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PROCESS FOR PRODUCING DECORATIVE SURFACE COVERING

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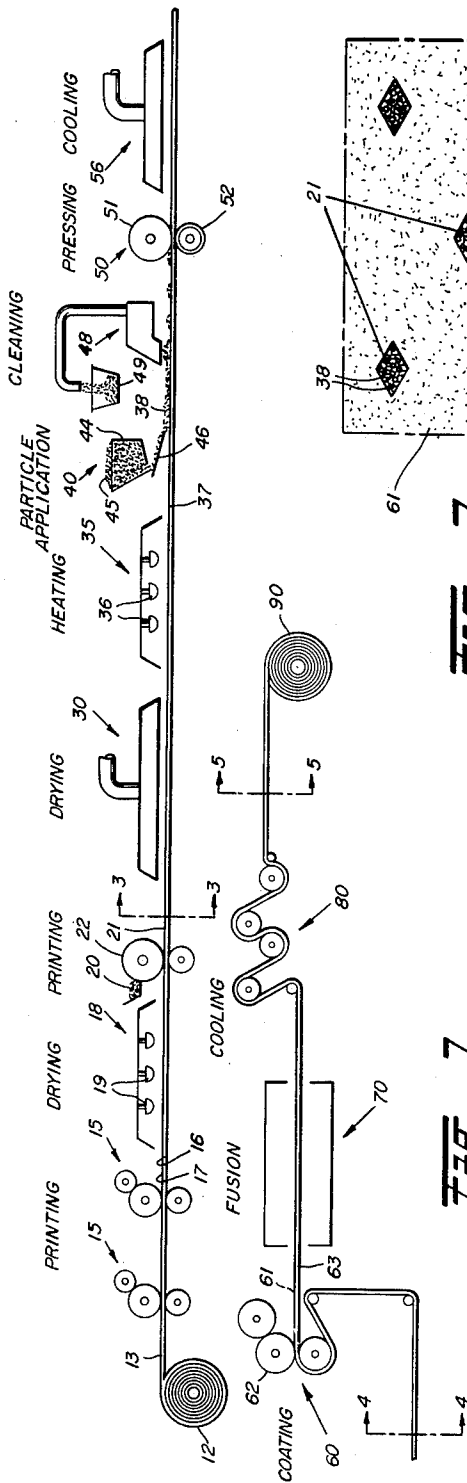


Fig. 1

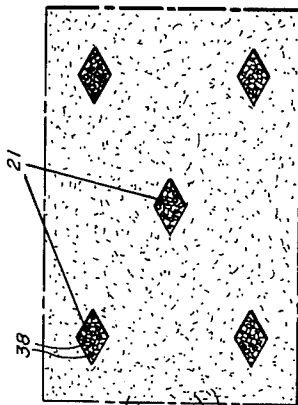


Fig. 2

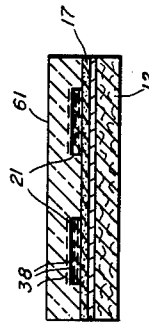


Fig. 3

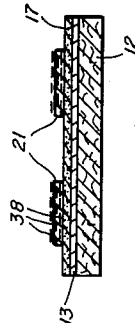


Fig. 4

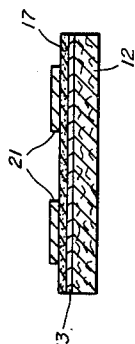


Fig. 5

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PROCESS FOR PRODUCING DECORATIVE SURFACE COVERING

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16 Claims. (Cl. 117-15)

This invention relates to decorative surface coverings for floors, walls and the like, and in particular to plastic surface coverings incorporating metallic chips and to a method of producing such plastic surface coverings.

Printed decorative surface coverings are well-known in the art. The most widely produced covering of this type is produced by impregnating a felt sheet with a water-proofing agent, applying to the surface of the sheet a number of coatings to prevent bleeding of the impregnants and to effect a smooth printing surface, and thereafter printing a decorative design on the coated felt by means of a rotogravure press or similar printing apparatus. After the printing, a transparent vinyl plastic coating or film is applied to the surface of the material to give the product wear resistance. The thickness of the surface coating or film determines the degree of wear resistance and, therefore, the service life of the product.

Recently, small metallic particles have been incorporated in the wear layer of printed surface coverings to give the product a decorative appearance. These particles are conventionally metal foil, such as aluminum which have been coated with a material which is compatible with the wear layer composition. A process for producing such a product is disclosed in United States patent application Ser. No. 853,818, filed November 18, 1959, by R. A. Carlisle and C. Pecker. In accordance with the disclosure in this application, the printed base is heated to soften the coatings, decorative chips are pressed into the heated surface and thereafter the conventional wear layer is applied. The wear layer application causes some of the chips to be displaced and, therefore, the final product has the chips randomly disposed at various levels throughout the thickness of the wear layer.

Attempts have been made to place such decorative chips at particular places on the backing sheet rather than randomly to produce geometric patterns or to accent the printed decoration. This has been accomplished by printing an adhesive composition at the places and in the shape desired for the chips and then depositing the chips on the adhesive while it is tacky. The excess chips are then removed by either flexing the sheet or using a vacuum-cleaning system. This procedure is effective but care must be exercised to prevent the chips from being removed from the adhesive while removing the surplus chips. Additionally, it is desirable to press the chips into the adhesive by passing through planishing rolls to prevent their displacement during the subsequent coating operation. If the adhesive is tacky, the adhesive sticks to the rolls and causes a substantial reduction in the yield of perfect product which can be obtained. Another disadvantage of an adhesive is that the chips which lay on the edge of the adhesive are not securely held and, therefore, are usually removed with the surplus chips. This results in an irregular edge which seriously detracts from the design.

An object of the invention is to provide a simple process for producing floor covering containing decorative chips in a geometric or pre-arranged pattern. Another object of the invention is to provide such a process which is readily adaptable to high speed processing equipment. Other objects and the advantages of the invention will appear hereinafter.

In accordance with the invention, a printed floor covering is produced in the conventional manner by printing a

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design on the surface of a backing. The printed sheet is then subjected to a second printing operation whereby a wax solid in a solvent carrier is applied as a printing composition where it is desired to have chips applied. It is essential to the invention for the wax solid to have a sharp melting point within the range of about 110° F. to about 200° F. and preferably about 140° F. to about 180° F. In addition, it must have a boiling point above 320° F. The printing composition is then dried to remove the carrier. Subsequently, the printed sheet is heated to convert the printing composition into a liquid and the decorative chips distributed over the sheet to at least cover the liquid wax. The excess chips are then removed without affecting the chips on the liquid wax material. If the chips utilized are relatively small in size, it is not uncommon for the chips to be piled on top of each other to a depth of about two to four chips. The chips have an attraction for each other and, therefore, are not readily separated and removed from the sheet if the lowermost chip is in contact with the liquid wax. They will, however, separate during the subsequent coating operation and cause contamination in the product. For this reason, it is preferred to subject the sheet to a planishing operation at this stage in order to cause chips which are stacked one on the other to adhere together by softening their coatings and, therefore, be bound to the printing composition through the lowermost chip. The wear layer is then applied as a coating in the conventional manner to completely cover the surface of the sheet and the product is passed through an oven to fuse the wear layer. The product is then cooled and is ready for packaging. Decorative chips of different colors can be added by repeating the operation as many times as necessary. This results in the building-up of a series of wear-layer coatings or layers. As an alternate, wax compositions having different sharp melting points in the range specified can be utilized to produce multi-colored and varied effects.

The invention will be better understood from the following detailed description when read in conjunction with the accompanying drawing wherein

FIGURE 1 is a schematic representation illustrating apparatus for carrying out the method of the invention;

FIGURE 2 is a plan view of the product produced in accordance with the procedure shown in FIGURE 1;

FIGURE 3 is a cross-sectional view greatly enlarged taken along lines 3-3 showing the intermediate product after the application of the wax printing composition;

FIGURE 4 is a cross-sectional view greatly enlarged taken along lines 4-4 showing the intermediate product after the application of the decorative chips; and

FIGURE 5 is a cross-sectional view greatly enlarged taken along lines 5-5 of the final product.

A resilient base sheet, such as an impregnated felt 12, having one or more seal coats 13 on its surface, is printed with a design by utilizing a conventional rotogravure press generally indicated at 15. Only two printing cylinders are illustrated although the conventional press has four or five. The printed sheet 16 having the design 17 on its surface is then dried by passing through a heating chamber generally indicated at 18 which can be a series of heat lamps 19. The dried sheet is then passed to a second printing step whereby the wax solid 20 is applied as a liquid printing composition at predetermined points 21 on the surface of the sheet. This printing step can be carried out by any other conventional printing means, such as offset rotogravure cylinder 22, printing blocks or the like. The sheet is then passed through a drying chamber generally indicated at 30 whereby the solvent carrier is removed from the wax composition 20. It is preferred that the solvent be removed by utilizing a large volume of air or the like while maintaining the temperature of the sheet below the melting point of the wax. After such drying,

the sheet can be rolled up and stored before further processing, if desired. The dried sheet then passes through a heater, generally indicated at 35, such as a bank of infra-red heat lamps 36, to raise the temperature of the wax solid to above its melting point. The heated sheet 37 is then passed under a distributing device whereby a uniform layer of decorative particles 38 are distributed on the surface of the sheet. The distributing device, generally indicated at 40, can be any type of distributor which is capable of depositing a uniform layer of chips. A suitable device comprises a hopper 44 containing a mass 45 of chips 38 and an inclined vibrating plate 46. The sheet thereafter passes through a vacuum-cleaning arrangement, generally indicated at 48, which removes all the decorative chips except those held on the surface by the liquified wax composition. The chips which are removed are deposited in a hopper 49 for reuse. The chips on the surface of this wax composition remain because of the physical attraction of the composition in the liquid state to the chips. It is necessary for care to be exercised at this stage of the process to prevent the removal of the chips on the liquid composition. The sheet is then passed to heated planishing roll, generally indicated at 50, such as a steel roll 51 and a rubber-covered back-up roll 52, to cause the chips piled one on another to adhere together and be held by the liquid. The upper planishing roll 51 is heated to a sufficiently high temperature to cause the surface of the chips to become tacky and adhere to one another. The product is then cooled by passing through a cooling chamber, generally indicated at 56. The cooled product is then passed to a coating operation, generally indicated at 60, such as a reverse roll coater 62, whereby a clear vinyl resinous coating 61 is applied to the cooled surface. The product 63 then passes through a fusion oven, generally indicated at 70, which causes the fusion of the clear wax layer. This procedure can be repeated to place additional chips of contrasting coloration at predetermined points. The product after the last fusion is thereafter cooled by passing over cooling drums, generally indicated at 80, and wound on a collecting roll 90. The product is then ready for inspection and packaging.

The flexible backing can be woven, felted or a solid sheet of synthetic or natural material. The conventional flexible backing is 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 covering, that is, from 0.02 to 0.08 inch. A thickness of about 0.047 inch is usually preferred. The fibrous material used is normally cellulose or asbestos in origin, although other fibers can be used including those of mineral and animal 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 satisfactory use by such treatment as air blowing, steam distillation and the like.

The impregnant should be uniformly dispersed throughout the felt sheet. This can be controlled to some extent by the saturating technique through use of pressure rolls in the saturating bath. Where the impregnant is not uniformly dispersed throughout, blistering can frequently occur due to high concentrations of material adjacent to one surface of the felt.

Other impregnants for the fibrous sheet can also be used to form backing sheets for use in the production

of printed surface coverings in accordance with the invention. Such materials as phenol-formaldehyde and phenol-urea resins, polymerized vinyl compounds, such as polyvinyl chloride, polyvinyl acetate and the like, cellulose acetate, cellulose nitrate, butadiene-styrene copolymer, butadiene acrylonitrile copolymer, natural rubber and the like can be used. Polymerizable materials can also be incorporated into the felt and the sheet subjected to heat to cure and polymerize the material. Such materials as natural and synthetic drying oils, mixtures of polyhydric alcohols and polybasic acids which cure to form polyesters, mixtures of polyhydric alcohols and polyisocyanates which cure to form urethane polymers, and the like can be used. In general, asphalt is the preferred impregnant due to its extremely low cost.

If an impregnated backing sheet is used, it usually is provided with one or more seal coats prior to printing the decorative design. The seal coats perform the desirable function of masking the color of the felt and preventing the impregnant from bleeding through and staining the wear layer and, in addition, create a smooth uniform surface suitable as a base for printing. Felt sheets of the type commonly used as backings for printed surface coverings tend to have minor surface irregularities due to non-uniformities in the felt-making equipment. The sheet also frequently shows a number of small protruding lengths of fibers. The seal coats are designed to hide all these irregularities. The total thickness of seal coats required is normally from about 4 to about 12 mils. This thickness can be created through use of a single thick coating or several superimposed thinner coatings. Using the conventional techniques of coating, such as flexible doctor roller application, the desired thickness is created by use of more than one coating. The use of multiple coatings is also desirable in promoting optimum adhesion of the wear surface layer to the backing, since the seal coat applied directly to the fibrous backing can be designed for optimum sealing against migration of bituminous impregnant and the uppermost seal coat can be designed for optimum adhesion to the polyvinyl chloride wearing surface layer.

The seal coat is conveniently applied in the form of an aqueous emulsion of resinous binder and filler. In the preparation of the seal coat, a resinous binder and filler are emulsified in water in the presence of conventional wetting agents, thickening agents, anti-foam agents, sequestering agents and the like. After the application of the seal coat to the backing sheet, the coating is dried by subjecting the sheet to heat, as for example, in the range of about 100° F. to about 150° F. for about 30 minutes to about 2 hours. Alternately, drying can be effected by exposing the coated sheet to a temperature of 350° F. to 400° F. for about 30 to about 300 seconds.

The resinous compound of the seal coat is preferably a vinyl resin. Suitable resins are commercially available in the form of aqueous dispersions containing from 40 to 50 percent solids. The dispersion can contain, in addition to the plasticizer, resin, pigment and filler, conventional wetting agents, thickening agents, anti-foam agents, sequestering agents and alkali. Suitable wetting agents include the sodium salt of polymerized alkyl aryl sulfonic acid, potassium oleate, alkyl aryl polyether sulfonate, resin acid soap and the like. Ammonium caseinate, borated casein, methyl cellulose, carboxymethyl cellulose, hydroxyethyl cellulose and the like are satisfactory thickening agents. Examples of suitable anti-foam agents are pine oil and silicone anti-foam agents, diglycol laurate, and octyl alcohol. Suitable sequestering agents include tetrasodium pyrophosphate and the tetrasodium salt of ethylenediamine tetra-acetic acid. The alkali provides a pH of about 7.0 so that there will be no tendency for the latex to coagulate. Calcium hydroxide, sodium hydroxide, ammonia, and potassium hydroxide are suitable alkalis for this purpose.

Normally, the pigments and fillers are ground with

water in the presence of wetting agents, thickening agents and the like and the pigment dispersion is mixed with the vinyl resin and plasticizer later. Alternately, the seal coat can be effectively applied in the form of a solution using, for example, a solvent such as toluene or methyl ethyl ketone. However, the cost of using solvent and the fire and health hazards created by its use render the method undesirable.

The seal coat can contain stabilizers to retard the decomposition of the vinyl resin and increase the life of the product, such as sulfides and sulfites of aluminum, silver, calcium, cadmium, carium, sodium, magnesium, strontium; lead and tin stearates; oleates and other complexes; glycerine, leucine, alanine, o- and p-aminobenzoic and sulfanilic acids, hexamethylene tetramine, salts including phosphates, stearates, palmitates, oleates, ricinoleates, abietates, laurates, salicylates; and the like.

As stated hereinabove, the resin component of the seal coat is preferably a vinyl resin, that is, a polymeric material obtained by polymerizing compounds containing at least one $-\text{CH}=\text{CH}-$ radical. Useful vinyl resins include homopolymers, such as polyvinyl chloride, polyvinyl acetate, polyvinyl propionate, polyvinyl butyrate, polymerized vinylidene chloride, polymerized acrylic acid, polymerized ethyl acrylate, polymerized methyl acrylate, polymerized propyl acrylate, polymerized butyl acrylate, and the like; copolymers of the above with each other such as vinyl chloride-vinyl acetate copolymer, vinylidene chloride-vinyl chloride copolymer, methyl methacrylate-vinyl chloride copolymer, methyl acrylate-ethyl acrylate copolymer, ethyl acrylate-butyl acrylate copolymer, and the like and copolymers of the above with other monomers copolymerizable therewith, such as vinyl esters including vinyl bromide, vinyl fluoride, vinyl chloroacetate, vinyl alkyl sulfonates, trichloroethylene and the like; vinyl ethers such as vinyl ethyl ether, vinyl isopropyl ether, vinyl chloroethyl ether and the like; cyclic unsaturated compounds such as styrene, chlorostyrene, coumarone, vinyl pyridine and the like; maleic and fumaric acid and their derivatives such as diethyl maleate, dibutyl fumarate and the like; unsaturated hydrocarbon such as ethylene, propylene, butylene and the like; allyl compounds such as allyl acetate, allyl chloride, allyl ethyl ether, and the like; conjugated and cross-conjugated unsaturated compounds such as butadiene, isoprene, chloroprene, 2,3-dimethylbutadiene-1,3, divinyl ketone and the like. The monomers listed hereinabove are useful in preparing copolymers with a vinyl resin and can be used as modifiers in the polymerization, in which case they may be present in an amount of a few percent, or they can be used in larger quantities, up to as high as 40 percent by weight of the mixture to be polymerized. If desired, a mixture of vinyl resins can be used in preparing coating paints for use in the invention.

A plasticizer for the vinyl resin is also frequently present in the seal coat composition. Suitable plasticizers for the vinyl resin include ester type plasticizers such as tributyl phosphate, dioctyl phthalate, dipropylene glycol dibenzoate, phenyl phosphate, dibutyl tartrate, amyl tartrate, butyl benzyl benzoate, dibutyl sebacate, dioctyl adipate, didecyl adipate and the like, rubbery plasticizers, such as butadiene-styrene copolymer, butadiene-acrylonitrile copolymer, and the like, and other materials which function as plasticizers, such as epoxidized drying oils, aromatic hydrocarbon condensates and the like. Where certain flexible soft vinyl resins are used in formulating the seal coat, such as polymers containing large proportions of ethyl acrylate, no plasticizer is needed. However, in most instances, a plasticizer is essential in order to impart the necessary properties of flexibility to the dried seal coat film. The seal coat must be compatible with the subsequently applied wear layer.

A decorative design is applied to the coated surface of the sheet after it has dried, if desired. The printing can be omitted and the sole decoration or design can be the

decorative chips. Unusually attractive products can be obtained by pigmenting the seal coats for background colors. Printing is conventional and paints and inks normally used for application of a decorative design to a vinyl film or layer are used. The composition is preferably formulated so that the binder of the ink contains an appreciable quantity of a vinyl resin. Suitable vinyl resins include vinyl chloride polymer, vinyl chloride-vinyl acetate copolymer, vinyl chloride-vinyl propionate copolymer, vinyl butyrate polymer, vinylidene chloride polymer, vinylidene chloride-vinyl chloride copolymer, copolymers of vinyl chloride and vinylidene chloride with esters of maleic and fumaric acid, such as dimethyl, diethyl, and dibutyl maleate and fumarate, and the like. Extender resins, such as nitrocellulose, can be employed as a portion of the binder of the ink or paint.

The decorative printing composition contains pigments according to the colors desired and is preferably formulated as a solution in a solvent such as cyclohexanone, methyl ethyl ketone, methyl isobutyl ketone and the like.

The decorative printing composition can be applied to the seal coated surface of the sheet in any way appropriate for producing the particular decoration desired. Any of the rotary graphic art printing processes, such as rotogravure, offset printing, or lithography, can be used. If desired, the design can be applied by conventional block printing technique.

Improved adhesion and clarity of the design and a reduction in the amount of decorative ink or paint required can be brought about by application of a thin size coat to the seal coat. The decorative design is then printed on the dry size coat. The size coat conventionally comprises a vinyl resin and a plasticizer and is applied preferably as a solution in a solvent. A typical size coat application is 0.02 pound per square yard of surface.

The wax composition is then printed on the surface of the decorative sheet at the positions and in the form in which the decorative chips are desired. The thickness of the printed wax composition can vary depending on the thickness of the chips. As a general rule, a thickness of from about 0.00025 inch to about 0.001 inch is sufficient. The wax composition is applied in a liquid medium, such as any of the conventional organic solvents used in gravure printing inks. As indicated above, the wax solid must have a sharp melting point of about 110° F. to about 200° F. and a boiling point above 320° F. It is not essential for all the components of the composition to melt within this range but a sufficient portion of the ingredients must give the composition the appearance and action of a liquid at a point within the defined temperature range. As a general rule, from about 50 to about 100 percent of the composition must be composed of the wax solid with at least 80 percent being preferred for the composition to have holding power for the chips. The remaining materials must be such that they will remain dispersed in the wax solid when it is liquified. It is necessary for this composition to be compatible with the composition which is to be utilized in the wear layer. Such capability can be determined by a simple test of coating the particular wear layer over a thin deposit of the material to be tested on a glass plate. The coated glass plate is then placed in an oven and heated to fuse the coating composition. If the wear layer readily separates from the wax solid composition under a force of less than one pound, then it is not suitable for use in the invention. Various additional components can be added to the wax solid composition, such as pigments, plasticizer, stabilizer, and the like. The addition of fine particles of vinyl resin are sometimes helpful to reduce tack. By the term "wax" is meant any natural or synthetic material which exhibits a sharp melting point in the defined limits and, of course, is compatible with the wear layer. It also should not cause the wear layer to yellow. The most commonly available materials of this type are plasticizers for the resin component of the wear layer. Ex-

amples of such materials are tricyclohexyl citrate, di-cyclohexyl phthalate; ethyl ester of cinnamic acid; di-ethyl ester of terephthalic acid; ethyl ester of vanillic acid; benzyl ester of stearic acid; the amyl ester of 3,5-dinitro benzoic acid; ethyl ester of benzoic acid; dimethyl ester of tartaric acid; methyl ester of anisic acid; ethyl ester of arachidic acid; dimethyl ester of d-tartaric acid; diethyl ester of 2,5-thiophenedicarboxylic acid; ethyl ester of carbamic acid; propyl ester of carbamic acid; phenyl ester of stearic acid; methyl ester of carbamic acid; ethyl ester of carbanilic acid; propyl ester of carbamic acid; dimethyl ester of oxalic acid; methyl and ethyl esters of behenic acid; methyl ester of arachidic acid; isobutyl ester of carbamic acid; diethyl ester of i-tartaric acid; cetyl ester of palmitic acid; trimyristate glycerol; 1,3-dilaurate glycerol; xenyl ester of isothiocyanoic acid; 2-bromo-naphthalene; p-phenylphenacyl ester of oleic acid; 1-fluoro-naphthalene; 4-isoamylresorcinol; 1,3-dichloronaphthalene; ethyl ester of benzoin; p-phenylphenacyl ester of euanthnic acid; dimyristate glycol; 1,7-dichloronaphthalene; isoamyl ester of carbamic acid; 4-isobutylresorcinol; p-phenylphenacyl ester of valeric acid; acetamide; α -acetochloroglucose; 4-bromodiphenol; p-bromodiphenol; 4-tert-butyl catechol; 4-chlorobenzophenone; 2-chloroethyl-2-xenyl ether; 2-chloro-4-phenyl phenol; di-(β -ethoxy) aniline, di-benzo thixin. Typical of the groups of materials are the cyclo-paraffins, such as cyclododecane; the straight chain wax olefins, such as cerotene and 1-hentriacontene; the wax alcohols, such as n-heptodecanol and n-nonadecanol; the saturated fatty and wax acids, such as isomargaric acid, myristic acid and palmitic acid; the unsaturated fatty acids, such as the solid keton carboxylic acids, such as hexacosadienoic acid; alkyl esters of higher fatty and wax acids, such as the ethyl esters of tricosoic, pentacosic and cerotic acids; and the natural waxes, such as yellow beeswax, bayberry, paraffin 138/140AMP; ceresin, artificial; jasmine, floral; sugar cane, East Indian; ghedda; rose, floral; flax; hydrogenated cottonseed oil; beeswax, yellow ordinary; beeswax, white USP; paraffin, American 143/145; beeswax, yellow USP; and paraffin, Asiatic 148/150.

The decorative material is then sprinkled or otherwise distributed over the surface of the printed sheet. The pieces must be of a composition which is compatible with the wear layer coating. A particularly desirable effect is obtained by using small chips of metal foil, such as aluminum, copper, steel and the like, which have been coated with a pigmented vinyl coating composition, such as those disclosed herein for the wear layer composition. The metal foil should be as thin as possible, such as from about 0.0006 to about 0.001 inch. The metal foil can be embossed to give it added luster. It has been found that flat decorative particles having a largest dimension of about 0.125 to about 0.005 inch are suitable. Particularly effective are pieces about $\frac{1}{32}$ to about $\frac{1}{64}$ of an inch in largest dimension. Mixtures of various size particles can be used. The decorative particles are preferably about 0.001 to about 0.003 inch thick.

After distributing the decorative chips over the whole sheet, the sheet is flexed, passed under a vacuum cleaner arrangement or otherwise treated to remove the decorative elements which are not in contact with the liquified wax. Particularly unusual effects are obtained when the chips are of uniform geometric shape, such as square, hexagon, diamond, etc. The decorative material must have a thickness substantially thinner than the thickness of the wear layer. As a general rule, the chips should be less than one-half the thickness of the wear layer. Since a number of the chips may be stacked one upon the other, it is desirable to pass the sheet through a planishing unit to cause the chips to adhere to one another. Careful control is necessary to prevent all the pieces from being picked off the surface of the sheet.

It is essential that the temperature of the roll contacting the surface of the sheet be low enough and the

contact time be kept at a minimum to prevent the seal coats from sticking to the roll. Using the preferred vinyl chloride composition, the temperature of the roll should be about 170° F. to about 250° F. and preferably about 200° F.

The wear layer must be a transparent or translucent composition so that the printed design and decorative chips are visible from the surface. The invention is particularly applicable to relatively thin wear layers. The wear layer can be from about 0.002 inch to about 0.015 inch thick, but the best results are obtained with a thickness of from 0.0025 inch to about 0.005 inch. The composition of the wear layer is preferably a mixture of resin and plasticizer in the proportions of about 20 to about 60 parts plasticizer for each 100 parts of resin.

The resin component of the wear layer is preferably a vinyl resin. Useful vinyl resins are those listed hereinabove for the resin component of the seal coat compositions. Plasticizers such as those listed above for the seal coating compositions can be utilized with the resin.

The wear layer can contain stabilizers to retard the decomposition of the vinyl resin and increase the life of the product, such as sulfides and sulfites of aluminum, silver, calcium, cadmium, cerium, sodium, magnesium, strontium; lead and tin stearates; oleates and other complexes; glycerine, leucine, alanine, o- and p-aminobenzoic and sulfanilic acids, hexamethylene tetramine, salts including phosphates, stearates, palmitates, oleates, ricinoleates, abietates, laurates, salicylates; and the like.

The wear layer can be applied as an organosol, plastisol, or hydrosol. An organosol is preferred wherein the component is carried in an organic solvent. After the coating application, it is heated to remove the solvent and fuse the composition. A temperature of about 350° F. to about 375° F. is normally required for fusion of the resin, although higher or lower temperatures can be used depending on the molecular weight of the vinyl resin and time of heating.

The following example is given for purposes of illustration:

Example

A floor felt formed on a paper-making machine is saturated with approximately 90 percent by weight, based on the dry weight of the felt, of asphalt having a softening point of about 160° F. A seal coating paint is applied to the surface of the felt at approximately 5 mils thickness. The seal coat has the following composition:

	Parts
Vinyl chloride resin latex (50% solids)-----	30
Butadiene-acrylonitrile copolymer latex (50% solids)-----	30
Sodium alkylaryl sulfonate-----	2
Titanium dioxide-----	14
Whiting-----	54
Methyl cellulose suspension (7% solids)-----	15
Water-----	20

The seal coat is heated to a temperature of about 115° F. for a period of 100 minutes to dry the coating. A light application of a size coat is applied to the dried seal coat. The size coat has the following composition:

	Percent
Polyvinyl chloride-----	12.1
Tricresyl phosphate-----	6.5
Methyl ethyl ketone-----	81.4

A decorative design is applied to the seal coat by means of a multi-cylinder rotogravure printing press using an ink having the following formula:

	Percent
Polyvinyl chloride-----	8.3
Pigments-----	18.0
Polypropylene glycol sebacate-----	14.5
Methyl ethyl ketone-----	44.3
Cyclohexanone-----	14.9

After each cylinder, the sheet is subjected to heat to remove the solvent from the printing ink formulation.

The sheet and the decoration printed on its surface is then passed to a second printing operation whereby the wax composition having the following composition is applied by means of a gravure cylinder to designated portions of the sheet:

	Percent
Tricyclohexyl citrate -----	22.8
Methyl ethyl ketone -----	44.3
Cyclohexanone -----	14.9
Pigments -----	18.0

The surface of the sheet is then subjected to a high volume of air heated at about 100° F. to remove the solvents from the composition.

The sheet is then further heated to a temperature of approximately 160° F. to convert the composition to a liquid and passed under a distributor which spreads evenly over the surface square decorative chips $\frac{1}{4}$ inch square, having an overall thickness of about 1.5 mils. The decorative chips are distributed in such a fashion as to completely cover the whole sheet. The decorative chips comprise an aluminum foil of 0.0008 inch thickness having a gold pigmented coating of a copolymer of vinyl chloride (87%)-vinyl acetate (13%) and dioctyl phthalate (60/40) on each surface. The sheet then passes through a vacuum apparatus which removes all of the chips except those in contact with the liquid wax. The sheet is then passed between two rolls forming a planishing unit. The calendar roll contacting the surface of the sheet has a smooth polished surface maintained at a temperature of about 200° F. The roll contacting the back of the sheet is rubber-covered and maintained at approximately 130° F. The rolls exert sufficient pressure on the decorative chips to firmly bond them together and press them into the decorative chips to firmly bond them together and press them into the wax composition. The product is then cooled to 90° F. and passed through a reverse roll-coater which completely covers the surface of the sheet with a clear coating of 0.004 inch thickness having the following formula:

	Parts
Vinyl chloride polymer -----	50
Dioctyl phthalate -----	17
Toluene -----	30

The coated sheet is then passed through a fusion oven maintained at a temperature of approximately 400° F. thereby removing the solvent and fusing the vinyl chloride resin by raising the temperature of the coating to about 350° F. The fused product is then passed between cooling rolls to reduce the temperature and wound on a collection roll.

The printed surface covering produced was characterized by a high degree of clarity and fidelity of the design having decorative chips spaced at various points visible through the wear layer.

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

What is claimed is:

1. In a process for producing a decorative surface covering which comprises printing a decorative design on one surface of a base, covering the printed base with a vinyl resinous coating composition and thereafter subjecting the composition to heat to form a smooth wear resistant layer completely covering the surface of said base, the improvement which comprises applying in spaced relationship on said surface, prior to the application of said wear layer, deposits of a printing composition comprising a liquid vehicle and a wax compatible with said wear layer composition having a softening point of about 110° F. to about 200° F. and a boiling point above 320° F., heating said surface to remove the liquid vehicle and

to liquify the wax, and while said wax is liquified performing the further steps of uniformly covering the printed surface with a uniform layer of decorative chips and then removing the decorative chips which are not on top of said liquified wax, and then cooling the sheet to solidify said wax.

2. In a process for producing a decorative surface covering which comprises applying seal coats of a vinyl resinous composition to one surface of a felt sheet impregnated with a waterproofing agent, drying said coatings, printing a decorative design on the surface of said coatings, covering the printed surface with a vinyl resinous coating composition and thereafter subjecting the composition to heat to form a smooth, hard wear resistant layer completely covering the surface of said base, the improvement which comprises applying in spaced relationship on said surface, prior to the application of said wear layer, deposits of a printing composition comprising a liquid vehicle and a wax composition compatible with said wear layer composition having a softening point of about 110° F. to about 200° F. and a boiling point above 320° F., heating said surface to remove the liquid vehicle and to liquify the wax, and while said wax is liquified performing the further steps of uniformly covering the printed surface with a uniform layer of decorative chips and then removing the decorative chips which are not on top of said liquified wax, and then cooling the sheet to solidify said wax.

3. The process of claim 2 wherein said wax has a melting point of about 140° F. to about 180° F.

4. The process of claim 2 wherein said wax is a plasticizer for said vinyl coating composition.

5. The process of claim 2 wherein said wax is an alkyl ester of a fatty acid.

6. The process of claim 2 wherein said wax is a straight chain wax olefin.

7. The process of claim 2 wherein said wax is tricyclohexyl citrate.

8. The process of claim 2 wherein said wear layer is about 0.002 inch to about 0.015 inch in thickness.

9. The process of claim 2 wherein said wear layer is about 0.0025 inch to about .005 inch in thickness.

10. The process of claim 2 wherein said decorative chips are pieces of metal foil having a thickness of about 0.0006 inch to about 0.002 inch and having a vinyl resinous coating on their surface.

11. The process of claim 10 wherein said decorative chips have an overall thickness of about 0.001 inch to about 0.003 inch.

12. The process of claim 10 wherein said decorative chip have a largest dimension of about 0.005 inch to about 0.125 inch.

13. The process of claim 10 wherein said chips have a largest dimension between about $\frac{1}{32}$ to about $\frac{1}{64}$ of an inch.

14. The process of claim 10 wherein the thickness of said chips is less than one-half the thickness of said wear layer.

15. The process of claim 10 wherein after the removal of said surplus chips said sheet is passed through heated pressing rolls to soften the coating on said chips and cause them to adhere to each other.

16. The process of claim 15 wherein the roll contacting the surface of said base is heated to about 170° F. to about 250° F.

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