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FLOOR COVERING

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This invention relates to floor coverings and more particularly to an improved process for producing smooth surface floor coverings carrying the color pattern substantially through the sheet.

5 In co-pending application Serial Number 12,110 filed by L. L. Larson and G. L. Schwartz of even date herewith, there is disclosed a process for making floor coverings in which a printed and substantially filled sheet is produced and cured in a single continuous operation. The process just mentioned consists essentially of saturating with low body drying oil resin varnish of low solvent content a highly absorbent paper felt of about .05" thickness from the face to an extent 10 of about 35-70% by volume of the saturating capacity of the sheet; printing the sheet from the face with a paint of low solvent content; applying saturant to the back of the sheet (a step which may be omitted if the face saturant and print paint occupy 95% or more of the initial saturating capacity of the sheet) and curing the printed and saturated sheet at elevated temperature. Subse- 15 quent processing involves simply the surface finishing steps. For this reason the process has an important advantage in that further application of saturant to fill the sheet and additional time-consuming curing steps are avoided.

This invention has as an object an efficient and simplified process which is adapted to operation with thinner sheets than those used in the fore- 20 going process and which also produces in a continuous operation a printed, well filled and cured sheet. A further object is process and product improvements in the manufacture of a smooth surface floor covering having the color or pattern visible on the surface and extending substantially through the sheet. Other objects will appear hereinafter.

The foregoing objects are accomplished by the following invention which consists essentially in utilizing in the printing operation a print paint and a thin (about .01" to about .015") sheet of absorbent paper felt, the paint and sheet being of such character that the application of the print 25 paint alone not only prints the pattern through the sheet but supplies substantially all of the saturant or filling material contained in the sheet. We then apply back saturant and cure the printed and filled sheet at elevated temperature. It should be observed, however, that the sheet material is saturated in substantial amount by the print paint alone and that the pores toward the surface of the sheet are filled to an extent that further saturant is not applied to the face of the 30 sheet after the curing step.

After curing, the sheet may be finished by the methods, such as sanding, calendering, or plate pressing followed by waxing, lacquering, or varnishing, as described in the above mentioned ap- 35 plication. The thin printed sheet is then lami-

nated to any suitable base such as an asphalt saturated felt. The back saturant need not always be applied immediately after printing and before curing since the back is for many purposes satisfactorily filled with adhesive during the lami- 40 nating operation.

The saturating base is a porous, absorbent, continuous sheet. The width of the sheet is regulated to the width of the print machine, and the printed area is commonly two or three yards wide with an extra inch or more on each side for the bands that carry the sheet over the print machine. 45

The physical properties of the absorbent sheet have an important influence on the successful operation of the process. The kerosene absorp- 50 tion should be within 180 to 240%, and the preferred range is 210 to 230%. The porosity of the sheet must be high or the print paint will not penetrate satisfactorily. For example, a sheet .01" thick should have a porosity within 2.0 to 6.0 55 seconds (time required for the displacement of 400 cc. of air through three plies of the sheet on a Gurley Densometer), and the preferred value is about 4.0 seconds. A saturating base having the above requirements may be made by the process described in U. S. Patent No. 1,857,100.

In the operation of our improved process the print paints serve to impart a pattern substantially through the sheet, to fill the pores in the upper part of the sheet, and to seal the surface. 60 By properly regulating (1) the amount of print paint, (2) the properties of the print paints, and (3) the properties of the absorbent base, the printed sheet will carry a pattern substantially through the sheet, the pores in the upper part of the sheet will be filled, and the surface will be coated with a continuous film of paint as a pattern with good definition of design. Thus, a floor covering is produced that on the one hand is similar to felt base floor covering in that the sur- 65 face is coated with a continuous film of paint, and that on the other hand resembles inlaid linoleum in that the pattern visible on the surface extends through the sheet. In order to accomplish this object the print paint should have (1) a high viscosity; (2) a high pigment content; and (3) a low solvent content.

The print paints serve to fill the sheet as well as to impart a pattern substantially through it, so they have an important influence on the 70 quality of the finished product, especially in regard to cleanability. In order to obtain the maximum filling of the sheet, it is important that the solvent content of the paint should be as low as possible consistent with satisfactory penetrating 75 properties. Also, the paint should be formulated so that the finished product will have good wearing and cleaning properties. As the binder for the paint, we prefer to use a varnish consisting of a resin, such as one of those hereinafter men- 80

tioned, China-wood oil, and linseed oil, and the optimum composition is around 10-20% by weight of resin and a China-wood oil content equal to approximately 20% by weight of the total oil. A factor which limits the use of higher China-wood oil contents is the tendency of the paint to skin on the print blocks. However, the addition of an oxidation inhibitor to the paint permits the use of a China-wood oil content as high as 50% or more of the total oil.

The paint should contain sufficient pigment to have good covering power, brightness and depth of color, and satisfactory hardness, dryness, cleanability, and resistance to expansion through changes in atmospheric humidities. These properties are best obtained by using a high pigment content. For the present purpose we use a print paint the non-volatile part of which consists of about 55% to 70% by weight of pigment.

The viscosity of the paint should be as high as possible consistent with satisfactory printing properties. The object is to hold the solvent content of the paint to a minimum, and obtain a finished product substantially free from large pores. The viscosity for best results should be from 3.0 to 6.0 poises at 77° F., and the solvent content should not be greater than 20% by volume and preferably 15% or less.

In the practice of the process described herein the print paint before curing occupies at least 50% of the saturating capacity of the sheet, and preferably it should occupy 60% to 80%. When the sheet is saturated by printing with print paint to the extent just mentioned the application of further saturant is not required and in fact the sheet is incapable of accepting further saturant from the face or printed side in substantial amount. The initial saturating capacity is determined by the Standard A. S. T. M. method for measuring the kerosene absorption of roofing felts.

The following examples are illustrative of the methods used in practicing our invention:

Example I

The saturating base has the following physical properties:

Weight per square yard.....	pound.....	0.21
Thickness	inch.....	0.01
Kerosene absorption.....	per cent.....	223
Porosity (Gurley Densometer, 400 cc. displacement of air through three plies of sheet).....	seconds.....	4.2
Mullen bursting strength.....	pounds.....	18

The sheet was prepared in accordance with regular paper making procedures from a furnish consisting of 70 parts of artificially crinkled kraft fibers, 30 parts of soda pulp, 10 parts of swollen corn starch, ¼ part of rosin as rosin size, alum to precipitate the rosin, and the usual amount of water for suspension of the fiber.

The sheet was printed by the conventional printing machinery such as that illustrated by the above mentioned application on the wire side with 0.41 pound per square yard of Print Paint "A" described below and then saturated from the back with 0.15 to 0.20 pound per square yard of Saturant "B". The sheet was then pulled into a straight rack oven and cured for 2 days at 150° F. It was then finished by sanding and waxing the surface. The finished sheet was laminated with a waterproof adhesive to a 0.043" thick sheet of asphalt impregnated felt.

The absorbent sheet thus processed is well filled, the pattern extends substantially through

the sheet, and the surface is sealed to such an extent that a fairly continuous coating of paint remains on the surface with excellent definition of design.

Example II

The procedure was as outlined in Example I except that the print paint was applied to the felt side of the sheet. In this case the sheet is well filled, but a continuous film of paint is not held on the surface. Thus a product having a lower gloss and a softer appearance is produced.

Example III

Instead of the print paint used in Example I a paint was used which consisted of equal parts by weight of Print Paint "A" and Saturant "A". The admixture of Saturant "A" with the print paint increases the China-wood oil content of the paint thus improving the grease resistance and the cleanability of the finished product. Also, a high amount of a low cost filling pigment is incorporated thus cheapening the process without sacrificing quality.

Example IV

A saturating base is prepared by regular paper making procedure from a furnish consisting of cotton linters, free from fiber dust, and cooked to remove oil and hull particles, and then bleached. The thickness is 0.015", weight per square yard 0.33 pound, kerosene absorption 190%, and Mullen bursting strength of 17 pounds. The sheet is printed on the felt side as in Example II using the same print paint mixture to the amount of 0.57 pound per square yard. After curing at 140-150° F. for 30 hours it is removed and passed between two heated smooth calender rolls set to 0.010" clearance. The thickness after calendering is 0.014". It has a smooth dense surface with practically all of the pores closed. A thin film of wax is applied to the surface from a hot melt using a machine that polishes the wax before it is completely cooled. It is then combined by means of a stearin pitch to a sheet of asphalt impregnated felt of 0.047" thickness. The top sheet of this laminated product is denser and its surface design is clearer than that of Example I.

Example V

The saturating base used in Example I is treated with an alcoholic solution of glycerine so that it retains 0.022 pounds of glycerine per square yard and, after evaporation of the alcohol, it is printed on the wire side with 0.43 pound of Print Paint "A". After curing in an oven at 140-150° F. for 24 hours it is passed between heated calender rolls set to 0.006" clearance. It is coated with a pyroxylin lacquer containing a high softener ratio and dried by quick passage through a heated coating chamber.

The product is very pliable, has a smooth surface, and is useful as coverings for tables, shelves, etc.

The composition of the saturants and print paint mentioned in the examples is as follows:

Saturant "A"

		Parts by weight
Pigment (such as precipitated calcium carbonate treated with a wetting agent).....		40.50
Varnish "A".....		
Resins, drying oils, and driers.....	40.5	45.00
Mineral spirits.....	4.5	
Creosol.....		0.32
Mineral spirits.....		14.18

The above ingredients are ground in a pebble mill for approximately 20 hours.

The saturant has a viscosity of 4.5 poises at 77° F. This viscosity will vary somewhat from batch to batch.

Varnish "A", which is a constituent of this saturant, is prepared as follows: 100 parts of a rosin modified phenolic resin (such as BS-1 Amberol), 769.3 parts of China-wood oil, and 77.8 parts of varnish maker's alkali-refined linseed oil are run to 525° F. The kettle is then removed from the fire and 100 parts of French rosin (combined fused resins of lead and calcium) and 1.25 parts of manganese resinate are added. When these have fused, 115 parts of a heat bodied alkali-refined linseed oil (body of S on the Gardner-Holdt scale) is added. Finally, 131 parts of mineral spirits and 2.8 parts of a lead-manganese liquid drier (4.77% lead, 1.42% manganese) are added. The above amounts are in parts by weight. The varnish is strained while hot. The varnish has a viscosity of Z-1±1 bubble at 77° F. on the Gardner-Holdt scale.

Saturant "B"

Parts by weight

Mill base (roller mill grind)	
Pigment (such as glider's whitening)	57.40
Varnish "A"	
Resins, drying oils and driers	38.34
Mineral spirits	4.26
	42.60
Formulation of saturant	
Mill base	84.10
Creosol	0.36
Mineral spirits	15.54

The saturant has a viscosity of 3.60 poises at 77° F.

Print Paint "A"

Parts by weight

Pigments	
White pigment (such as litho-pone treated with a wetting agent)	53.60
Tinting pigment (such as chrome yellow)	1.60
	55.20
Varnish "B"	
Resins, drying oils, and driers	36.72
Mineral spirits	4.08
Mineral spirits	4.00

A thorough dispersion of the pigments in the vehicle is obtained by roller mill or pebble mill grinding.

The paint has a viscosity of 4.0 poises at 77° F. A more practical procedure for preparing the paint is to make individual grinds of the pigments with the vehicle, and then tint the white paint with the colored paint.

Any sheet material possessing the characteristics of kerosene absorption, porosity, strength and pliability may be used for the base, such as cotton liners or a mixture of artificially crinkled kraft fibers with mineral wool, asbestos, etc.

Paints other than those described herein may be used providing they have the proper viscosity, solids content, drying characteristics and that they contribute surfaces of satisfactory grease and water resistance.

Any softeners for the cellulose fibers may be

used, such as sodium lactate, glycols, etc., providing they do not cause rapid deterioration of the sheet. The softeners may be applied to the sheet at any stage of its manufacture or they may be applied as a dispersion in the paint or back saturant.

The calendering or plate pressing are done after the cure is complete in order to obtain low cost production. However, this operation may be effected when the cure is from 50% to 80% completed if a higher density product is desired.

The product of the present invention is especially useful for floor coverings. It also has many similar uses such as wall coverings and oil cloth, and for these purposes the sheets processed are somewhat thinner than the sheets used for floor coverings.

It will be seen from the foregoing description that we have developed an economical and efficient process for the manufacture of floor coverings which have the print paint coloring or design extending through the sheet and which serve as inexpensive substitutes for linoleum.

A particular advantage of our invention is the production of a substantially filled sheet carrying a pattern well through the sheet in a single continuous operation which involves simply the printing of the sheet, application of back saturant, and curing. The short period of time required for the manufacture of the product is an important commercial advantage. Another advantage is that the print paint fills the pores in the upper part of the sheet so that there is no need for a subsequent saturating operation which would dull the colors and thereby detract greatly from the full and rich appearance of the product.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments thereof except as defined in the appended claims.

We claim:

1. In a process for producing in a single continuous operation a substantially filled and printed floor covering, the steps consisting of printing absorbent sheet material from the face with high viscosity, high pigment, low solvent content print paint the non-volatile part of which consists of from 55% to 70% pigment, and thereby through the application of said print paint alone in the printing step saturating the sheet in amount from 60% to 80% of the saturation capacity of the sheet, said paint penetrating and printing through the absorbent sheet sealing the pores toward the surface to an extent that the sheet will not accept from the face any substantial amount of additional filling material, and then applying saturant to the sheet from the back, and then curing the sheet at elevated temperature, the application of said saturant producing a substantially filled sheet at the curing stage.

2. The process set forth in claim 1 in which the absorbent sheet material has a kerosene absorption of 180% to 240%, and a porosity 2 to 6 seconds.

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