature of 175° F. are dissolved in 74 parts of toluene and to this solution is added 2 parts of a 50 percent solution of methyl hydrogen polysiloxane[2] in xylene.

A sizing solution with the following composition was obtained:

	Parts
Asphalt	24
Toluene	74
Xylene	1
Siloxane polymer	1
	100

One side of a 0.043 inch thick all rag felt (50 percent mattresses, 25 percent rags and 25 percent cotton cuttings) was sized with the sizing solution to a depth of penertation of 0.024. The felt was dried and the sized zone had the following composition:

	Parts per 100 parts dry felt
Felt	100
Asphalt	21
Siloxane polymer	0.9

The unsized side of the felt was contacted with a molten bath of asphalt maintained at a temperature of 465° F. The felt was impregnated to a depth of .025 inch (0.006 inch overlap zone). The impregnated zone had a composition of 105 parts asphalt to 100 parts dry felt.

The sized and impregnated felt was coated front and back with oleoresinous seal and backing paints of conventional formulation and dried. The dry seal coat weight on the impregnated side of the felt and the backing paint weight on the sized side of the felt was 0.13 pound per square yard.

The product is suitable as a backing material for a surface covering product.

EXAMPLE 6

To the seal coat of the product of Example 5 was laminated a sheet of linoleum composition with a composition consisting of 37.9 parts binder, 52.5 parts inert filler and 9.6 parts pigment. The binder consisted of 84 percent oxidized and polymerized linseed oil, 1 percent lead naphthenate drier and 15 percent rosin. The filler consisted of 51 percent wood flour and 49 percent calcium carbonate.

The uncured linoleum on the felt backing was cured at 170° F. for 26 days. A linoleum product characterized by rapid adhesion to a surface and freedom from tenting tendencies is produced.

EXAMPLE 7

The product of Example 2 was fed to a conventional block printing machine and on the seal coat was printed a decorative pattern with standard printing enamels. A typical printing enamel composition is formulated by mixing 100 parts pigments and extenders and 42 parts vehicle consisting of 50 percent linseed and soy bean oils, 27 percent phenolic and alkyd resins, 14 percent naphtha and 1 percent metallic driers to form a thick smooth

[2] DC-1107, Dow Corning Corporation, Midland, Michigan.

paste. This paste is thinned with additional vehicle to produce an enamel of the proper consistency.

The printed sheet leaving the block printing machine is dried for 3 days at 155° F. The decorative product is characterized by ease of adhesion to a surface and freedom from tenting tendencies of the seams.

EXAMPLE 8

The following mixture is heated for 3 minutes in a Banbury mixer at 300° F.:

	Parts by weight
Vinyl chloride-vinyl acetate copolymer	243
Tricresyl phosphate	131
Asbestos	155
Wood flour	40
Silica flour	325
Stearic acid	1
Basic lead carbonate	5
Titanium dioxide	100

The mixture is sheeted between hot metal rolls at 325° F. to produce a smooth sheet of resin composition.

To the seal coat of the product of Example 2 is applied a coating of an adhesive composition comprising 65 parts butadiene-acrylonitrile copolymer latex of 50 percent solids and 35 parts "Vinsol." "Vinsol," made by Hercules Powder Company, is a hard, dark, thermoplastic resin with a melting point between 234° F. and 239° F. which is a byproduct in the extraction of wood rosin from pine stumps.

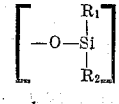
The coated felt is dried and then the adhesive coating is activated by heating to about 235° F. The smooth resin composition sheet is laminated to the adhesive coated felt to produce a product characterized by ease of adhesion to a surface and freedom from severe tenting tendencies.

Although the fibrous sheet produced in accordance with the invention has been described as being useful as a backing for a surface covering product, it may be used alone as a lining felt which is interposed between a flexible smooth surface covering and a subfloor and which is bonded both to the overlying covering and to the subfloor by suitable adhesives. When the fibrous sheet is used as a lining felt, it ordinarily is used without either seal or backing coats.

Any departure from the above description which conforms to the present invention is intended to be included within the scope of the claims.

I claim:

1. In a method of treating a felted fibrous sheet to render it suitable as a backing for a smooth surface covering for floors, walls and the like which comprises impregnating from one surface of the sheet to a depth of about 20 to about 70 percent of the thickness of the sheet with a dispersion in a volatile solvent of a sizing binder selected from the group consisting of bituminous binders and organic resinous binders thereby forming a first zone in said sheet and thereafter impregnating from the opposite surface of the sheet to a depth sufficient to at least contact the first zone but less than 90 percent of the thickness of the sheet with an impregnating binder selected from the group consisting of bituminous binders and organic resinous binders thereby forming a second zone in said sheet, there being at least 10 percent greater percentage of binder in said second zone than in said first zone, the improvement which comprises uniformly incorporating in said dispersion of sizing binder a heat-hardenable organopolysiloxane having a molecular structure comprising repeating units of the radical

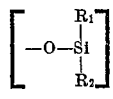


wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group con-

sisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, thereby incorporating in said first zone from about 0.1 to about 5 percent of said organopolysiloxane based on the weight of the dry sheet in the first zone.

2. The method according to claim 1 wherein said organopolysiloxane has a viscosity of about 5 to about 5,000 centistokes when measured at 77° F. in a mixture of 90 percent of the organopolysiloxane and 10 percent xylene.

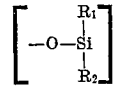
3. In a method of treating a felted fibrous sheet to render it suitable as a backing for a smooth surface covering for floors, walls and the like which comprises impregnating from one surface of the sheet to a depth of about 20 to about 70 percent of the thickness of the sheet with a dispersion in a volatile solvent of a bituminous sizing binder thereby forming a first zone in said sheet and thereafter impregnating from the opposite surface of the sheet to a depth sufficient to at least contact the first zone but less than 90 percent of the thickness of the sheet with a bituminous impregnating binder thereby forming a second zone in said sheet, there being at least 10 percent greater percentage of binder in said second zone than in said first zone, the improvement which comprises uniformly incorporating in said dispersion of sizing binder a heat-hardenable organopolysiloxane having a molecular structure comprising repeating units of the radical



wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, thereby incorporating in said first zone from about 0.1 to about 5 percent of said organopolysiloxane based on the weight of the dry sheet in the first zone.

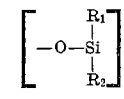
4. The method according to claim 3 wherein said organopolysiloxane has a viscosity of about 5 to about 5,000 centistokes when measured at 77° F. in a mixture of 90 percent of the organopolysiloxane and 10 percent xylene.

5. A fibrous sheet comprising an impregnated zone, a middle zone and a sized zone, said impregnated zone extending inward from one surface of said sheet and said sized zone extending inward from the opposite surface of said sheet, said impregnated zone and said sized zone being separated within said sheet by said middle zone, said sized zone and said middle zone constituting about 20 to about 70 percent of the thickness of the sheet and being uniformly sized with about 5 to about 40 percent of a bituminous sizing binder by weight and 0.25 to 1 percent of a cured organopolysiloxane by weight, the weights being based on the weight of dry sheet in said sized zone and said middle zone, said bituminous sizing binder having a softening point between about 130° F. and about 200° F., said organopolysiloxane having a molecular structure comprising repeating units of the radical



wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen and having a viscosity of about 5 to about 5,000 centistokes when measured at 77° F. in a mixture of 90 percent of the organopolysiloxane and 10 percent xylene, the impregnated zone being uniformly impregnated with more than 40 percent of a bituminous impregnating binder by weight based on the weight of the dry sheet in the impregnated zone, the ratio of the impregnating binder to the dry sheet in the impregnated zone being at least 10 percent greater than the ratio of the sizing binder to the dry sheet in the sized zone and the middle zone, said bituminous impregnating binder having a softening point between about 100° F. and about 160° F. and said middle zone having a thickness of less than 25 percent of the thickness of said sheet and comprising the bituminous impregnating binder in an amount progressively decreasing within said middle zone from the impregnated zone towards the sized zone.

6. In a method of treating a felted fibrous sheet to render it suitable as a backing for a smooth surface covering for floors, walls and the like which comprises impregnating from one surface of the sheet to a depth of about 20 to about 70 percent of the thickness of the sheet with a dispersion in a volatile solvent of a bituminous sizing binder having a softening point of about 130° F. to about 200° F. thereby forming a first zone in said sheet and thereafter impregnating from the opposite surface of the sheet to a depth sufficient to at least contact the first zone but less than 90 percent of the thickness of the sheet with a bituminous impregnating binder having a softening point of about 100° F. to about 160° F. thereby forming a second zone in said sheet, said first zone comprising about 5 to about 40 percent of the bituminous sizing binder by weight based on the weight of the dry sheet in said first zone and said second zone comprising at least 40 percent of the bituminous impregnating binder by weight based on the weight of the dry sheet in said second zone, the ratio of the impregnating binder to the dry sheet in said second zone being at least 10 percent greater than the ratio of the sizing binder to the dry sheet in said first zone, the improvement which comprises uniformly incorporating in said dispersion of sizing binder a heat-hardenable organopolysiloxane having a molecular structure comprising repeating units of the radical

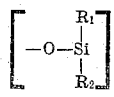


wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, said organopolysiloxane having a viscosity of about 5 to about 5,000 centistokes when measured at 77° F. in a mixture of 90 percent of the organopolysiloxane and 10 percent xylene, thereby incorporating in said first zone from about 0.1 to about 5 percent of said organopolysiloxane based on the weight of the dry sheet in the first zone.

7. The method according to claim 6 wherein said dispersion contains about 0.2 to about 10 percent of said organopolysiloxane.

8. In a method of treating a felted fibrous sheet to render it suitable as a backing for a smooth surface covering for floors, walls and the like which comprises impregnating from one surface of the sheet to a depth of about 20 to about 70 percent of the thickness of the sheet with a dispersion in a volatile solvent of a bituminous sizing binder having a softening point of about 130° F. to about 200° F. thereby forming a first zone in said sheet and thereafter impregnating from the opposite surface of the sheet to a depth sufficient to at least contact the first zone but less than 90 percent of the thickness of the sheet with a bituminous impregnating binder having a softening point of about 100° F. to about 160° F. thereby forming a second zone in said sheet, said first zone comprising about 5 to about 40

percent of the bituminous sizing binder by weight based on the weight of the dry sheet in said first zone and said second zone comprising from 65 percent to 150 percent of the bituminous impregnating binder by weight based on the weight of the dry sheet in said second zone, the improvement which comprises uniformly incorporating in said dispersion of sizing binder about 0.2 to about 10 percent by weight of a heat-hardenable organopolysiloxane having a molecular structure comprising repeating units of the radical



wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, said organopolysiloxane having a viscosity of about 5 to about 5,000 centistokes when measured at 77° F. in a mixture of 90 percent of the organopolysiloxane and 10 percent xylene, thereby incorporating in said first zone from about 0.1 to about 5 percent of said organopolysiloxane based on the weight of the dry sheet in the first zone.

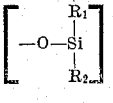
9. The method according to claim 8 wherein said organopolysiloxane has a viscosity of 10 to 100 centistokes when measured at 77° F. in a mixture of 90 percent of organopolysiloxane and 10 percent xylene.

10. The method according to claim 9 wherein said dispersion contains 0.5 to 1.25 percent of said organopolysiloxane by weight and wherein said first zone contains from 0.25 to 1 percent of said organopolysiloxane by weight based on the weight of the dry sheet in the first zone.

11. The method according to claim 10 wherein said organopolysiloxane is methyl hydrogen polysiloxane.

12. The method according to claim 10 wherein said organopolysiloxane is dimethylpolysiloxane.

13. In a method of treating a felted fibrous sheet to render it suitable as a backing for a smooth surface covering for floors, walls and the like which comprises impregnating from one surface of the sheet to a depth of about 20 to about 70 percent of the thickness of the sheet with a dispersion in a volatile solvent comprising about 10 to about 50 percent by weight of a bituminous sizing binder having a softening point of 170° F. to 190° F. thereby forming a first zone in said sheet, drying said sheet to remove said solvent and thereafter impregnating from the opposite surface of the sheet to a depth sufficient to at least contact the first zone but less than 90 percent of the thickness of the sheet with a bituminous impregnating binder having a softening point of 140° F. to 150° F. thereby forming a second zone in said sheet, said first zone comprising about 5 to about 40 percent of the bituminous sizing binder by weight based on the weight of the dry sheet in said first zone and said second zone comprising from 65 percent to 150 percent of the bituminous impregnating binder by weight based on the weight of the dry sheet in said second zone, the improvement which comprises uniformly incorporating in said dispersion of sizing binder a heat-hardenable organopolysiloxane having a molecular structure comprising repeating units of the radical



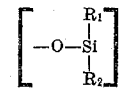
wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, thereby incorporating in said first zone from about 0.1 to about 5 percent of said organopolysiloxane based on the weight of the dry sheet in the first zone.

14. The method according to claim 13 wherein said organopolysiloxane has a viscosity of about 5 to about 5,000 centistokes when measured at 77° F. in a mixture of 90 percent of the organopolysiloxane and 10 percent xylene.

15. The method according to claim 14 wherein said organopolysiloxane is methyl hydrogen polysiloxane.

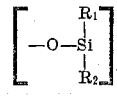
16. The method according to claim 14 wherein said organopolysiloxane is dimethylpolysiloxane.

17. In a flexible felted fibrous sheet comprising a first zone and a second zone, said first zone extending from one surface of the sheet to a substantial depth and being uniformly sized with about 5 to about 40 percent by weight based on the weight of the dry sheet in said first zone of a sizing binder selected from the group consisting of bituminous binders and organic resinous binders and said second zone extending from the opposite surface of the sheet to contact said first zone and being uniformly impregnated with an impregnating binder selected from the group consisting of bituminous binders and organic resinous binders, the ratio of the impregnating binder to the dry sheet in said second zone being at least 10 percent greater than the ratio of the sizing binder to the dry sheet in said first zone, the improvement which comprises incorporating uniformly in said first zone about 0.1 to about 5 percent of a cured organopolysiloxane based on the weight of the dry sheet in said first zone, said organopolysiloxane having molecular structure comprising repeating units of the radical



wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen.

18. In a flexible felted fibrous sheet comprising a first zone and a second zone, said first zone extending from one surface of the sheet to a depth of between 20 percent and 70 percent of the thickness of the sheet and being uniformly sized with about 5 to about 40 percent of a bituminous sizing binder by weight based on the weight of the dry sheet in said first zone, said bituminous sizing binder having a softening point of about 130° F. to about 200° F. and said second zone extending from the opposite surface of said sheet to at least contact said first zone and being uniformly impregnated with a bituminous impregnating binder having a softening point of about 100° F. to about 160° F., the ratio of the impregnating binder to the dry sheet in said second zone being at least 10 percent greater than the ratio of the sizing binder to the dry sheet in said first zone, the improvement which comprises incorporating uniformly in said first zone about 0.1 to about 5 percent of a cured organopolysiloxane, said organopolysiloxane having a molecular structure comprising repeating units of the radical.



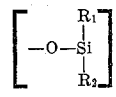
wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, said organopolysiloxane having a viscosity of about 5 to 5,000 centistokes when measured at 77° F. in a mixture of 90 percent organopolysiloxane and 10 percent xylene.

19. The flexible felted fibrous sheet according to claim 18 wherein said organopolysiloxane has a viscosity of 10 to 100 centistokes when measured at 77° F. in a mix-

ture of 90 percent organopolysiloxane and 10 percent xylene.

20. The flexible felted fibrous sheet of claim 19 wherein said first zone contains 0.25 to 1 percent cured organopolysiloxane.

21. In a flexible felted fibrous sheet comprising a first zone and a second zone, said first zone extending from one surface of the sheet to a depth of between 20 percent and 70 percent of the thickness of the sheet and being uniformly sized with 15 to 35 percent of a bituminous sizing binder by weight based on the weight of the dry sheet in said first zone, said bituminous sizing binder having a softening point of about 130° F. to about 200° F. and said second zone extending from the opposite surface of the sheet to at least contact said first zone and being uniformly impregnated with 65 percent to 150 percent of a bituminous impregnating binder by weight based on the weight of the dry sheet in said second zone, said bituminous impregnating binder having a softening point of about 100° F. to about 160° F., the improvement which comprises incorporating uniformly in said first zone 0.25 to 1.25 percent of a cured organopolysiloxane, said organopolysiloxane having a molecular structure comprising repeating units of the radical

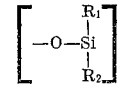


wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, said organopolysiloxane having a viscosity of about 5 to 5,000 centistokes when measured at 77° F. in a mixture of 90 percent organopolysiloxane and 10 percent xylene.

22. The flexible felted fibrous sheet according to claim 21 wherein said organopolysiloxane is methyl hydrogen polysiloxane.

23. The flexible felted fibrous sheet according to claim 21 wherein said organopolysiloxane is dimethylpolysiloxane.

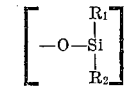
24. In a resilient smooth surface covering for floors, walls and the like, which comprises a flexible felted fibrous backing sheet comprising a first zone and a second zone, said first zone extending from one surface of the sheet to a depth of between 20 percent and 70 percent of the thickness of the sheet and being uniformly sized with about 5 per cent to about 40 percent of a bituminous sizing binder by weight based on the weight of the dry sheet in said first zone, said bituminous sizing binder having a softening point of about 130° F. to about 200° F. and said second zone extending from the opposite surface of said sheet to at least contact said first zone and being uniformly impregnated with a bituminous impregnating binder having a softening point of about 100° F. to about 160° F., the ratio of the bituminous impregnating binder to the dry sheet in said second zone being at least 10 percent greater than the ratio of the sizing binder to the dry sheet in said first zone, and bonded to said opposite surface bearing said second zone a layer of decorative and wear-resistant composition, the improvement which comprises incorporating uniformly in said first zone about 0.1 to about 5 percent of a cured organopolysiloxane, said organopolysiloxane having a molecular structure comprising repeating units of the radical



wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, said organopolysiloxane having a viscosity of about 5 to 5,000 centisokes when measured at 77° F. in a mixture of 90 percent organopolysiloxane and 10 percent xylene.

25. The fibrous sheet according to claim 5 wherein said middle zone has a thickness of between 10 percent and 20 percent of the thickness of said sheet.

26. In a method of treating a felted fibrous sheet to render it suitable as a backing for smooth surface coverings for floors, walls and the like which comprises impregnating from one surface of the sheet to a depth of 30 to 60 percent of the thickness of the sheet with a dispersion in a volatile solvent of a bituminous sizing binder having a softening point of about 130° F. to about 200° F. thereby forming a first zone in said sheet and thereafter impregnating from the opposite surface of the sheet to a depth sufficient to at least contact the first zone but less than 80 percent of the thickness of the sheet with a bituminous impregnating binder having a softening point of about 100° F. to about 160° F. thereby forming a second zone in said sheet, said first zone comprising about 5 percent to about 40 percent of the bituminous sizing binder by weight based on the weight of the dry sheet in said first zone and said second zone comprising at least 40 percent of the bituminous impregnating binder by weight based on the weight of the dry sheet in said second zone, the ratio of the impregnating binder to the dry sheet in said second zone being at least 10 percent greater than the ratio of the sizing binder to the dry sheet in said first zone, the improvement which comprises uniformly incorporating in said dispersion of sizing binder a heat-hardenable organopolysiloxane having a molecular structure comprising repeating units of the radical



wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, said organopolysiloxane having a viscosity of about 5 to about 5,000 centistokes when measured at 77° F. in a mixture of 90 percent of the organopolysiloxane and 10 percent xylene.

27. The method according to claim 26 wherein said bituminous sizing binder has a softening point of 170 to 190° F. and said bituminous impregnating binder has a softening point of 140 to 150° F.

28. The method according to claim 26 wherein said dispersion contains 20 to 40 percent of said bituminous sizing binder by weight.

29. The method according to claim 26 wherein said impregnating binder penetrates into said first zone for a distance of less than about 25 percent of the thickness of said sheet.

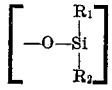
30. The method according to claim 26 wherein said impregnating binder penetrates into said first zone for a distance of between 10 percent and 20 percent of the thickness of said sheet.

31. The method according to claim 29 wherein said organopolysiloxane is methyl hydrogen polysiloxane.

32. The method according to claim 29 wherein said organopolysiloxane is dimethylpolysiloxane.

33. In a flexible felted fibrous sheet comprising a first zone and a second zone, said first zone extending from one surface of the sheet to a depth of between 20 percent and 70 percent of the thickness of the sheet and being uniformly sized with about 5 to about 40 percent of a bituminous sizing binder by weight based on the weight of the dry sheet in said first zone and said second zone extending from the opposite surface of said sheet to at least contact said first zone and being uniformly impregnated with a bituminous impregnating binder, the ratio of the impregnating binder to the dry sheet in said second zone being at least 10 percent greater than the ratio of the

sizing binder to the dry sheet in said first zone, the improvement which comprises incorporating uniformly in said first zone about 0.1 to about 5 percent of a cured organopolysiloxane, said organopolysiloxane having a molecular structure comprising repeating units of the radical



wherein R_1 is a hydrocarbon group containing from 1 to 8 carbon atoms and R_2 is selected from the group consisting of hydrocarbon groups containing from 1 to 8 carbon atoms and hydrogen, said organopolysiloxane having a viscosity of about 5 to 5,000 centistokes when measured at 77° F. in a mixture of 90 percent organopolysiloxane and 10 percent xylene.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,849,335 August 26, 1958

Leon B. Palmer

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading of the printed specification, between lines 7 and 8, insert the following:

-- Continuation-in-part of S. N. 427,229 filed May 3, 1954 --; column 7, line 59, after "impregnated" insert -- to --; column 9, line 7, for "felt was" read -- felt with --; line 29, for "penertation" read -- penetration --; column 10, line 10, for "300° F." read -- 330° F. --.

Signed and sealed this 16th day of June 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents