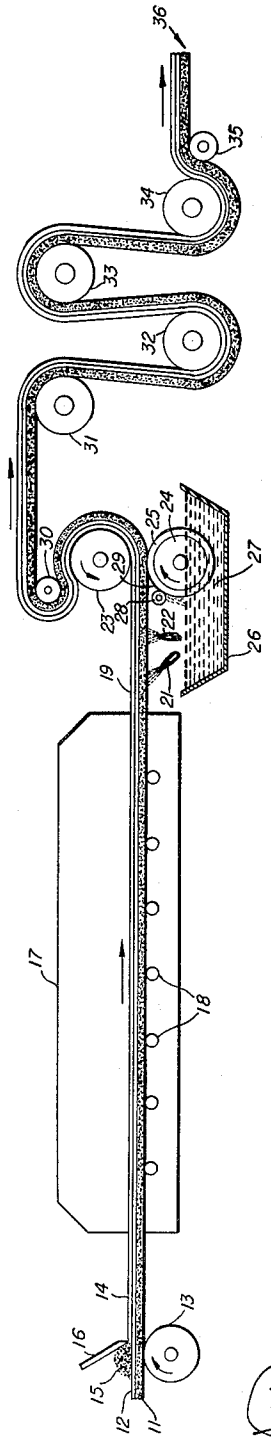
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METHOD OF IMPARTING DIMENSIONAL STABILITY
TO FELT BACKED SURFACE COVERINGS
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METHOD OF IMPARTING DIMENSIONAL STABILITY TO FELT BACKED SURFACE COVERINGS

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This invention relates to decorative printed surface coverings having a fibrous backing and a wear resisting top layer and in particular to a method of imparting dimensional stability to such products.

Decorative printed surface coverings having a felted fibrous backing are well known in the art and find wide application as coverings for floors, walls and the like surfaces. In recent years such products have come to be produced with a decoration printed by the rotogravure printing technique with the resulting thin design layer being protected by a clear layer of wear resisting composition. Clear vinyl resinous compositions have been used to form the wear resisting top layer since vinyl resins have excellent properties of resistance to abrasion and to attack by chemicals of the type normally found in households.

In one widely used method of producing rotogravure printed surface covering products a felted fibrous sheet is impregnated with a strengthening impregnant such as asphalt and the sheet is provided with a plurality of sealing coats of paint on both sides. The side of the impregnated felt backing upon which the decorative design is to be printed is provided with a sufficient thickness of seal coating paint to provide a smooth white background which forms an ideal base for the subsequent printing operation. The opposite side of the felt backing sheet is also coated in order to prevent bleeding of the asphalt saturant from the backing during the high temperature treatment to which the product is subjected during its manufacture. After the felt backing has been coated on both sides as described above, a decorative design is printed on the upper surface of the coated backing by means of high speed rotogravure printing. A layer of clear vinyl resinous composition is then applied to the decorative design and the sheet is passed through an oven maintained at temperatures up to 450° F. to fuse the vinyl resinous composition in the clear layer in order that the layer can obtain the optimum strength and abrasion resistance.

U.S. patent application Serial No. 781,391, filed December 18, 1958, by Paul C. Wetterau, entitled "Method of Removing Surface Defects From Printed Surface Coverings," discloses that a printed sheet bearing a fused clear layer of wear resisting composition is passed directly from the fusion oven to the nip between a metal roll which engages the clear fused layer and a resilient surfaced roll which supports the backing, thereby removing surface defects from the clear fused layer. The sheet is stripped from the surface of the metal roll, cooled, inspected and finally packaged for sale.

It has been found that products produced by the method described above tend to grow after they are installed. This phenomenon of growth is particularly undesirable since a floor covering, if installed to closely contact the walls of a room will, of necessity, tend to bulge if there is any evidence of growth. It has been discovered that the reason for this growth is the absorption of water vapor from the atmosphere into the impregnated felt backing of the product. This backing is in an essentially bone dry condition after the sheet leaves the high temperature fusion oven. The absorption of water vapor into the backing after the product is installed causes the individual fibers in the felt to swell and expand, resulting in the undesirable growth of the product as described above.

It is an object of the invention to provide a method of introducing a controlled amount of moisture into the backing of a printed surface covering, thereby imparting dimensional stability to the product and preventing its growth or shrinkage after installation. Other objects and the advantages of the invention will appear hereinafter.

In accordance with the invention, a printed surface covering comprising a fused clear layer of wear resisting composition, a decorative design and an impregnated felted fibrous backing is passed immediately from the oven which fuses the clear layer over a plurality of water sprays which spray the backing and then between a metal roll which engages the fused layer and a resilient surfaced roll which supports the backing, said resilient surfaced roll bearing upon the surface thereof a thin film of water. The combination of the water sprays and the wet surface of the resilient surfaced roll serves to introduce sufficient moisture into the backing to insure a final product which is free from tendencies to grow or shrink after installation.

The invention will be described with reference to the drawing which illustrates in schematic form an embodiment of the invention.

A sheet **11** of impregnated felted fibers bearing a film of backing paint on its bottom side and a film of coating paint on its upper side upon which is printed a decorative design layer **12** passes over a roll **13**. A clear film of liquid vinyl resinous composition **14** is applied to the design layer from a mass of vinyl resinous composition **15** by means of a doctor knife **16**. The coated sheet is then passed through a hot air oven **17** in which it is supported upon spaced rollers **18**. The hot sheet emerging from the oven bears an upper layer **19** of fused clear vinyl resinous composition which protects the decorative design layer. The back of the sheet is contacted with a uniform water spray pattern from spray units **21, 22** and then the sheet passes between a steel roll **23** which engages the fused clear layer and a backing roll **24** having a resilient covering **25** which supports the felt. The resilient covered backing roll revolves partially immersed within a pan **26** containing a supply **27** of water. Water is carried out of the pan on the resilient surface of the backing roll and is doctored by a doctor roll **28** to leave a thin film **29** upon the roll which contacts the felt in the nip between the rolls. The sheet passes around the metal roll **23** and is removed therefrom over a roll **30** and is cooled by passing over cooling rolls **31, 32, 33, 34**. The printed product **36** is removed from the last cooling roll over a roll **35** and is inspected, packaged and shipped for sale. The printed product is dimensionally stable and is free from tendencies to grow or shrink after installation.

The fibrous base upon which the decorative design is printed is most frequently a web of felted fibers. The felt generally is produced using a Fourdrinier or cylinder paper machine with the thickness of the resulting sheet being that usually used in floor and wall coverings, that is, from 0.02 to 0.08 inch. The fibrous material used is normally cellulosic in origin, although other fibers can be used including those of animal and mineral origin. The sources of cellulosic material can include cotton or other rag material, wood pulp including both ground wood and chemical wood pulp, paper, boxes, or mixtures thereof in any proportion. The web can also contain fillers such as wood flour.

The felt is normally strengthened and improved in water resistance by impregnation with a bituminous material. Numerous bituminous materials are well known as impregnants in the production of printed surface coverings and include asphalts of petroleum or natural origin and tars and pitch residues of animal or vegetable origin. These materials can be treated to attain the desired physical properties of softening point or viscosity for satisfac-

tory impregnation by such treatment as air blowing, steam distillation and the like.

The impregnated felt is provided with seal coats on both sides in order to provide a smooth surface upon which the decorative design can be printed and to seal against the migration of any impregnant out of the back of the finished product. The seal coats serve to mask the generally dark color of the impregnated felt backing and also create a smooth uniform base for printing. The seal coats are preferably applied in the form of an aqueous dispersion of a vinyl resin in the presence of plasticizer and large amounts of pigment and filler. Seal coat systems of the type described in co-pending application of John Biskup, Spencer Johnson and Paul C. Wetterau, Serial Number 750,124, filed July 22, 1958, are particularly effective. The seal coats for the side of the impregnated felt opposite to the side which is printed can be formulated as described above, but for reasons of cost are preferably formulated from comparatively cheap binder systems such as butadiene-styrene copolymer, polyvinyl acetate and the like in the presence of large amounts of filler, up to as high as 85 percent by weight of the dried seal coat film.

The base sheet, either in the form of a seal coated felt or paper or other suitable printing base, is then printed with a decorative design using printing inks which are compatible with the vinyl composition wearing surface layer. Printed products having a wearing surface layer are most commonly printed by the high speed rotogravure technique. In this technique of printing each color is applied from an etched cylinder in the form of closely spaced dots upon a white background. The sheet is heated to dry the printing ink after each cylinder of the rotogravure printing press. Printing inks comprising vinyl resinous binders in organic solvents are most commonly used. In addition to the rotogravure technique the decorative design can be applied by any of the other rotary graphic art printing processes such as offset printing, lithography and the like. Alternately, the printed design can be applied by the flat bed printing process.

The decorative wearing surface layer is applied as a plastisol, organosol or latex of a vinyl resin with an organosol being the most widely used type. The composition is applied by any of the conventional techniques of coating such as reverse roller coating or doctor knife coating. After application of the clear wearing surface layer the sheet is subjected to elevated temperatures to bring about fusion of the vinyl resinous composition applied. Using the vinyl resins which are most commonly used in clear wearing surface layers, for example polyinvyl chloride, the layer must attain a temperature in the order of 350 to 375° F. in order to effect fusion. The temperature of the fusion oven and residence time in the oven are adjusted so that complete fusion of the wearing surface layer is attained.

In accordance with the invention, the hot sheet bearing the layer of fused wear resisting composition leaving the fusion oven is immediately contacted on the side opposite to that bearing the decorative design with a uniform spray of water. The spray can be delivered to the back of the sheet from a plurality of spray units, such as nozzles, which are adapted to deliver a fine controlled spray of water uniformly over a given area. The spray units are spaced so as to deliver a uniform amount of water over all portions of the back of the sheet; that is, the side opposite to that bearing the decorative design. The quantity of water applied by the sprays is normally in the range of 0.0004 to 0.005 gallon per square foot of sheet with a range of 0.0008 to 0.002 gallon per square foot being particularly effective.

The sheet after water spray application, as described above, passes immediately between a metal surface which engages the fused wearing surface layer and a resilient surface which supports the base upon which the design is printed. For continuous operation, the metal and resilient surfaces are preferably in the form of rolls, as illustrated in the drawing. The temperatures of the two rolls must be maintained within carefully controlled limits in order to yield a satisfactory product. When the wearing surface layer is formed of a vinyl resinous composition and leaves the fusion oven at a temperature of about 350° F. the metal roll should be maintained at a temperature between about 150° F. and about 230° F. and the resilient surface roll should be maintained at a temperature preferably between about 100° F. and about 175° F. For particularly effective operation, the metal roll should have a temperature between 160° F. and 200° F. and the resilient surfaced roll should have a temperature between 120° F. and 140° F.

The metal roll which contacts the fused layer of wear resisting composition is formed with a smooth polished metal surface preferably of chromed steel. The interior of the roll is provided with a number of passages for passage of heat regulating fluids to permit close control of the roll temperature. Where a wearing surface layer having a high gloss is not desired in the finished product, the chrome surface of the roll can be provided with a matte finish in order to promote any degree of surface gloss desired in the finished product.

The roll which supports the backing is formed with a resilient surface over a metal core. The resilient surface is formed from rubber or other elastomeric material and the roll provides a cushion to permit uniform contact of the metal roll with the fused surface layer.

The rolls are urged together by means of a hydraulic pressure unit or other conventional pressure applying device to maintain a pressure in the order of 100 to 500 pounds per linear inch of the printed sheet passing between the rolls.

In accordance with the invention the resilient surface which supports the backing of the printed product bearing a fused wearing surface layer which is contacted by the metal surface, as described hereinabove, bears a thin, uniform film of water. In the preferred method for continuous operation, wherein the metal and resilient surfaces are in the form of rolls, as illustrated in the drawing, the resilient surfaced roll should bear a thin film of water at the point where it supports the backing in the nip between the resilient surfaced roll and the metal roll. The film can be applied to the resilient surfaced roll in many ways with the embodiment illustrated in the drawing being a particularly effective means. Where the resilient surfaced roll revolves partially submerged in a bath of water, the surface of the roll emerging from the water bears a film of water the thickness of which can readily be controlled by means of a doctor roll or other metering device maintained at a controlled spacing to the resilient surfaced roll. By maintaining the resilient surfaced roll partially immersed in a bath of water, control of the temperature of the resilient surfaced roll can be facilitated. In addition, the pan in which the roll revolves can be extended beneath the water spray units so that any surplus water dropping from the backing of the sheet will collect in the pan, thereby serving as at least a partial source of replacement of the water in the pan. The water in the pan in which the resilient surfaced roll revolves can include wetting agents such as sulfonated mineral oils, metallic salts such as oleates, resinates, stearates, and the like, lecithin, methyl cellulose, and the like, which aid in removing any deposits which may collect on the surface of the resilient surfaced roll and thereby keep the roll clean. The particular technique described above and illustrated in the drawing is by no means exclusive since other means maintain a thin, uniform film of water on the surface of the resilient surfaced roll at the point where it supports the backing of the printed sheet in the nip between the resilient surfaced roll and the metal roll. For example a moistened strip of cloth can contact the resilient surfaced roll prior to the nip or the surface of

the roll can be sprayed or brushed with water to provide the desired thin water film.

The printed sheet bearing a fused upper layer of wear resisting composition is maintained in contact with the metal roll over at least a portion of its circumference and then is withdrawn for cooling, inspection and final packaging for sale.

It is a particular feature of the invention that the printed product produced is characterized by dimensional stability. The product, after its installation, does not show any marked tendencies towards growth or shrinkage with the result that, when two sheets are laid adjacent to each other with a tight fitting seam, bulges or gaps at the seam do not occur. This desirable result is obtained through the presence of about 1 to about 3 percent moisture in the impregnated felt backing of the printed product, based on the weight of the product. It is essential that a combination of water sprays upon the backing of the sheet after it leaves the fusion oven and the passage of the backing in contact with a film of water on the resilient surfaced roll, as described hereinabove, must be used. The use of either means of water introduction individually is not effective. The finished product does not have dimensional stability and further, other operating difficulties are observed. If one attempts to utilize merely the water sprays and to maintain the resilient surfaced roll in a dry condition, not only is insufficient water introduced into the impregnated felt backing, but, in addition, the resilient surfaced roll tends to accumulate deposits of backing paint. These deposits can, after a period of time, build up to such a thickness and roughness as to permanently deform the printed product as it passes through the nip between the resilient surfaced roll and the metal roll. If, on the other hand, one attempts to introduce water into the backing merely through use of a film of water on the resilient surfaced roll without the use of the water sprays, again serious operating difficulties are observed. The wet film on the resilient surfaced roll, upon contact with the hot layer or backing paint on the backing of the product leaving the fusion oven, causes severe pick-off of the backing paint onto the resilient surfaced roll. This occurs to such an extent that large areas of the finished product have no backing paint whatever, with the result that, when the product is rolled up for storage and shipment, the uncoated areas of the backing can contact the fused wearing surface layer, causing discoloration of the fused wearing surface layer.

By the method of the invention, a controlled amount of water can be added to the backing of the printed product, thereby yielding the dimensionally stable product. It is of particular significance that other methods of water introduction have proved unsuccessful. Attempts to store printed products in humidified atmospheres are unsatisfactory. The tightly wound rolls prevent the free passage of moist air to all portions of the backing and the time required for such treatment, even if successful, would be so long as to cause unusually costly and burdensome inventories in the manufacturer's plant. Also, attempts to add water to the backing by spraying or steaming the backing after the sheet is taken from the metal roll have not been successful in introducing sufficient water into the backing to yield a dimensionally stable product. It is necessary, in order to accomplish the desired result, to employ a combination of water sprays and a film of water on the resilient surfaced roll in the manner described hereinabove.

Example

A sheet of felted cellulose fibers made up of rags, wood fibers and paper was uniformly impregnated throughout with asphalt in an amount constituting 110 percent by weight of the dry fibers. The impregnated felt, having a thickness of 0.043 inch, was coated on one side with a plurality of vinyl resinous seal coats having a total thickness of 0.007 inch to provide a smooth, white opaque surface for printing of a decorative design. The opposite side of the impregnated felt was seal coated to prevent exudation of asphalt from the felt.

A decorative design was printed upon the white coating by a multi-cylinder rotogravure printing press using vinyl resin printing inks, the printed sheet being passed under infra red lamps after the application of each color to dry the ink.

A vinyl resinus organosol was then roller coated onto the printed surface, the organosol having the following composition:

	Parts by weight
Vinyl chloride polymer	80
Dioctyl phthalate	30
Stabilizers	4
Mineral spirits	17
Methyl ethyl ketone	2

The printed sheet, bearing a layer of organosol having a thickness of 0.0045 inch, was then continuously passed through a long hot air oven maintained at a temperature up to 425° F. in order to fuse the vinyl chloride polymer in the organosol and evaporate the solvent. The speed of the sheet in the fusion oven was at 100 feet per minute.

The printed sheet bearing a layer of fused vinyl chloride polymer composition upon the upper surface, although immediately upon leaving the fusion oven passed over a plurality of water sprays which directed a uniform spray of water to all portions of the impregnated felt backing. A total quantity of water amounting to 1.6 gallons per minute was supplied to the sprays. This amounted to an average of 0.0013 gallon per square ft. of printed sheet leaving the fusion oven. Immediately after the back of the sheet was contacted with the uniform water spray, the sheet was passed between an upper steel roll maintained at a temperature of 180° F. which contacted the fused wearing surface layer and a rubber covered lower roll maintained at a temperature of 130° F., which supported the impregnated felt backing. The rolls were urged together by means of hydraulic pressure with a force of 200 lbs. per lineal inch of sheet width. The rubber covered lower roll revolved partially immersed in a bath of warm water at 130° F. As the surface of the roll revolved out of the water, it was contacted by a rubber covered doctor roll which was closely spaced from the rubber covered lower roll to yield a thin water film on the rubber covered roll at the point where it contacted the impregnated felt backing.

The sheet was withdrawn from the surface of the upper metal roll after traveling around 240° of its circumference and was then cooled by passing over a number of cooling cans. The finished product was inspected and wound in rolls and packaged for sale. The finished product contained 2% of its weight of water and was dimensionally stable after installation.

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

What is claimed is:

1. In a method of producing a decorative surface covering for floors, walls and the like comprising applying a clear layer of a fusible resinous composition to one surface of a web of felted fibers containing a strengthening impregnant, heating to fuse said resinous composition to yield a clear fused wear layer integrally bonded to said web, and immediately passing the resulting sheet between a rotating metal roll which engages said fused layer and a rotating resilient surfaced roll which supports said coated web, the improvement which comprises directing a uniform spray of water upon the coated surface of said web opposite to that bearing the coating immediately after the heating step and before the sheet passes between said rolls and maintaining a thin uniform film of water upon the surface of said resilient surfaced roll at the point where said resilient surfaced roll sup-

ports said coated web thereby effecting the introduction of a controlled amount of water into said coated web to produce a decorative surface covering with a high degree of dimensional stability.

2. The method of claim 1 wherein said uniform spray of water constitutes about 0.0004 to about 0.005 gallon per square foot of said coated web.

3. The method of claim 1 wherein said uniform spray of water constitutes 0.0008 to 0.002 gallon per square foot of said coated web.

4. In a method of producing a decorative surface covering for floors, walls and the like comprising impregnating a web of felted fibers with a strengthening impregnant, depositing a uniform layer of pigmented coating paint upon each surface of the impregnated web to prevent migration of impregnant therefrom, applying a decorative design to one surface of said coated web, applying a clear layer of a fusible resinous composition to said printed design, heating to fuse said resinous composition to yield a clear fused wear layer integrally bonded to said decorative design, and immediately passing the resulting sheet between a rotating metal roll which engages said fused layer and a rotating resilient surfaced roll which supports said coated web, the improvement which comprises directing a uniform spray of water upon the coated surface of said web opposite to that bearing the decorative design immediately after the heating step and before the sheet passes between said rolls and rotating said resilient surfaced roll partially immersed in a bath of water, said improvement resulting in the production of a decorative surface covering containing from about 1 to about 3 percent of its weight of water uniformly distributed throughout said coated web, said decorative surface covering having a high degree of dimensional stability.

5. The method according to claim 4 wherein said uniform spray of water constitutes about 0.0004 to about 0.005 gallon per square foot of said coated web.

6. The method according to claim 4 wherein said uniform spray of water constitutes 0.0008 to 0.002 gallon per square foot of said coated web.

References Cited in the file of this patent

UNITED STATES PATENTS

2,659,680	Gray	Nov. 17, 1953
2,716,074	Mick et al.	Aug. 23, 1955
2,801,937	Hess	Aug. 6, 1957
2,819,754	Feigley	Jan. 14, 1958