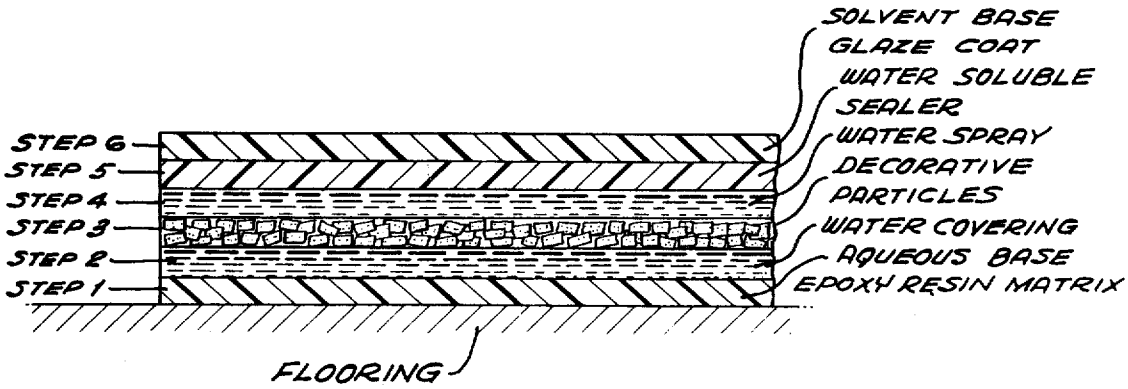
Sept. 12, 1972 M. ANDRESKI 3,690,914

METHOD OF FORMING SEAMLESS FLOORING

Original Filed Oct. 19, 1967



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United States Patent Office 3,690,914 Patented Sept. 12, 1972

3,690,914

METHOD OF FORMING SEAMLESS FLOORING

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Continuation of abandoned application Ser. No. 676,460, Oct. 19, 1967. This application Mar. 18, 1971, Ser. No. 125,864

Int. Cl. B44d 1/02

U.S. Cl. 117—26 11 Claims

ABSTRACT OF THE DISCLOSURE

Seamless surface coverings, e.g. seamless floor coverings with a markedly reduced incidence of surface protrusions through the resinous overlayer from projecting decorative particles are disclosed to be obtainable by spraying the particles which have been randomly deposited onto the base coat or matrix with water to wet the particles and thus decrease the number and protrusion extent of projecting particles.

This application is a continuation of Ser. No. 676,460, filed Oct. 19, 1967, now abandoned.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention has to do with surface coverings and particularly combinations of steps and materials providing outstanding surface qualities from both the practical and aesthetic standpoint. In general, the invention is concerned with method for forming surface coverings, particularly floor coverings. Although the specification will be addressed primarily to floor covering application, as presently the single most important use of my invention, it is to be remembered throughout the following description that the invention is likewise applicable to the formation of coverings on walls, counter tops, table tops, stair treads, patios, pool decks, boat hulls, shelves and as metal finishing. Typical substrates thus will include wood, ceramic, cementitious, metallic and plastic surfaces.

The invention is not appropriately classified as a painting technique involving as it does multiple coats of different materials and importantly separate application of the particulate decorative component.

More correctly, the invention is classified with seamless flooring, an industry still in its infancy, which provides the consumer with floor surfaces having the remarkable toughness of high polymers, the kaleidoscopic design variety of linoleum or tile, and the high polish and low maintenance properties normally associated with glass and all with an easy applicability similar to modern paints.

(2) Prior art

Seamless floor coverings are known. In general, the commercially successful products utilize a polyurethane base coat or a matrix, to which is added a particulate decoration such as metal flakes, or parti-colored plastic chips, and over which is layered a tough glossy resin, such as a polyurethane, usually termed a glaze coat.

These products are generally completely organic solvent based and tend to shrink somewhat on evaporation of the solvent. Such polyurethane matrix coats may, on shrinking, tend to curl and pick up the substrate to which they are applied, particularly if it is a linoleum or tile substrate. This curling tendency results in unsightly edges and corners, and provides opportunity for water seepage under the floor covering which is unsanitary and otherwise undesirable.

A common problem in the formation of seamless flooring is the difficulty of eliminating protruding decorative particles which may even protrude to a degree causing penetration of the finishing coat. The usual method of applying the decorative particles is to scatter them randomly, e.g. by raining them onto the base coat. This technique provides an attractive randomness of pattern, which is highly sought, but also provides a randomness of particle orientation which often results in certain of the particles being relatively elevated or lying on edge and, therefore, protruding from the matrix coat. Attempts to flatten these protruding particles following application are generally unsuccessful, involving as they do ordering rearrangements of the random pattern and disruption of the matrix uniformity since it is not yet hardened. In addition, the layman's attempt to accomplish such flattening is often quite messy.

SUMMARY OF THE INVENTION

It is an object therefore of the present invention to provide a combination of steps and materials for the easy application to any surface of a seamless covering with reduced protrusions of decorative particles and with a substantial absence of a tendency to shrink or curl on drying. Other objects will appear hereinafter.

It has now been discovered that seamless surface coverings such as seamless flooring can be formed in a highly advantageous manner by a method useful to the layman and do-it-yourself enthusiasts and which employs a positive step to reduce protrusion of decorative particles. In general, the method of the invention is applicable to formation of seamless flooring which is effected by depositing decorative particles on a previously applied and liquid matrix containing a resinous binder in an aqueous carrier in a manner normally tending to cause deposited particles to protrude from the matrix surface sufficiently to interfere with the surface smoothness of a subsequently applied resinous overlayer. The invention involves the novel step of wetting the surfaces of particles left protruding by the usual method with a liquid compatible with the aqueous carriers such as water or water containing a wetting agent, thus to reduce particle protrusion by increasing the affinity of the aqueous based matrix for the normally hydrophobic particle surface.

In preferred practice the matrix or underlayer coat first applied to the flooring or other surface will be an aqueous mixture of a thermosetting resin, particularly of an epoxy resin and the final coat or overlayer will be a glossy resinous material such as a polyurethane resin in an organic solvent solution. Typically the decorative particles are broadcast randomly over the matrix to deposit thereon in a locally irregular, but generally repetitive pattern.

Wetting of the so deposited particles is effected by misting, fogging or otherwise lightly spraying over the particles a water coating, sufficient to increase receptivity of the particles into the matrix but less than that flooding or disturbing the matrix surface and orderly randomness of particle pattern. Following settling or submersion of the decorative particles the thermosetting resin is permitted to harden, i.e. cure and subsequent layers are added such as the organic solution of a glaze resin and, if desired, a sealer coat intermediate the matrix and glaze to preclude solvent attack on solvent vulnerable components of the matrix-particle mixture.

BRIEF DESCRIPTION OF THE DRAWINGS

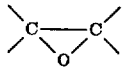
In the drawing the single figure illustrates schematically the stepwise formation of a floor covering according to the present method.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In terms of materials the present invention utilizes a matrix resin, an overlayer or finishing resin and decorative particles, together with a sealer resin in preferred practice.

The decorative particles are those conventionally employed in seamless flooring. As such they may be inorganic, e.g. metallic or asbestos materials or organic, e.g. synthetic organic polymers. Obviously, great variation in colors, configuration and cost can be had among such decorative materials. In general, the size of decorative particles will be less than 3/8" in greatest dimension. Rectangles, squares, circles, semicircles, triangles, crescents and other regular and irregular geometric shapes in solid or variegated coloration and of various thicknesses may be employed. Most often the particles will be rectilinear, essentially planar and less than 1/16" on a side. Among suitable metal particles are chips of aluminum, copper and tin. Among suitable plastic particles are chips of vinyl polymers especially polymers of vinyl chloride, styrene and ethylene or propylene monomers as well as acrylic acid and acrylic acid derived monomers and copolymers of the foregoing with each other and other copolymerizable monomers. The decorative particles are deposited on the matrix layer usually by raining or gravity effect, if suitable, e.g. for decorating floor coverings, or by ballistic techniques if particle flow is against gravity. In kit form, ready for do-it-yourself use, the chips or decorative particles are packaged in a bag or other container in an amount to cover the expected coverage of matrix resin.

The matrix layer, so-called because it envelops and surrounds the decorative particles is the first coating formed on the surface to be covered. This is Step **1** in the figure. This first coating should be adherent to the substrate, be it plastic, wood or mineral, non-curling and nonshrinking on drying, easily handled, nontoxic and have a reasonable working period. I have found that aqueous carrier mixtures of air curing epoxy resin have all the requisite properties and at not too great a cost. Other thermosetting resins such as phenolics, melamines and urethanes are prone to shrinkage on evaporation of their solvent carrier, lack adhesion or may be toxic in closed spaces and give dermatological difficulties. Thus, although any of these resins may be used, I generally employ an epoxy resin system. By the term "epoxy resin" herein I refer to resins characterized by the presence of oxirane oxygen, i.e.



and such resins which undergo progressive crosslinking polymerization either with themselves or with crosslinking agents to form tough, adherent coatings which are clear and hard. This class of resins is well known and it will suffice to indicate that in general useful epoxy resins are those derived from polyhydroxy compounds and epichlorohydrin, e.g. from dihydric phenols particularly polynuclear dihydric phenols such as the bisphenols. A commercially available and highly useful resin is that known as the diglycidyl ether of bisphenol-A, i.e. 2,2-bis(4-hydroxyphenyl)propane. Suitable epoxy resins have the repeating unit —D—O—E—O in which D is the radical residuum of a polyhydric phenol and E is the radical residuum of epichlorohydrin.

The above epoxy resins may be cured by reaction with polyfunctional compounds such as polybasic acids, acid anhydrides, polyamines and complexes such as boron trifluoride. In general hardeners are used in effective amounts e.g. 0.1 to 10% by weight of the epoxy resin. The term "thermosetting epoxy resin" herein refers to epoxy resins which will cure to hardened states on exposure to air and/or heat (including room temperature) because of their intrinsic chemistry or the presence of a hardener.

A full description of epoxy resins and hardeners useful herein may be found in U.S. Pat. 3,238,087 to S. Norwalk et al.

As stated these epoxy resins are preferably employed as water based products. Because they are water insoluble, aqueous mixtures of epoxy resins may be termed emulsions or suspensions or simply, and more generally mixtures. Preparation and characteristics of such products are detailed in U.S. Pat. 3,020,350 to S. Norwalk. It is preferred to employ a mixture having a viscosity enabling easy trowling or spreading over the surface to be covered, stiff enough to remain in place but fluid enough to spread easily. Thixotropic additives such as polyamide modified alkyd resins may be employed in the matrix material to give desired handling qualities. In kits for the home owner the epoxy resin will be typically in a can or other sturdy container in an amount appropriate for a predetermined surface area. Generally the epoxy system will be two component so that the cure reaction begins only on mixing of the two components, applying to the surface and exposing to air.

While the base coat or matrix cures e.g. in an hour the decorative particles are deposited thereon. This is Step **3** in the figure. Matrix viscosity should be such as to not inhibit penetration of the matrix surface by and resultant submersion of the particles.

Advantageously following smoothing of the matrix on the surface, the matrix may be water wetted for better reception of the particles. This is Step **2** in the figure. Water treatment may be a relatively heavy application e.g. flooding or flushing but puddle formation or disruption of the matrix surface smoothness should be avoided. This wetting may be effected by spraying and the water used may include wetting agents, to be described hereinafter.

Following deposition of the particles either directly on the matrix coating or on a superficial water layer on the matrix coating the particles are themselves wetted, suitably with a water spray. This is Step **4** in the figure. The water spray may be obtained from a conventional garden spray gun, paint sprayer or other device capable of generating small particles of water. Just enough spray to water wet the particle surface adjacent the matrix is required. This coating is believed to so alter the surface properties of the particle sufficiently that full reception of the particle into the matrix is readily effected.

The water used in Step **4** may include a wetting agent by which term is meant a compound which lowers the surface tension of water below 72 dynes/cm.

Among wetting agents useful in the water spray are ionic, nonionic or cationic, organic or inorganic wetting agents. Concentrations in aqueous media will range from just significant to 2% to 40% and higher, i.e. sufficient to lower water surface tension.

In general, suitable non-ionic agents are those which may be produced by the introduction of alkylene oxide group into an organic hydrophobic compound or group having an aliphatic or aromatic structure. The hydrophobic organic group generally contains at least 8 carbon atoms and up to about 30 carbon atoms. Condensed with the hydrophobic group are at least 5 and preferably up to about 50 alkylene oxide groups. It is preferred to use the polyoxyethylene condensates derived from ethylene oxide. Among the nonionic detergents, it is preferred to use the polyalkylene oxide condensates of alkyl phenol, such as the polyoxyethylene ethers of alkyl phenols having an alkyl group of at least about six, and usually about 8 to 12 carbons, and an ethylene oxide ratio (number of moles per phenol) of about 7.5, 8.5, 11.5 or 20, though the number of ethylene oxide groups will be usually from about 8 to 18. The alkyl substituent on the aromatic nucleus may be di-isobutylene, diamyl, polymerized propylene, dimerized C_6–C_7 olefin, and the like.

Other suitable wetting agents are the polyoxyalkylene esters of organic acids, such as the higher fatty acids, rosin acids, tall oil acids, or acids from the oxidation of petroleum, et cetera. These polyglycol esters will contain usually from about 12 to about 30 moles of ethylene oxide or its equivalent and about 8 to 22 carbons in the acyl group. Suitable products are refined tall oil condensed with 16 or 20 ethylene oxide groups, or similar polyglycol esters of lauric, stearic, oleic acids, etc.

Additional non-ionic wetting agents are the polyalkylene oxide condensates with higher fatty acid amides, such as the higher fatty acid primary amides, mono- and diethanolamides. Suitable agents are coconut fatty acid amide condensed with about 10 to 50 moles of ethylene oxide. The fatty acyl group will have similarly about 8 to 22 carbons, and usually about 10 to 18 carbon atoms, in such products. The corresponding sulfonamides may be used also if desired.

Other suitable polyether non-ionic wetting agents are the polyalkylene oxide ethers of high aliphatic alcohols. Suitable fatty alcohols having a hydrophobic character, preferably 8 to 22 carbons, are lauryl, myristyl, cetyl, stearyl and oleyl alcohols which may be condensed with an appropriate amount of ethylene oxide, such as at least about 6, and preferably about 10 to 30 moles. A typical product is oleyl alcohol condensed with about 12, 15 or 20 moles of ethylene oxide. The corresponding higher alkyl mercaptants or thioalcohols condensed with ethylene oxide are suitable also. The water-soluble polyoxyethylene condensates with hydrophobic polyoxypropylene glycols may also be employed.

Further suitable non-ionic materials are the higher fatty acid alkanolamides, such as the monoethanolamides, diethanolamides and isopropanolamides wherein the acyl radical has about 10 to 14 carbon atoms and amine oxides. Examples are coconut (or equivalent lauric), capric and myristic diethanolamide, monoethanolamide and isopropanolamide, dodecyl dimethyl amine oxide and dimethyl acetoxyalkylamine oxide where alkyl is C_{11}–C_{14}.

Other suitable agents are anionic aromatic materials, e.g. water-soluble higher alkyl aryl sulfonates particularly those having from 8 to about 15 carbon atoms in the alkyl group having a mononuclear aryl nucleus, such as toluene, xylene, or phenol. The higher alkyl substituent on the aromatic nucleus may be branched or straight-chained in structure, examples of such group being nonyl, dodecyl and pentadecyl groups derived from polymers of lower mono-olefins, decyl, keryl, and the like.

Illustrative of suitable aliphatic anionic agents are the normal and secondary higher alkyl sulfate detergents, particularly those having about 8 to 15 carbons in the fatty alcohol residue, such as lauryl (or coconut fatty alcohol) sulfate. Other suitable detergents are the sulfuric acid esters of polyhydric alcohols incompletely esterified with higher fatty acids, e.g. oleic acid ester of isothionic acid; the higher fatty acid (e.g. coconut) ethanolamide sulfate; the higher fatty acid amide of amino alkyl sulfonic acids, e.g. lauric acid amide of taurine; and the like.

Typical specific examples are: the sodium salt of a sulfate ester of an alkylphenoxypoly (ethyleneoxy) ethanol, the ammonium salt of this sulfate ester, sodium methyl oleyl taurate, sodium alkyl naphthalene sulfonate, alkyl acyl sodium sulfonate, sodium tetrahydronaphthalene sulfonate, sodium alkyl aryl sulfonate, alkyl amido sulfate, cocomonoglyceride sulfate, dodecylbenzene sodium dodecyl diphenyl oxide disulfonate, sulfonated castor oil, polyethoxyalkyl phenol sulfonate triethanolamine salt, sodium triethanolamine alkyl aryl sulfonate, magnesium lauryl sulfate, potassium lauryl sulfate, sodium lauryl ether sulfate, ammonium lauryl ether sulfate, sodium tallow sulfate, dodecylbenzene sodium sulfonate, oleyl methyl tauride, ammonium lauryl sulfate, amide sulfonate and the like.

Other suitable synthetic detergents are cationic agents such as the amines particularly primary fatty amines such as lauric amine, myristic amine, palmitic amine, stearic amine, oleyl amine, linoleyl amine, coco amine and tallow amine. Also N-fatty propylene diamine and heterocyclic tertiary amines as well as fatty halides, e.g. stearyl dimethyl benzene ammonium chloride, dodecylbenzene chloride, lauryl pyridinium chloride and sulfates, e.g. lauryl pyridinium bisulfate can be used.

In Step 5 of the figure a sealer or barrier coat is put on. It is the function of this coating to protect the decorative particles and the matrix coat, if necessary, from attack by the finishing or glaze coat. It is preferred to employ an aqueous based resin as the barrier coat. Numerous materials are useful including alkyds, acrylics and vinyl polymer solutions and suspensions. Preferred resins are water soluble polyurethanes.

In Step 6 of the drawing the finishing or glaze coat is added. This coat is typically an organic solvent solution of a polyurethane but may be any resin affording high gloss, toughness, detergent resistance and long wearing properties.

The sealer and glaze coats as stated are preferably polyurethane. The term "polyurethane" herein has reference to synthetic organic polymers derived from reaction of polyisocyanates with compounds having a plurality of active H atoms typically various polyols. Polyurethanes may be classified according to their cure mechanism e.g. as "moisture curing" from the presence of excess isocyanate groups which are moisture reactive to cure the resin or "two component" from the curing reaction between two different materials one having an excess of isocyanate groups and the other active hydrogens e.g. in an hydroxyl group or "drying oil" type in which cure reaction is through unsaturation of alcoholized drying or semi-drying oils reacted with a polyisocyanate.

Polyurethane resins of the moisture curing type can be prepared from a polymer having at least two groups possessing active hydrogen atoms such as hydroxyl rich polyesters or polyethers, and an organic polyisocyanate, such as tolylene diisocyanate present in substantial excess e.g. 10 to 110 percent greater than the stoichiometric amount.

Polyurethane resins of the two component type are preparable by reacting a substantial excess of organic polyisocyanate with a compound having a number of groups containing an active hydrogen, such as an alkane polyol e.g. hexane triol; the other component is generally a polymer having a number of groups containing an active hydrogen such as an hydroxyl rich polyester or polyether or the like. These two components are mixed just before use. The isocyanate groups of the first component react with the active hydrogens of the second component effectively crosslinking the components into a tough durable coating. The resin system can be catalyzed with driers such as cobalt naphthenate or stannous octoate.

The polyurethanes of the drying oil type are urethane oils produced by reacting an alcoholized drying or semi-drying vegetable or marine oil, or oil acid, with an organic polyisocyanate. Among suitable oils are linseed oil, perilla oil, safflower oil, soybean oil, tung oil, castor oil, dehydrated castor oil, octicica oil and the like as well as oil acids of such oils. These oils are alcoholized with a polyol such as one of the alkylene glycols e.g. ethylene glycol, propylene glycol, hexamethylene glycol and pinacol or triols such as glycerol, trimethylolpropane, hexanetriol, as well as erythritol, pentaerythritol, mannitol and other polyhydroxy alcohols having from 2 to about 10 hydroxy groups and 2 to 20 carbon atoms. Following alcoholysis the oils are reacted with an organic isocyanate in known manner.

In preparing the foregoing polyurethanes preferred isocyanates include alkylene, cycloalkylene, aryl and haloaryl di- and triisocyanates generally containing from 4 to 20 carbon atoms e.g. hexamethylene diisocyanate, cyclohexyl-1,4-diisocyanate, tolylene diisocyanate, diphenyl methane - 4,4'diisocyanate, biphenyl - 4,4'diisocyanate,

naphthalene diisocyanates, 1,2,4-benzene triisocyanate, butane-1,2,2-triisocyanate, triphenyl diisocyanate, ethylene diisocyanate, and chlorophenyl-2,4-diisocyanate and the like.

The sealer and glaze coats are applied following hardening of the matrix layer with the decorative particles embedded therein. Application is by means of a roller, trowel or other device enabling smooth spreading of the resinous solutions over the matrix surface.

EXAMPLE

Flooring to be resurfaced and having a covering of linoleum is first thoroughly cleaned to remove wax and polishes and apparent cracks are filled. A surfacing kit including two containers of aqueous epoxy resin, a container of particolored vinyl plastic chips, a container of polyurethane in water solution and a container of polyurethane in xylene solution is used. The two containers of epoxy resin are thoroughly mixed, initiating a curing reaction allowing a working time of about one hour. The aqueous epoxy having the viscosity of cream and at about 70% by weight solids is roller coated or troweled across the linoleum surface to form a flood coat. The flood coat is allowed to dry and the resin cure. This requires about one hour. After the hour or when the flood coat will support a person's weight, a second layer of epoxy resin is laid down, as a matrix. Immediately a water spray is applied to the matrix to thoroughly wet the surface without puddling or locally flooding. The vinyl chips are then broadcast by being tossed upward and allowed to float downward onto the wet matrix surface. On settling of the chips a fine water mist is played over them to lightly but completely wet their surfaces to insure settling of the chips into the matrix layer. The applied surfacing is then allowed to dry for about twelve hours at about 70° F. Thereafter loose chips are swept from the floor and the area is sanded if desired for increased smoothness. The sealer coat is now applied consisting of a polyurethane resin in aqueous solution. Application is at a thickness covering all deposited chips. After the sealer coat is dry the glaze coat is applied consisting of several e.g. three applications of a catalyzed polyurethane resin in an organic diluent with intermediate sanding and vacuuming steps. The presence of the sealer resin layer prevents the solvent in the glaze from attacking the vinyl chips and muddying their coloration. No curling or warping of the finished floor covering was noticed after six months of use.

CONTROL

The example was duplicated but omitting the water spray before and after decorative chip deposition. Numerous chips protruded upwardly sufficiently from the matrix to render final finishing operations difficult and high surface smoothness nearly impossible to obtain.

I claim:

1. The method of forming a surface covering such as a floor covering in place which includes depositing decorative particles on a previously applied and liquid matrix containing an epoxy resin in an aqueous carrier in a manner normally tending to cause deposited particles to protrude from the matrix surface sufficiently to interfere with the surface smoothness of a subsequently applied resinous overlayer and spraying water onto protruding particles to wet the particle surfaces to reduce the protrusion thereof.

2. Metnod according to claim **1** including also curing said epoxy resin following deposition of particles thereon.

3. Method according to claim **1** including also forming said overlayer by coating the matrix containing deposited particles with a solution of a polyurethane resin and evaporating the solvent from said solution.

4. Method according to claim **1** in which depositing includes randomly distributing a quantity of decorative particles onto said matrix by broadcasting the particles adjacently above the liquid matrix.

5. Method according to claim **1** including also spraying water over the matrix before particle deposition.

6. The method of forming in place a surface covering on a wood, ceramic, cementitious, metallic or plastic surface whicn includes coating the surface to be covered with an adherent curable epoxy resin in an aqueous carrier to form a matrix, broadcasting decorative particles over the matrix to randomly deposit same on the matrix surface, water spraying the deposited particles to increase their penetration into the matrix, curing the epoxy resin with the particles therein and coating the cured epoxy resin with a resinous overlayer.

7. Method according to claim **6** including also water-wetting the epoxy resin coating prior to application of decorative particles thereto.

8. Method according to claim **7** in which the resinous overlayer comprises a polyurethane resin in organic solvent solution and including also coating the cured epoxy resin with a water base resin and drying prior to application of the organic solvent based polyurethane.

9. Method according to claim **7** including also lowering the surface tension of the water to be water sprayed prior to spraying over the deposited particles to aid in wetting said particles.

10. Metnod according to claim **7** including air curing said epoxy resin.

11. The method of forming in place a surface covering on a wood, ceramic, cementitious, metallic or plastic surface which includes coating the surface to be covered with an adherent curable epoxy resin in an aqueous carrier to form a matrix, broadcasting decorative particles over the matrix to randomly deposit same on the matrix surface, water wetting the deposited particles to increase their penetration into the matrix, curing the epoxy resin with the particles therein and coating the cured epoxy resin with a resinous overlayer.

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U.S. Cl. X.R.

94—3; 117—16, 21, 25, 29, 33, 62.1, 64, 100 R, 100 M, 100 D; 161—5, 162, 184, 190