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SANDING SEALERS EMBODYING POLYVINYL BUTYRAL RESINS

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This invention relates to coating materials and more particularly to sanding sealers for use in finishing wood.

The customary procedure in the finishing of wood surfaces, such as furniture, with lacquer involves first the application of a sanding sealer which should dry rapidly enough to permit sanding within one hour with dry sandpaper; this is followed with two coats of lacquer with one or two hours between coats. The lacquer is frequently rubbed or polished with conventional rubbing materials to complete the finishing operation.

The function of a sanding sealer is to provide a suitable base or foundation for the subsequent coats of lacquer. The sealer must dry quickly and when dry provide a surface which can be sandpapered without clogging the paper. The film provided by the sealer must build up sufficiently so that it may be sanded to provide a smooth level surface. The film must be hard and firm enough to support the subsequent lacquer coatings and prevent them from penetrating the wood. These qualities can be obtained by conventional sanding sealers which ordinarily comprise nitrocellulose lacquers embodying a hard, high melting resin, such as maleic resin, having a quick solvent release. Materials such as zinc soaps, with or without a minor proportion of magnesium carbonate and finely divided soap stone, are frequently incorporated in sealers to make the film more friable and thus improve the sanding properties. Such sanding sealers, however, are unsatisfactory with respect to the durability of the ultimate finish, for the reason that in order to obtain the required qualities of hardness, quick drying and easy sanding, the toughness and elasticity of the sealers has been sacrificed, with the result that wood surfaces finished with conventional sealers and conventional lacquers are subject to marring and scratching and to failure under cold check tests. Heretofore, it has been impossible to produce sanding sealers which embody the desired sanding qualities and also the necessary toughness and adherence required to produce a durable mar resistant finish.

Accordingly, a general object of the present invention is the provision of sanding sealers which have all of the desirable characteristics of prior types of sealers in that they are quick drying and easy to sand and have the ability to hold out the subsequent lacquer coats, and which, in addition, are tough and adherent and thus furnish a strong bond between the lacquer and the underlying wood surface and improve the quality of the entire finish. Another object is the provision of sanding sealers which can be manufactured economically. Another object is the provision

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of sanding sealers which will maintain their toughness and elasticity for long periods of time. Another object is the provision of lacquer sanding sealers which will not adversely affect the qualities of lacquers coated on them.

Briefly, the above and other objects and advantages of my invention are obtained by sealers embodying polyvinyl butyral resins of relatively low viscosity with a suitable percentage of zinc stearate or the like to improve the sanding characteristics. The polyvinyl butyral resins are dissolved in conventional solvents and may be used in conjunction with other film forming materials such as nitrocellulose, ethyl cellulose, cellulose acetate butyrate, and other acetals of polyvinyl alcohol such as the acetaldehyde acetal of polyvinyl alcohol. So far as I am aware, polyvinyl butyral has never before been employed in the production of sanding sealers. Probably the reason for this is that polyvinyl butyral resins in general are tough rather than hard, and have the quality of retaining rather than quickly releasing solvents. Both of these characteristics are seemingly antithetical to the qualities required in a sanding sealer, but contrary to expectations, I have found that sanding sealers incorporating polyvinyl butyral resins in proper concentration dry quickly so that they may be sanded within an hour or less without any sign of clogging the sandpaper. They are hard and firm enough to support the finishing coats properly and in addition their toughness and adhesiveness is such that the entire finishing system is of greater durability and has better resistance to marring or scratching than systems obtainable with prior types of sanding sealers and the same lacquers. Preferably, I employ polyvinyl butyral of low viscosity, although by proper blending with other resins, high viscosity resins may be used with good results. By low viscosity resins I mean resins made from polyvinyl acetate having a viscosity of 10 centipoises or less in solution in benzene at a concentration of 86 grams per liter at 20° C. Viscosities of polyvinyl acetate referred to hereinafter are on this basis, and are indicated by "V" followed by a numeral corresponding to the viscosity.

The following are examples of sanding sealers embodying my invention. These examples are given by way of illustration only and not by way of limitation.

EXAMPLE 1.—A SANDING SEALER EMBODYING A LOW VISCOSITY POLYVINYL BUTYRAL RESIN

A. *Preparation of butyral resin*

A solution was prepared containing 172 grams polyvinyl acetate (V–7) in 1000 cc. of 95 percent ethyl alcohol. To this solution was added (with stirring) 60 cc. of concentrated hydrochloric acid followed by 72 grams of butyraldehyde.

The mixture was allowed to react for 48 hours at 50° C. The solution was then diluted with three liters of 95 percent ethyl alcohol and the polyvinyl butyral precipitated by pouring into water. After washing substantially free of contaminants the fibrous product was air-dried for several days.

B. *Preparation of sanding sealer*

A stock solution was prepared containing 13 grams of the above resin in 100 cc. of solvent (25 cc. of butyl acetate, 75 cc. of methyl acetone). To 60 cc. of this was added 10 cc. of a preground dispersion of zinc stearate in nitrocellulose solution, and 2 cc. of butyl acetate. The final composition contained the maximum butyral resin for good spraying qualities.

The following formula shows the composition of the final mixture ready for application:

Polyvinyl butyral	g—	7.8
Zinc stearate	g—	0.7
½ sec. nitrocellulose	g—	0.7
Butyl acetate	cc—	19.0
Methyl acetone	cc—	40.0
Methyl ethyl ketone	cc—	3.0
Toluene	cc—	3.0

One coat of this composition was sprayed on a gumwood panel. After ½ hour it was possible to sand the panel without drag and without picking up any of the coating on the sandpaper as a gummy deposit. Two coats of a conventional furniture rubbing lacquer (nitrocellulose, hard resin and plasticizer) were then applied by spraying.

After one month, the lacquer-sealer system was compared with a standard system embodying the same lacquer and a conventional sanding sealer. The experimental system was very much tougher and more mar resistant than the standard.

A sanding sealer made as described above is very satisfactory, but the washing and drying of the low viscosity polyvinyl butyral is difficult even under laboratory conditions. Accordingly, in the absence of commercially available low viscosity polyvinyl butyrals, I prefer to employ various other materials in combination with the butyral. For example, I may employ a co-precipitate of polyvinyl butyral and a cellulose derivative produced in accordance with the disclosure of my copending application Serial No. 648,011, filed of even date herewith, for Low viscosity polyvinyl butyral resins and methods of making same. Such a sealer is described in the immediately following example:

EXAMPLE 2.—A SANDING SEALER EMBODYING LOW VISCOSITY POLYVINYL BUTYRAL AND A CELLULOSE DERIVATIVE

A. *Preparation of butyral resin*

The following were mixed in a glass vessel:

Polyvinyl acetate (V–7)	g—	172
95% ethyl alcohol	cc—	600
Butyraldehyde	cc—	80
Hydrochloric acid (sp. g. 1.18)	cc—	50

After allowing the reaction to proceed for four days at 40° C., forty cubic centimeters of additional butyraldehyde was added. After two days the resin (which was insoluble in the reaction mixture) had settled out as a viscous lower layer.

Both layers were rapidly poured into two liters of 95 percent ethyl alcohol containing 24 grams of sodium hydroxide (sufficient to neutralize the hydrochloric acid). The supernatant liquid was then poured off thus removing some of the contaminants.

The residual mass of soft resin was then taken up in about 1 liter of 95 percent ethyl alcohol containing about 5 percent of butyl cellosolve ($C_4H_9.O.CH_2.CH_2OH$), which was added to obtain complete solution of the resin. One hundred grams of ¼-second nitrocellulose (65 grams dry weight) dissolved in 500 cc. of acetone was then mixed with the butyral solution.

The resulting solution was poured into a stream of water, resulting in a white, fibrous precipitate which was easy to wash and dry without agglomeration. The yield was 184 grams of air-dried material. Approximately 65 grams or 35 percent of this was cellulose nitrate.

B. *Preparation of sanding sealer*

Ten grams of the above co-precipitated material was dissolved in 85 cc. of solvent. To this solution was added 15 cc. of a dispersion of zinc stearate in cellulose nitrate solution.

The final composition was as follows:

Polyvinyl butyral	g—	6.5
Cellulose nitrate	g—	4.4
Zinc stearate (8.2% of vehicle solids)	g—	0.9
Toluene	cc—	47.0
Butyl acetate	cc—	35.0
Ethyl acetate	cc—	13.0
Methyl ethyl ketone	cc—	5.0

This composition, which contains about 12 percent of solids by weight, was sprayed without difficulty onto a gumwood panel. After drying for ½ hour, the panel was sanded readily without any drag or gumming of the sandpaper. The wood panel was then finished with two coats of the same conventional nitrocellulose furniture rubbing lacquer used in the previous example, and tests after 60 days indicated that the entire finish system was much tougher and had greater resistance to marring than a similar panel finished with a conventional sanding sealer and two coats of the same lacquer.

Sanding sealers may also be produced from co-precipitates of polyvinyl butyral and ethyl cellulose and of polyvinyl butyral and cellulose acetate butyrate, such as the co-precipitates described in Examples 4 and 5 of my aforesaid copending application, using appropriate proportions of solvents to give the desired viscosity.

EXAMPLE 3.—A SANDING SEALER EMBODYING A COMMERCIALLY AVAILABLE POLYVINYL BUTYRAL

The following were placed in a pebble mill and ground for 18 hours:

Polyvinyl butyral VF–4100	g—	56.7
Zinc stearate	g—	3.39
Ethyl acetate	cc—	590.00
Butyl acetate	cc—	295.00
Ethyl alcohol (denatured)	cc—	295.00

An equal volume of toluene (1180 cc.) was added to reduce the concentration of butyral sufficiently to allow application by spray gun. Higher concentrations of this resin "feather" or "spider web" from the gun.

The above composition sanded readily after drying ½ hour. Although the solids content of the sealer could not be made as high as ordinarily employed, "holdout" of finish coats was fairly satisfactory and comparative tests demonstrated substantial improvement in toughness in

the sealer-lacquer system as compared to a standard system.

Polyvinyl butyral VF-4100 is manufactured by E. I. du Pont de Nemours & Company and is a polyvinyl butyral resin having a viscosity of 40 cp. in 95 percent ethyl alcohol at a concentration of 5 percent by weight at a temperature of 80° F. and containing about 10 percent of unreacted vinyl alcohol groups.

EXAMPLE 4.—A SANDING SEALER EMBODYING THE SAME POLYVINYL BUTYRAL USED IN EXAMPLE 3 AND AN ACETALDEHYDE ACETAL OF POLYVINYL ALCOHOL

The following materials were ground for 12 hours in a pebble mill:

Polyvinyl acetal of acetaldehyde made from polyvinyl acetate (V-5)	g..	150.4
Polyvinyl butyral VF-4100	g..	49.6
Zinc stearate suspended in nitro-cellulose solution	g..	15.9
Toluene	cc..	946.0
95% ethyl alcohol	cc..	592.0
Ethyl acetate	cc..	148.0

The resulting mixture was thinned to spraying viscosity with 1950 cc. of a thinner composed of the following:

	Parts by volume
Ethyl acetate	5.0
Butyl acetate	22.5
95% ethyl alcohol	10.0
Butanol	7.5
Toluol	55.0

The sealer gives very good results, spraying readily at reasonable concentrations of solids; in this respect it is superior to the sealer of Example 3. The sprayed coating may be sanded without drag or gumming of the sandpaper, and tests after aging indicate that a system of finishing materials embodying this sealer and two coats of the same conventional nitrocellulose furniture rubbing lacquer used in previous tests is much superior, insofar as toughness, resistance to marring and durability, are concerned, to a system embodying two coats of the same lacquer over a conventional sanding sealer.

EXAMPLE 5.—A SANDING SEALER EMBODYING A MIXED POLYVINYL ACETAL OF BUTYRALDEHYDE AND ACETALDEHYDE (REFERRED TO HEREINAFTER AS "BUTYRACETAL"), AND MADE WITHOUT ISOLATING THE RESINS

Sanding sealers of this type are disclosed and specifically claimed in my copending application Serial No. 648,013 filed of even date herewith for Coating compositions embodying polyvinyl butyral resins and methods of making the same. One such sealer may be produced as follows:

The following ingredients were mixed in the order indicated and reacted during two days at 50° C. with occasional stirring:

Polyvinyl alcohol of 5 cp. viscosity in 4% by weight solution in water at 25° C.	g..	264
95% ethyl alcohol	cc..	1500
Sulfuric acid (sp. g. 1.84)	cc..	10
Butyraldehyde (97.2 g.)	cc..	120
Paraldehyde (59.4 g.)	cc..	60

The resulting thick, somewhat hazy dope was neutralized with 181 cc. of a solution made by dissolving 100 grams sodium hydroxide in 1 liter of ethyl alcohol. The resulting solution had a pH of about 7.

Solvents were then added as follows to facilitate filtering and to provide suitable consistency for spraying:

Toluene	cc..	1600
Methyl ethyl ketone	cc..	900
Petroleum naphtha (B. P. 93°–112° C.)	cc..	500

The solution was filtered with pressure through paper to remove sodium sulfate and gel particles.

Zinc stearate (21 grams) was ground into 3525 cc. of the solution and 87.5 grams of ½-second nitrocellulose was added. This amount of nitrocellulose improves the sanding qualities and does not detract greatly from the toughness of the final system.

The resulting sanding sealer consists of the following:

Polyvinyl "Butyracetal"	g..	262.0
½-sec. nitrocellulose (65%) (50 g. dry wt.)	g..	87.5
Zinc stearate (6.7% of vehicle solids)	g..	21.0
95% ethyl alcohol	cc..	1500.0
Toluol	cc..	1600.0
Petroleum naphtha (B. P. 93°–112° C.)	cc..	500.0
Methyl ethyl ketone	cc..	900.0

When sprayed on wood the composition dried quickly and was sanded after ½ hour without drag or gumming. When two coats of the same clear lacquer as used in previous tests were applied over the sealer, "hold-out" was equivalent to conventional sealers. Comparative tests of the sealer-lacquer system showed much greater toughness than a standard system embodying a conventional sealer and the same lacquer.

Sanding sealers made according to the above examples all have the characteristics of drying so that they may be sanded within an hour after spraying, of being easily sanded to a smooth surface without drag or gumming of the sandpaper, of being compatible with ordinary nitrocellulose lacquers and "holding-out" succeeding lacquer coats, and of being tough and adherent so that a finish system embodying one of the sanding sealers of the present invention and a conventional lacquer is superior to a system embodying the same lacquer and a conventional sanding sealer, with respect to toughness, adherence, durability, resistance to marring and scratching and when subjected to cold check tests.

The foregoing examples show that butyral resins may be used successfully in sanding sealers of various formulations and in combination with various other resins and the like. However, in order to secure proper toughness and adhesion, I prefer that not less than 50 percent of the film forming material content be polyvinyl butyral. Where polyvinyl butyral resins are used without substantial quantities of other film formers, it is preferable to use polyvinyl butyrals of low viscosity, i. e., having viscosities corresponding to the viscosity of polyvinyl butyrals made from polyvinyl acetate having a viscosity of 10 cp. or less, and preferably about 7 cp. Also if polyvinyl butyrals made from polyvinyl acetate having a viscosity of less than about 4 cp. are employed, it is desirable to blend them with higher viscosity butyrals such as those made from polyvinyl acetate having a viscosity of about at least 6 cp. in order to prevent the sealer from being too brittle. It is also desirable to employ resins in which the hydroxyl content, as polyvinyl alcohol, does not exceed about 22 percent. Such resins can tolerate more modifying agents, such as cellulose derivatives, and other polyvinyl acetals while retaining the desired characteristic of polyvinyl butyral,

than resins of greater hydroxyl content. In order to obtain good sanding qualities it is desirable that a material such as zinc stearate or other suitable agent be incorporated in the sealers to make the films more friable; also the sealers must not contain substantial quantities of any material, such as shellac, which will gum or clog the sandpaper. In the prior art it has always been taught that maleic-rosin resins must be present to obtain good solvent release. However, I have found that no substantial amount of maleic resins can be tolerated in butyral sealers because such maleic resins immediately cause loss of toughness.

The formulations set forth above may be modified to obtain various characteristics in the sealers, and various other changes and modifications may be made without departing from the teachings of my invention. It is therefore to be understood that the foregoing examples are given by way of illustration and not as limiting the invention.

I claim:

1. A sanding sealer particularly adapted for application to wood surfaces preparatory to the application of lacquer thereto, said sealer comprising an organic solvent, a major portion of the solids content of said sealer being a polyvinyl butyral resin having the viscosity of a polyvinyl butyral resin made from polyvinyl acetate having a viscosity of not more than 10 centipoises at 20° C. in a solution in benzene containing 86 grams per liter, said sealer containing substantially no shellac and substantially no maleic resin, said sealer containing zinc stearate in the amount of not more than 10 percent of the solids content thereof, and said sealer drying sufficiently rapidly to permit sanding within one hour after spraying without drag or gumming of the sandpaper.

2. A sanding sealer according to claim 1 wherein the total solids content of the sealer at spraying viscosity is at least 7 percent by weight.

3. A sanding sealer according to claim 1 in which the solids content comprises a co-precipitate of low viscosity polyvinyl butyral and a cellulose derivative from the group consisting of cellulose nitrate, cellulose acetate butyrate and ethyl cellulose and mixtures thereof.

4. A sanding sealer particularly adapted for application to wood surfaces preparatory to the application of lacquer thereto, said sealer comprising an organic solvent a major portion of the solids content of said sealer being a mixtue of acetals of polyvinyl alcohol one of which is polyvinyl butyral, said sealer containing a small percentage but not more than 10 percent of zinc stearate.

5. A sanding sealer according to claim 4 wherein the weight of polyvinyl butyral is at least half the total weight of acetals of polyvinyl alcohol present.

6. A sanding sealer particularly adapted for application to wood surfaces preparatory to the application of lacquer thereto, said sealer comprising an organic solvent, the resin content of said sealer comprising polyvinyl butyral and the acetaldehyde acetal of polyvinyl alcohol, said sealer containing a small percentage but not more than 10 percent of zinc stearate.

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The following references are of record in the file of this patent:

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