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MASH BLOCK TRANSFER PRINT PROCESS

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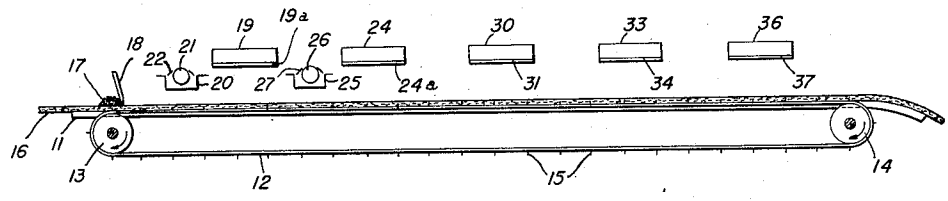


FIG. 1

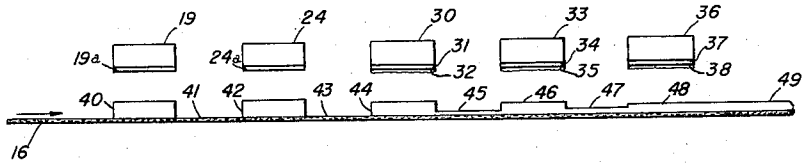
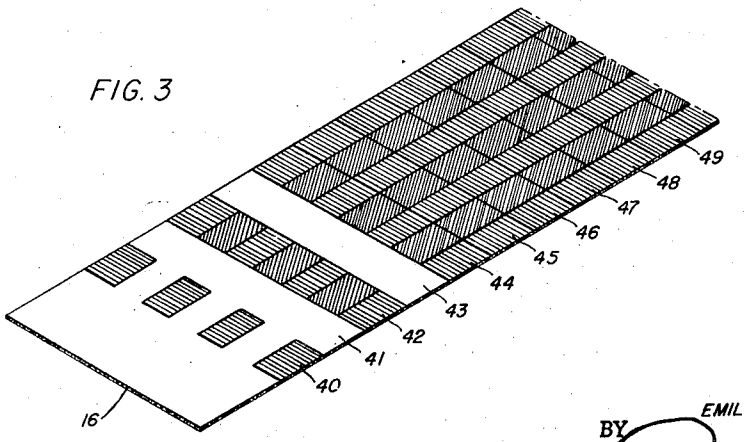


FIG. 2

FIG. 3



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MASH BLOCK TRANSFER PRINT PROCESS

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12 Claims. (Cl. 117—38)

The invention relates to printed surface coverings such as are applied to floors, walls and the like and particularly to a method for producing such surface coverings.

The printing of an enamel paint composition upon a web of backing material in the form of a colorful and attractive pattern is well known in the production of products conventionally referred to as printed felt base. Printed felt base is normally produced on a flat bed printing machine by means of which the design is printed by intermittently advancing a web of backing material beneath a series of vertically movable printing blocks which are cut in the form of the pattern to be printed. Each printing block bears a printing surface cut to correspond to that part of the pattern in one particular color. The number of printing blocks used is a function of the number of separate colors in the desired pattern. Patterns having up to 24 distinct colors can be printed on conventional flat bed printing machines.

A large part of the cost of producing a printed surface covering is represented by the cost of the printing enamel used. Thus, the manufacturing cost and selling price of printed felt base is directly proportional to the thickness of the decorative paint film applied by the printing machine. The easiest method of reducing the thickness of the decorative paint film in the finished product is to reduce the thickness of paint applied to the printing surface of the different printing blocks. In a flat bed printing machine, paint is applied to the printing surface of each printing block prior to each print dip of the blocks by passing a paint covered roller beneath the printing surface, thereby transferring a thin film of paint from the roller to the printing surface. The roller freely revolves partially immersed in a reservoir of paint. The thickness of paint applied to the roller is controlled by means of doctor blades spaced a variable amount from the roll surface. By adjusting the doctor blade setting and the clearance of the paint roller to the print block it is possible to reduce the thickness of the paint film applied to the printing surface. The clearance between roller and block is adjusted by means of shims. There is a lower limit, however, below which the thickness of paint applied to the printing surface can not fall. When the paint roller is raised to more closely approach the printing surface on the block, the likelihood of damage of the printing surface is increased, such as by breaking off part of the thin wood sections which form the printing surface on the block. Also, where the paint film thickness is too low all the printing surface on a block may not be covered with paint in spite of the most careful shimming and thus incomplete printing of the design results. The resulting printing product is therefor unacceptable. It has been found that a decorative paint film having a thickness of less than 0.0035 inch can not be printed using conventional printing blocks on a flat bed printing machine.

The thickness of the decorative paint film applied by a flat bed printing machine can also be controlled by varying the percentage of exposed wood on the printing surface composed to the total area of the printing surface. Conventional printing blocks have printing surfaces in the form of a series of wood strips separated by parallel spaced cuts or kerfs in the wood. The blocks normally have from 9 to 12 strips per inch. The spacing between the strips and width of each strip can be varied to change the percentage of exposed wood in a given area of the printing surface. These conventional blocks commonly have from about 40 percent to about 60 percent exposed wood, with the remaining area made up of the spaces or kerfs. Special blocks, at greater cost, are also available wherein the exposed wood is in the form of small areas or pins separated by spaces or kerfs which extend both parallel to the length of the block and at right angles thereto, that is across its width. In such blocks, the percentage exposed wood can be as low as 20 percent of the area of the printing surface. These special blocks are known as Vertigrain blocks, the name stemming from the fact that the spaced pins extend from the block with the grain of the wood vertical or parallel to the pin. This construction has greater strength, the pins being able to stand flexing when contacted by the paint roller without breaking.

The use of Vertigrain blocks is undesirable for several reasons. First, they cost more than conventional blocks. Second, their use requires the preparation of an entire extra series of blocks when the same pattern is to be printed with both heavy and light weight decorative paint films. This greatly increases costs since considerable labor is required to cut out the printing surfaces in accordance with the pattern to be printed. Third, the spaced pin construction of the printing surface means that the decorative paint is applied to a web of backing material in the form of spaced dots which must then flow together to form a smooth uniform surface. In this step, some distortion of the pattern can occur, and unsatisfactory levelling of the paint can lead to a non-uniform surface in the product. It is apparent therefore that it would be desirable to have a method wherein both a light and heavy weight printed melt base could be produced using the same printing blocks.

One such method is available and comprising printing a design using standard printing blocks upon a web and then while the paint is still wet and fluid, bring a second web into contact with the printed paint film on the first web, thereby transferring a portion of the printed film to the second web and producing two sheets bearing the identical printed design but each with about ½ the paint film thickness of that originally applied by the printing blocks. Satisfactory operation of this transfer process is difficult. The contact between the second web and the printed film on the first web must be closely and uniformly controlled, all of which requires the use of costly equipment. In spite of the most careful control it is found that the yield of perfect merchandise produced by this method is in general low since there almost invariably tends to be smearing of the paint composition when the two moving sheets separate after the transferring step.

It is an object of the invention to produce a printed surface covering having a decorative film thickness of less than 0.0035 inch by using conventional printing blocks. Another object of the invention is to produce a printed surface covering with a thin decorative paint layer by a method wherein high yields can be produced. A further object of the invention is to produce a printed surface covering having a thin printed decorative layer through use of a conventional flat bed printing machine without necessitating the expenditure of a large sum of money.

In accordance with the invention a decorative surface covering is produced by applying a paint film in the form of a decorative design to a portion of one surface of a

backing and then transferring approximately one-half the thickness of said paint film to the uncovered portions of the backing thereby duplicating said design and yielding a product with a decorative film completely covering the surface of said backing. The invention permits the production of a printed surface covering having a thin uniform design layer by use of a conventional flat bed printing machine without requiring expenditure of large sums of money.

In a flat bed printing machine a backing web having a width of 6 to 12 feet is passed intermittently in a stepwise fashion beneath a plurality of printing blocks. The printing blocks extend the full width of the web and are 18 inches wide and spaced 18 inches apart. The web moves in a series of 18 inch steps. Associated with each printing block is a paint reservoir within which can revolve a hard surfaced roll. When this roll moves across the printing surface of the block with the clearance between block and roller carefully controlled a uniform film of paint carried by the roll is applied to the printing surface. In the conventional operation of the printing machine all the printing blocks are lowered simultaneously when the backing is at rest and deposit a film of paint upon the web. The blocks are then raised and the web moves forward an 18 inch step. Simultaneously the paint reservoirs move horizontally beneath the printing blocks and apply a film of paint to the printing surface of the blocks. The cycle is then repeated until the complete design is printed.

In the production of products in accordance with the invention the operation of a flat bed printing machine is modified so that the printing blocks are depressed upon the web after every second advance of the backing. Thus, after the blocks have been depressed to apply the paint to the backing the blocks are raised and the sheet advances 18 inches. The blocks do not come down again upon the sheet until after a second 18 inch advance. This cycle is repeated until the complete design is printed as a uniform paint film in a series of 18 inch stripes extending the full width of the backing, the stripes themselves being spaced 18 inches apart. After the paint film has been completely applied to the printed stripes in the desired design, the backing moves beneath a series of transfer blocks which are arranged above the backing in the same manner as printing blocks except that no paint reservoirs are associated therewith. The transfer blocks can vertically reciprocate when the backing is at rest in the same manner as conventional printing blocks. Although the printing blocks reciprocate only with every second advance of the web, the transfer blocks reciprocate after every 18 inch advance. When a transfer block comes down upon a previously printed stripe and is then raised, a portion of the paint is removed from the web and transferred to the surface of the transfer block. After the backing has advanced 18 inches the transfer block is depressed thereby depositing the removed paint upon a previously unprinted stripe of the backing.

The transfer blocks can be similar in construction to the blocks which are used in conventional flat bed printing to insure complete uniformity in thickness of the printed paint film. Such blocks are commonly called mash blocks. A mash block has a surface which contacts the paint film when the block is depressed thereon which bears a number of closely spaced wooden pins separated by cuts or kerfs which extend parallel to the length and width of the block. Normally, there are from 8 to 12 kerfs per inch in each direction, so that there are from 64 to 144 pins per square inch of mash block surface. This type of construction is ideally suited to use as a transfer block, since the kerfs permit storage of transferred paint by capillary action until the paint is released when the block is brought back in contact with the web.

By means of the transfer blocks, a portion of the paint film representing the complete design is removed from

the printed stripes and applied to the previously unprinted stripes, thus duplicating the design in the previously unprinted areas of the backing. It has been found that the transfer is best effected in at least two successive steps, although three, four or more separate transfer steps can be used to build up the paint film in the previously unprinted areas of the backing. As portions of the printed paint film are removed from the painted stripes, the paint film becomes progressively thinner and the transferred paint film becomes progressively thicker on the previously unprinted areas of the backing until at the end of the transfer section the backing is fully covered with a decorative paint film having a thickness approximately ½ of that applied by the printing blocks to the backing in the printed stripes. The design applied in the printed stripes is duplicated in the previously unprinted stripes. The fidelity of the design is unimpaired by the transfer operaton, so that it is impossible to determine by examination of the product which areas of the backing were directly printed and which were covered with paint by the transfer steps.

The operation of the invention will be described in connection with the drawings wherein:

Figure 1 is a schematic representation of a flat bed printing machine for use in the production of products in accordance with the invention;

Figure 2 is an enlarged schematic view illustrating the way in which a printed surface covering is produced in accordance with the invention; and

Figure 3 is a view of a portion of a web being printed in accordance with the invention.

The block printing machine shown in Figure 1 consists of a bed **11** which extends its entire length and width. At each of the opposite sides of the bed is an endless belt **12** which is provided with a plurality of evenly spaced pins **15** throughout its length. The belt **12** passes around drums **13, 14** located at each end of the machine which are intermittently rotated to advance a backing web **16** in stepwise fashion along the machine. The web is driven by means of the pins extending from the belts which pierce the backing adjacent to the edges thereof. A doctor blade **18** is provided at the front portion of the printing machine. The edges of the doctor blade is maintained in close relation to the face of the moving backing thus causing a thin film of paint from a paint pool **17** to be deposited on the backing. The printing machine is provided with vertically reciprocable printing blocks **19, 24** equipped with printing surfaces **19*a*, 24*a***. Each printing surface is cut to conform to the pattern to be printed in one particular color. Associated with the blocks are paint pots **20, 25** provided with rollers **21, 26** partially immersed within a supply of paint in the paint pots and a pair of doctor blades **22, 27** for limiting the amount of paint applied to the rollers. Transfer blocks **30, 33, 36** provided with transfer surfaces **31, 34, 37** are provided above the bed of the printing machine after the printing blocks. Each printing block and transfer block is **18** inches in width, that is in a direction parallel to the motion of the backing, and the printing blocks and transfer blocks are spaced 18 inches apart.

The mechanical operation of a flat bed printing machine is well established in the art; consequently, the means for intermittently rotating the drums and for horizontally reciprocating the paint pots beneath the print blocks and the means for vertically reciprocating the print blocks and the transfer blocks are not shown in the drawing for the sake of simplicity.

In the operation of the flat bed printing machine in the production of products in accordance with the invention, the backing web is delivered to the machine and is engaged by the pins in the endless belts which serve to advance the backing along the machine. The backing is contacted by the doctor blade located immediately forward of the paint pool, thus dampening the backing with

a small amount of paint. This thin paint layer is well known in the art of flat bed printing as a "wet-face." The backing is advanced along the machine in a series of 18 inch steps. After every second 18 inch advance of the backing, the printing blocks are lowered and deposit a film of paint upon the backing. The blocks are then raised and the paint pots horizontally reciprocate beneath the blocks thereby applying a film of paint to the printing surfaces thereof. The transfer blocks vertically reciprocate and contact the backing after every 18 inch advance of the web.

The appearance of a backing being printed in accordance with the invention is illustrated in Figures 2 and 3. For clarity, only the backing, printing and transfer blocks and the decorative paint applied to the web are shown in Figure 2. The figure shows the appearance of the backing and blocks immediately after all the blocks have been raised. A top view of a portion of the backing at the same time is illustrated in Figure 3. The printing surface **19***a* deposits a paint film **40** which covers the backing in an **18** inch stripe in those portions represented by a single color in the desired pattern. The printing surface **24***a* deposits the second color in the areas of the stripe previously imprinted by the surface **19***a* to form a completely printed film **42**. Unprinted stripes **41**, **43** are located before and after the film **42**. In the transfer section of the flat bed printing machine, the paint previously applied to the backing in the form of the printed stripes is transferred in steps to the unprinted stripes. As shown in the figures, the transfer is effected with three transfer blocks. The printed film **44** is reduced in thickness as compared to the printed film **42** by the thickness of the paint film **32** transferred therefrom onto transfer surface **31**. In a similar fashion, the film **46** is thinner than film **44** and film **48** is thinner than film **46** by the thickness of the films **35**, **38** transferred therefrom onto transfer surfaces **34**, **37** respectively. The transfer to the unprinted stripes on the backing is built up in a series of three transfers as described above. Films **45**, **47**, **49** represent the transferred film after the first, second and third transfers respectively. The films **48** and **49** are the same thickness, that is each one is one-half the thickness of the film **42**.

Figures 2 and 3 are static depictions of the appearance of the backing immediately after all the blocks are raised. In actual operation, after this moment of raising of the blocks, the backing advances 18 inches. Then, the three transfer blocks are depressed upon the backing. The film **32** is applied to the unprinted stripe **43**, the film **35** is applied to the film **45** and the film **38** is applied to the film **47**. The blocks are then raised and the backing advances another 18 inches. During this advance paint is applied to printing surfaces **19***a* and **24***a* by their associated paint rollers. After the sheet stops, all blocks are depressed, the print paint is applied and portions thereof are removed to each of the three transfer surfaces. This cycle is continued.

The invention has been illustrated in the figures for the sake of simplicity by showing the printing of a decorative pattern having only 2 colors, that is, requiring the use of only 2 printing blocks. It is apparent, however, that patterns of far greater complexity can be printed in accordance with the invention. Conventional flat bed printing machines have space for up to 24 blocks. The only limitation in the complexity of patterns printed in accordance with the invention is the fact that some of the final printing stages on the flat bed machine are occupied by the transfer blocks. Thus, patterns having a number of separate colors which is 24 less the number of transfer blocks required can be printed in accordance with the invention on a conventional flat bed printing machine. The figures illustrate the use of 3 transfer blocks. In some instances, 4, 5 or even 6 transfer blocks can be used. The use of 3 or 4 transfer blocks has been found particularly effective. It has also been found that satisfactory uniform transfer can not be obtained using less than 2 transfer blocks. The invention has been described in terms of a conventional flat bed printing machine wherein the blocks are 18 inches in width and are spaced 18 inches apart. All the flat bed printing machines now in use in the production of printed surface coverings are of this type. However, the invention is also applicable to flat bed printing machines having blocks of different widths. The only limitation is that the printing blocks and the transfer blocks must be of the same width and the spacing between the blocks must be equal to the width of the blocks. In addition, the motion of the backing along the flat bed machine must be in steps equal to the width of the block.

Alternately, the design can be applied to areas of the backing using other techniques of printing such as rotary or silk screen printing. The printing film can then be transferred in successive portions to the unprinted areas in accordance with the invention, duplicating the design and yielding a backing completely covered with a design layer having a thickness of approximately one-half that of the original printed film.

The backing on which the decorative design is applied in accordance with the invention is preferably a sheet of felted fibrous material which has been strengthened by impregnation with a water proofing and strengthening impregnant and which bears upon the surface upon which the design is printed one or more seal coats to prevent any migration of the impregnant to the surface of the product with resulting staining and discoloration. It is preferable that a sheet of felted fibers be employed. The felt generally is produced using a Fourdrinier or cylinder paper machine with the thickness of the resulting sheet normally falling in the range from about .02 to about .08 inch. The fibrous material used is normally cellulose in origin although other fibers can be used including fibers of mineral and animal origin. The sources of cellulose 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 fibrous sheet can also contain fillers such as wood flour.

The felted fibers are normally strengthened by impregnation. Various bituminous materials are most commonly used due to their low cost. Normally, quantities ranging from 80 percent to about 140 percent by weight of the impregnant based on the bone dry weight of the felt are used although sometimes as little as 25 percent impregnant will provide a satisfactory product. Numerous bituminous materials are conventional and include asphalts of petroleum of natural origin and tars and pitch residues of vegetable and animal origin. These materials may be crude, blown or steam distilled. In addition, various natural and synthetic resinous materials can be used for impregnating felt. Suitable resinous impregnants include phenol-formaldehyde and phenol urea resins, polymerized vinyl compounds, such as polyvinyl chloride, polyvinyl acetate and copolymers thereof, cellulose acetate, cellulose nitrate, and butadiene-styrene, butadiene-acrylonitrile, and natural rubber latices, and the like.

The impregnated felt is normally coated with one or more seal coats designed to seal against any migration of impregnant to the surface of the sheet and also to provide a smooth surface upon which the design is printed free of any loose ends of fibrous material. The seal coats are commonly of either the oleoresinous or latex type. In an oleoresinous seal coat, the vehicle can contain dispersed in solvent any of the drying oils and resins which after application dry to a hard, tough, solid consistency. In the case of a seal coat of the latex type, the vehicle comprises an aqueous emulsion of a rubber latex such as natural rubber, butadiene-styrene copoly-

mer and the like. These vehicles are conventionally used in conjunction with inert fillers such as whiting, clay, wood flour, limestone, and titanium dioxide, zinc oxide, and other inorganic and organic pigments, and the like. While it is preferred that the felt be coated with two coats of a sealing material, any number of coats can be used.

The web is preferably moistened with a thin paint film at the start of the printing machine. Normally, a paint similar in composition to that used as a printing enamel is used. This moistening of the web prior to printing is desirable in effecting flow of the printing enamel.

The printing composition used is formulated from conventional pigments, extenders and fillers in conjunction with suitable binders and thinners. Any of the binders well known in the formulation of paint compositions can be used. For example, the binder can be an oleoresinous system, that is, a mixture of drying or semi-drying oils in conjunction with synthetic or natural resins and gums. The drying oil component can include both naturally occurring and chemically treated oils such as tung oil, linseed oil, perilla oil, tall oil partially esterified with a polyhydric alcohol and the like. Various natural and synthetic resins can be used in conjunction with the drying oils such as alkyd resins, including the reaction products of phthalic, isophthalic, terephthalic, sebacic, adipic, succinic, oxalic, fumaric, citric, glutaric, diglycollic, maleic, camphoric, dilactic, pimelic, suberic, azelaic acids, and the like with polyhydric alcohols such as sorbitol, ethylene glycol, propylene glycol, pentaerythritol, glycerol, butylene glycol, trimethylene glycol, diethylene glycol, triethylene glycol, and the like; phenolic resins, including the reaction products of phenols, such as phenol, o-, p-, and m-cresol, the xlyenols, pyrogallol, resorcinol, the naphthols, and the like with aldehydes, such as acetaldehyde, formaldehyde, acrolein, isobutylraldehyde, furfural, paraldehyde, and the like; coumaroneindene resins; urea-formaldehyde resins, such as obtained by reacting amides, including urea, thiourea, ethylideneurea, naphthalene monosulphonamide, and the like with aldehydes such as listed under the phenolic resins above; melamine resins; vinyl resins, such as polymers and copolymers of vinyl chloride, vinylidene chloride, vinyl acetate, vinyl butyrate, and the like; polymers and copolymers of acrylic and substituted acrylic acids; and the like.

The binder in the printing composition can be a synthetic thermoplastic or elastomeric resin instead of the oleoresinous binder as disclosed above. In such a binder, no drying oils are necessary. Thermoplastic resins such as the vinyl resins, including polymers and copolymers of vinyl chloride, vinylidene chloride and the like, the acrylic resins such as polymers and copolymers of acrylic acid, methacrylic acid, their derivatives and the like are useful binders in the formulation of printing compositions useful in the invention. In addition, printing compositions can be based on elastomeric resinous binders such as butadiene-styrene copolymer, butadiene-acrylonitrile copolymer and the like.

The satisfactory transfer of a paint composition printed on a backing to a transfer block and thereafter to the backing requires that the printing composition have certain critical flow characteristics. It is preferred that the consistency of the printing composition be such that when a quantity of paint filling a ring 0.75 inch inside diameter by 0.5 inch long is released upon a smooth plate maintained at an angle of 30° with the horizontal, the leading edge of the paint travels between about 5 and about 12 inches in 30 seconds. The most effective range for this distance of travel is from 7 to 10 inches in 30 seconds. This distance of travel is referred to as the "flow" of the paint and the term flow as used in the specification and in the claims refers to a determination of paint consistency by the technique described above. In contrast to this comparatively thin consistency is the "flow" of conventional printing enamels which normally is in the range of from 1 to 4 inches.

Oleoresinous printing compositions which contain as their drying oil component a modified oil formed by reacting an oil with drying properties, that is a drying or a semi-drying oil, with an unsaturated carboxylic acid having from 3 to 10 carbon atoms and thereafter esterifying by reacting with a polyhydroxy alcohol are particularly effective for use in the production of products in accordance with the invention. Any oil or mixture of oils with drying properties, including those of both natural and synthetic origin as enumerated above can be used.

In making the modified oil, the oil with drying properties is reacted with about 5 to about 30 percent of its weight of an unsaturated carboxylic acid having from 3 to 10 carbon atoms, such as acrylic acid, maleic acid, fumaric acid, crotonic acid, citraconic acid, angelic acid, glutaconic aid, itaconic acid, aconitic acid, muconic acid, and the like. The acid itself can be used or can be present in the reaction mixture as the corresponding anhydride. The condensation reaction is carried out by heating the oil with the acid for a period of from about 10 minutes to about 5 hours at a temperature between about 150° C. and about 300° C. The reaction is preferably carried out in a pressure autoclave since when low molecular weight unsaturated acids are used, the reaction temperatures will be above the atmospheric boiling point temperature of the acid, thus requiring pressure operation in the autoclave. Pressure operation for the reaction will occur in the case of the reaction of an oil with maleic or fumaric acids which are the preferred acids for use in the invention.

The reaction mixture is preferably esterified with a polyhydroxy alcohol to remove a substantial amount of the free acid present due to the unsaturated carboxylic acid used in the reaction. The polyhydroxy alcohols preferably contain from 2 to 6 carbon atoms and two or more hydroxy groups. Typical examples of suitable compounds are ethylene glycol, propylene glycol, glycerol, sorbitol, pentaerythritol, mannitol and the like. In order that the printing enamel formulated from the modified oil have satisfactory alkali resistance, which is a highly important property in a printed surface covering, it is preferred that the modified oil be neutral or have an acid number of at least no greater than about 20. Acid number is defined as the number of milligrams of potassium hydroxide required to react with 1 gram of material.

Although the reaction is preferably carried out by reacting an oil with an unsaturated acid, followed by esterification with a polyhydroxy alcohol, the ingredients can all be present in the reaction mixture simultaneously, or the unsaturated acid can be added in the form of a complete or partial ester. Also, in the case of the use of a small amount of a high molecular weight, unsaturated acid, treatment with the alcohol may not be required to produce a treated oil having an acid number of less than about 20.

In the preparation of the preferred binder a portion of the modified oil can be replaced by an air-blown drying oil if desired. Such an air-blown oil is made by blowing an oxygen containing gas through a supply of an oil with drying properties maintained at a temperature of between about 100° F. and about 200° F.

In the formulation of the preferred printing compositions the oil with drying properties which has been modified as described above is combined with resin either synthetic or natural such as those already listed above. The printing composition is formulated so that the ratio of modified oil to total resin is between 0.5 to 1 and 5 to 1. A particular effective ratio of modified oil to resin is from 1.5 to 1 to about 3 to 1.

In the formulation of a printing composition for use in the invention, the binder is dissolved or dispersed in a liquid thinner to yield a liquid system of satisfactory flow when the desired pigments, fillers and extenders are pres-

ent. Where oleoresinous binders are used, comprising either conventional drying oils or the preferred modified drying oils as disclosed above, conventional solvents or thinners are added in order that the composition attain the desired flow properties. The solvent used can comprise any of the solvents and thinners or mixtures thereof normally present in paints such as turpentine, naphtha, kerosene, benzene, toluene, mineral spirits and the like. The oleoresinous printing composition will normally contain from about 20 to about 40 percent solvent based on the weight of solvent plus binder. A particularly effective range is from 25 to 35 percent solvent.

Where thermoplastic or elastomeric resinous binders are used, the binder can be dissolved in a suitable solvent as disclosed in connection with oleoresinous binders. Alternately, the binder can be emulsified in the presence of suitable emulsifying agent in water to make an aqueous latex printing composition. Where a thermoplastic resinous binder is used, such as polyvinyl chloride or its copolymers, a plasticizer for the resin is also added to the composition. Such plasticizers as dioctyl phthalate, tricresyl phosphate, dipropylene glycol dibenzoate, didecyl adipate and the like are satisfactory.

The printing composition also contains conventional pigments, extenders, and fillers. Pigments are chosen according to the color desired and can include any of the organic and inorganic types well known in the paint art. Such well-known pigments as lead chromate, zinc chromate, lead molybdate, titanium dioxide, zinc oxide, zinc sulfide, copper ferrocyanide, the ferric-ferrocyanide complexes, toluidene red, copper phthalocyanine and the like can be used. These pigments are conventionally blended with extenders such as calcium sulfate, barium sulfate, lead sulfate and magnesium oxide. Such fillers as chalk, whiting, and clay can be used as desired. A separate printing composition is prepared for each color to be printed to create the desired pattern.

After the web of backing material has been printed in the manner of the invention and the printed film transferred to the unprinted stripes on the backing the product is passed to an oven in order to dry and cure the paint. When oleoresinous binders are used in the formulation of the printing composition the paint can be dried by passing through an oven maintained at a temperature of about 140° F. to 180° F. for about 8 to about 36 hours. Where thermoplastic resinous binders are used the temperature in the oven must be at the fusion temperature of the particular resin used in the binder which is normally in the range of 300 to 350° F.

The following examples are given for purposes of illustration for the invention:

Example I

A modified oil suitable for the preparation of printing compositions for use in the invention is produced by heating 750 pounds of linseed oil with 50 pounds of maleic acid at a temperature of 225° C. for 45 minutes in a pressure autoclave. To the hot reaction mixture is added 40 pounds of glycerol and the resulting mixture is stirred until the reaction is complete. The product has an acid number of 14.

Example II

12 separate printing compositions each pigmented a different color are each prepared as follows: 650 pounds of fillers and extenders, a mixture of zinc oxide, titanium calcium sulfate and calcium sulfate were ground with 330 pounds of vehicle on a standard 3 roll mill. A batch of vehicle was prepared by heating 700 pounds of the modified oil of Example I with 360 pounds of phenolic and alkyd resins to a temperature of 300° F. until the resins were completely dissolved. The solution was cooled to 200° F. and 530 pounds of mineral spirits and 5 pounds of cobalt and manganese dryers and conventional anti-skinning agents were added while continually stirring the mixture. Each of the 12 batches of printing composition was prepared by tinting the mixture of fillers and vehicle with tinting pigments in accordance with the colors required for reproducing the desired pattern. Each composition was then thinned with additional vehicle formulated as described above to a flow of 8 inches.

A web of asphalt saturated felt which had been double seal coated with standard oleoresinous seal coats was delivered to a flat bed printing machine. Twelve 18 inch printing blocks spaced 18 inches apart were provided at the 12 initial printing stations on the machine. Each block bore a printing surface cut to conform to one of the colors in the desired 12 color floral pattern. A thin oleoresinous "wet face" was doctored onto the seal coated side of the felt immediately prior to the first printing station. At printing stations **13**, **14** and **15** on the machine, three 18 inch transfer blocks each spaced 18 inches apart were provided. The web was delivered to the printing machine in a series of 18 inch steps. The printing blocks were reciprocated onto the web after every second 18 inch advance of the web. The three transfer blocks were reciprocated onto the web after every 18 inch advance of the web. The web leaving the last transfer block was completely covered with a smooth uniform layer of paint in the form of the desired 12 color floral pattern. The paint thickness equaled 0.0030 inch which was approximately ½ the thickness of the paint applied to the web by the printing blocks. The web then passed to a drying oven maintained at a temperature of 150° F. and maintained in the oven for a period of 16 hours.

Printed poducts produced in accordance with the invention are characterized by having a smooth uniform decorative printed layer. The method permits production of products having a decorative wearing surface of less than 0.0035 inch in thickness on conventional flat bed printing machines without requiring large additional investment. Special printing blocks need not be cut to prepare products having such thin decorative paint films in accordance with the invention since conventional printing blocks can be used. Waste resulting from nonuniformity of the printed pattern is very low and the method is characterized by high yields of perfect merchandise.

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

I claim:

1. A method of producing a surface covering having a uniform paint layer in the form of a decorative design on one surface of a backing which comprises applying a paint film of relative thickness in the form of a decorative design to a section of a surface of a backing and transferring approximately one-half of the thickness of said paint film to another section of said surface thereby duplicating said design thereon.

2. A method of producing a surface covering having a uniform paint layer in the form of a decorative design on one surface of a backing which comprises applying a paint film of relative thickness in the form of a decorative design to a section of said backing, thereafter pressing a transfer block against said paint film thereby transferring a portion of the thickness of said paint film to said transfer block, pressing said transfer block with said portion of said paint film thereon against a second section of said surface of said backing thereby transferring said portion of said paint film to said second section and repeating said operation until approximately one-half the thickness of said paint film is transferred to said second section thereby duplicating said design thereon.

3. A method of producing a surface covering having a uniform paint layer in the form of a decorative design on one surface of a backing which comprises applying a paint film of substantial thickness in the form of a decorative design to a surface of a backing in evenly spaced stripes separated from each other by equal sized unprinted stripes, transferring a portion of the thickness of said

paint film from each of said printed stripes to each adjacent unprinted stripe and repeating said operation until approximately one-half the thickness of said paint film is transferred to said unprinted stripes thereby duplicating said design thereon.

4. A method of producing a printed surface covering having a uniform decorative surface layer which comprises applying a film of paint composition of substantial thickness in the form of a decorative design to a surface of a backing in evenly spaced printed stripes extending the full width of said backing, said printed stripes being separated from each other by equal sized unprinted stripes, said paint composition having a flow of about 5 to about 12 inches, transferring a portion of the thickness of said film from each of said printed stripes to each adjacent unprinted stripe and repeating said operation until approximately one-half the thickness of said paint film is transferred to said unprinted stripes thereby duplicating said design thereon.

5. The method according to claim 4 wherein said film has a thickness of 0.0035 to 0.007 inch.

6. The method according to claim 4 wherein approximately one-half the thickness of said film is transferred from said printed stripes to said unprinted stripes in at least three successive operations.

7. A method of producing a printed surface covering having a uniform decorative surface layer which comprises applying a film of paint composition having a uniform thickness between 0.0035 and 0.007 inch in the form of a decorative design to a section of a surface of a backing to form a printed stripe extending the full width of said backing, pressing a transfer block having a size equal to that of said printed stripe against said paint film thereby transferring a portion of the thickness of said paint film to said transfer block, pressing said transfer block with said portion of said paint film thereon against a second section of said surface of said backing adjacent to said printed stripe, thereby transferring said portion of said paint film to said second section and repeating said operation until approximately ½ the thickness of said paint film is transferred to said second section, thereby duplicating said design thereon.

8. The method according to claim 7 wherein said paint composition has a flow of about 5 to about 12 inches.

9. The method according to claim 7 wherein said paint composition has a flow of 7 to 10 inches.

10. The method according to claim 8 wherein approximately one-half the thickness of said film is transferred from said printed stripe to said second section adjacent thereto in at least three successive operations.

11. A method of producing a printed surface covering which comprises intermittently advancing a backing in sucessive equal steps beneath a plurality of printing blocks which are positioned above said backing extending the full width thereof, each of said blocks bearing a printing surface conforming to the portion of the printed pattern to be applied in a particular color, the space between said blocks and the length of said blocks in a direction parallel to the length of said backing being equal to the length of each of said steps, applying a paint composition to said printing surfaces, vertically reciprocating said printing blocks after applying said paint composition to the printing surfaces thereof while said backing is at rest after every second step to deposit a film of paint from said printing surfaces upon said backing thereby forming a plurality of evenly placed printed stripes in a decorative design extending the full width of said backing separated from each other by equal sized unprinted stripes, advancing said backing beneath a plurality of transfer blocks which are positioned above said web extending the full width thereof, the space between said transfer blocks and their length in a direction parallel to the length of said web being equal to the length of said steps, vertically reciprocating said transfer blocks onto said web while said web is at rest after each step, thereby removing successive portions of said printed film totalling approximately one-half its thickness and transferring said removed portions successively to said unprinted stripes duplicating said design thereon.

12. The method according to claim 11 wherein the number of said transfer blocks is at least 3.

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