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FLEXIBLE FLOOR COVERING

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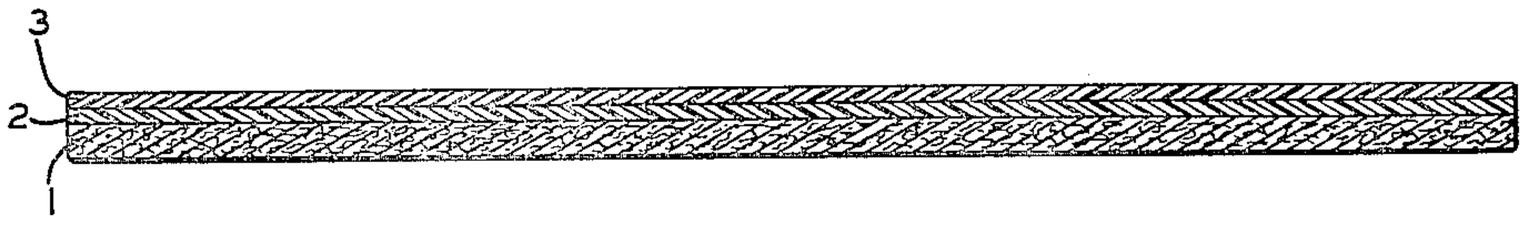

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FLEXIBLE FLOOR COVERING

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This invention relates to flexible hard-surface floor covering and a method of making the same. More particularly, the invention relates to the production of low-cost, flexible, hard-surface floor covering comprised of a saturated felt backing and one or more coatings deposited from aqueous dispersions of vinyl resins.

There are various types of hard-surface floor coverings known to the art. Probably the most widely known is linoleum. Linoleum is manufactured by depositing a mixture of filler pigment and linoleum binder, generally obtained by oxidizing a drying oil in the presence of a resin, upon a suitable carrier backing; for example, saturated felt. The mass is then stoved or cured for a considerable period of time to obtain the desired properties of resilience and flexibility in the wearing surface. Linoleum is a comparatively expensive flooring material because of the raw materials from which it is manufactured and further because of the techniques employed in its manufacture, particularly the comparatively long period of time required for the stoving step.

Another type of flexible hard-surface flooring material is that known as a felt-base flooring. Felt base is normally prepared by printing a decorative wearing surface upon a suitably-treated carrier backing. Generally speaking, the backing is comprised of an asphalt-saturated felt carrying a seal coat which serves to render the surface of the backing sufficiently smooth to receive the comparatively thin film of paint which forms the decorative wearing surface of the floor covering. While felt-base material is less expensive than linoleum, its manufacture requires rather expensive equipment and a stoving or drying operation to give to the deposited paint film the desired properties required in a flooring material.

There are certain types of installations of flooring material which require a product of the flexible, hard-surface type but which, due to the nature of the installation, require an extremely low-cost material. For example, in the case of a large flooring area in which the subfloor is low-cost wood or a low grade of concrete which develops dust rapidly, it is, generally speaking, necessary to provide a low-cost, hard-surface, flexible flooring material over the subfloor. A typical example would be a barracks area in a military installation. Such areas would be suitably covered with either linoleum or felt-base material, but the cost of the average installation of

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either of these types of materials is normally too high to warrant their use.

In order to provide a low-cost flooring material for installation in such areas, various products have been developed; but, generally speaking, such products are comprised of a wearing surface containing pitch or other materials susceptible to alkali attack as a binder ingredient. Such materials are also readily attacked by solvents and possess little resistance to the action of vegetable oils. The dark color of the pitch binder in such floor coverings makes it impossible to produce light-colored products. A further disadvantage lies in the susceptibility of such floor coverings to cracking when the material is rolled or unrolled, particularly in cold weather. In addition, in the manufacture of such material a considerable portion of the process time is consumed in stoving or otherwise treating the wearing surface composition to impart to it the right properties. This, of course, adds to the cost of the flooring material, as does the expensive equipment required for hot-melt application. Furthermore, materials of this type must be carefully controlled in their manufacture; or they vary considerably in their final properties so that it is difficult to reproduce the products according to specifications. Finally, such material possesses the undesirable characteristic of brittleness in the wearing surface so that in cutting the material for application to a given floor area the composition wearing surface cracks or chips to such an extent that an attractive installation is difficult.

I have found that a low-cost, flexible, hard-surface floor covering characterized by good wear resistance and other physical properties may be obtained by a comparatively simple method of applying one or more coatings of specially prepared aqueous dispersions of vinyl resins or their equivalent to a saturated felt backing or similar backing material.

The floor coverings of my invention are alkali resistant, resistant to vegetable oils, and resistant to hydrocarbon solvents. The binder components of the coatings are colorless. The finished product cuts cleanly with standard floor-covering knives. The finished product is very flexible, and may be rolled and unrolled in cold weather without cracking. The method of making the material involves room temperature operations in both preparation of the coatings and applications thereof to the backing.

A preferred embodiment of my invention is illustrated in the accompanying drawing, which is a sectional view of a floor covering in which 1 designates a saturated felt backing, 2 is the first coat described hereinafter, and 3 is the top coat described below.

In accordance with my invention, a sheet of raw felt or similar material is saturated with any of a number of conventional materials, such as asphalt, synthetic resins, or synthetic rubbers, to provide the carrier backing of our floor covering. The saturation may be carried out in conventional equipment, such as a tank provided with the saturant through which the sheet is slowly passed to absorb the desired amount of material. If desired, the beater saturation technique may be used in producing the carrier backing. In such a process the saturant is deposited upon the fibers in the beater, and the resulting slurry of coated fibers is formed into a sheet of the desired thickness on conventional paper-making equipment. The beater saturation process is particularly advantageous when a synthetic rubber, such as a copolymer of butadiene and styrene, is the principal ingredient of the saturant.

After the saturated felt carrier backing is produced as indicated above, it is particularly advantageous in the practice of the process of my invention to apply thereto a first coating containing a resinous vinyl polymer which is advantageously a resinous polymer of butadiene and styrene in which styrene is the principal ingredient. This first coating may also contain a selected amount of filler material which may be any of a number of conventional fillers, such as slate flour, wood flour, clay, ground limestone, and the like. A typical example of the base coat is as follows:

Example I

	Parts by weight
Copolymer of butadiene and styrene containing 60 parts of styrene and 40 parts of butadiene	20
Slate flour	70.4
Clay	8.0
Iron oxide pigment	1.6

The above weights are given on a dry basis. In preparing this first or base coat, a wetting agent, preferably an anionic surface-active agent such as the alkyl benzene sulfonates, for example sodium dodecyl benzene sulfonate; alkyl diphenyl sulfonates such as sodium butyl diphenyl sulfonate; alkyl naphthalene sulfonates, for example sodium di-isopropyl naphthalene sulfonate and the like; preferably a sequestering agent, such as tetrasodium pyrophosphate; and the desired amount of water, which is normally sufficient to provide a slurry containing about 60% to 70% solids, are blended by stirring. I may also employ a nonionic surface-active agent such as the partial esters of polyhydric alcohols, for example monoethylene glycol monolaurate, or a cationic surface-active agent such as salts of primary, secondary, and tertiary amines such as oleyl amine acetate. The pigments and fillers are then added to this dispersing medium and the mixture stirred vigorously to form a slurry to which is then added the resinous material. If acidic fillers are used, the pH of the slurry is adjusted to above 7 before addition of resinous material.

It is also within the scope of my invention to mix all of the ingredients of the base coat at one time as by agitation in a pebble mill. In following this procedure, the dry fillers, if used, and pigments may be ball milled with the binder dispersion, provided that sequestering and wetting agents, together with sufficient ammonia to maintain the pH above 7, are first added to the binder dispersions. By following such a procedure, one may obtain higher solids content formulations, thereby allowing the use of smaller quantities of thickening agents.

A coating material prepared as indicated above is then applied to the saturated felt backing by suitable means, advantageously a knife coater which is adjusted to obtain a wet film having a thickness of approximately six mils. The coated backing material is then dried for approximately two hours at a temperature of about 75° C. to about 85° C. In preparing this coating, which I term a base coat, it is particularly advantageous to observe a filler to binder ratio of four parts filler to one part binder. Some variation is permissible; but, in any event, a highly filled coating is preferred. However, I may employ a clear film as a base coat if desired. One or more applications of base coat material may be made. It is, generally speaking, desirable to apply sufficient coating material to obtain a smooth surface upon which to deposit the wearing surface coat which will be described below. This base coat, in addition to providing a smooth surface, functions somewhat as a wearing coat and, furthermore, prevents the normally dark saturated felt from showing through the later-applied decorative wearing coat.

Following application of the base coat as indicated above, the decorative wearing coat is applied.

The wearing coat may be prepared by first forming a dispersing medium for the filler and pigment containing water, a sequestering agent such as sodium pyrophosphate, sodium hexametaphosphate, and the like, and a wetting agent. To this dispersion medium may be added the fillers and pigments, the resulting slurry being pebble milled to produce the desired dispersion. Before addition of the binder for the coating to the slurry of pigment, it is, generally speaking, desirable to adjust the pH of the filler and pigment slurry to at least approximately 7 by means of ammonium hydroxide, or other suitable alkaline materials. After adjustment to the desired pH, the various aqueous dispersions of binders are blended with the slurry. If necessary, antifoaming agents, such as octyl alcohol, pine oil, dibutyl phthalate, and the like, may be added to the binder dispersion to prevent foaming during blending. The resulting blend is then ready for application as the wearing surface coating; and, if desired, a small amount, depending upon the method of application, of a thickening agent, for example carboxymethylcellulose, may be added. Normally about 1% by weight of thickening agent is sufficient.

Typical examples of wearing or top coat formulations are given below, and the parts by weight are given on a dry basis.

Example II

	Parts by weight
Blend containing 55 parts polyvinyl chloride, 45 parts of a copolymer containing 35 parts of acrylonitrile and 65 parts of butadiene	70
Slate flour	26.4
Clay	3
Pigment	0.6

Example III

	Parts by weight
Copolymer of butadiene and acrylonitrile containing 65 parts of butadiene and 35 parts of acrylonitrile	24.5
Polyvinyl chloride	45.5
Slate flour	26.4
Clay	3.0
Pigment	0.6

Example IV

	Parts by weight
Copolymer of butadiene and acrylonitrile containing 65 parts butadiene and 35 parts acrylonitrile	34.2
Polyvinyl chloride	63.8
Pigment	2.0

Example V

	Parts by weight
Copolymer of butadiene and styrene containing 60 parts of styrene, 40 parts of butadiene	35
Polystyrene	35
Slate flour	26.4
Clay	3.0
Pigment	0.6

Example VI

	Parts by weight
Copolymer of butadiene and styrene containing 95 parts styrene and 5 parts butadiene	52.5
Copolymer of butadiene and styrene containing 55 parts of styrene and 45 parts of butadiene	17.5
Slate flour	26.4
Clay	3.0
Pigment	0.6

Example VII

	Parts by weight
Copolymer of butadiene and styrene containing 95 parts styrene and 5 parts butadiene	73.5
Copolymer of butadiene and styrene containing 55 parts styrene and 45 parts butadiene	24.5
Pigment	2.0

Example VIII

	Parts by weight
Copolymer of butadiene and acrylonitrile containing 65 parts butadiene and 35 parts acrylonitrile	35
Polyvinyl chloride	65

As may be the practice in the production of the base coat, the wear or top coat may be prepared by ball milling dry fillers and pigments, if used, directly with the binder dispersion, provided similar conditions are observed.

Generally speaking, these top coats comprise a rubberlike polymer and a reinforcing resin manufactured from a material containing a vinyl group. Such resins are normally called vinyl resins and may be polymers of vinyl chloride or they may be polymers of vinyl aromatic compounds such as styrene. Ordinarily, we have obtained particularly advantageous results when the formulation for the top coat contains about 20% to 50% by weight of the binder of rubberlike material and about 80% to 50% by weight of the reinforcing vinyl resins. These ratios may, of course, be varied, depending, among other things, upon the particular ingredients employed in producing the coating material, the conditions

obtained in the coating process, and the like. For example, a top coat containing polyvinyl chloride and butadiene-acrylonitrile rubber advantageously contains between about 50% and 65% polyvinyl chloride and 35% to 50% butadiene-acrylonitrile rubber. Generally speaking, particularly advantageous results are obtained when the proportions are about 65% by weight of resin and 35% by weight of butadiene-acrylonitrile rubber. When the top coat formulation contains a rubberlike butadiene-styrene copolymer and is mixed with a straight polystyrene or slightly modified styrene polymer such, for example, as one containing up to 5% butadiene, it is, generally speaking, desirable to utilize about 20% to 40% by weight of the rubber polymer and about 60% to 80% by weight of the resinous polymer. Preferably, about 75 parts by weight of resin are employed in conjunction with about 25 parts by weight of a rubber polymer. In order to obtain the proper consistency for knife coating application, I have found that the concentration of aqueous dispersions is advantageously in the range of about 50% to 75% solids. Generally speaking in the preparation of the top coat a lower loading of the composition with fillers is used. For example, I have obtained advantageous results by employing about 25% to 35% filler in the top coat composition.

The top coat is applied to the base coated backing in much the same manner as employed in the application of the base coat. It is advantageous to pass the base coated backing through a knife coating apparatus which deposits a coating of material described immediately above in a thickness of about 6 mils. The coated material is then subjected to drying conditions which generally involve heating at a temperature of about 75° to 85° C. for a period of about one hour. If desired, following the drying of the top coat the dried film may be fused at temperatures between about 80° C. and 150° C. for two days to five minutes, the fusing time being inversely proportional to the fusing temperature. Fusion improves wear resistance, toughness, and similar properties. The resulting product can then be rolled into conventional rolls of flooring material, which material is characterized by the highly desirable properties mentioned hereinabove. While I have made particular reference to the production of a flooring material, it is obvious that the product is also suitable for use in covering walls where a low-cost material is desired. It is also within the scope of my invention to produce marbleized and printed decorative top coats.

I claim:

1. A flexible, hard-surface floor covering comprising a saturated felt backing, a first coating obtained by depositing from an aqueous dispersion containing polyvinyl chloride, and a fused top coat deposited from an aqueous dispersion containing about 50% to about 65% polyvinyl chloride and about 35% to 50% of butadiene-acrylonitrile rubber.

2. A flexible, hard-surface floor covering comprising a saturated felt backing, a first coating obtained by depositing from an aqueous dispersion containing a resinous vinyl polymer, and a fused top coat deposited from an aqueous dispersion containing about 20% to 50% by weight of a rubberlike butadiene polymer and about 80% to 50% by weight of a reinforcing vinyl resin of the group consisting of polymers of vinyl chloride and polymers of styrene.

3. A flexible, hard-surface floor covering com-

prising a saturated felt backing, a first coating obtained by depositing from an aqueous dispersion containing polyvinyl chloride, and a fused top coat deposited from an aqueous dispersion containing a mixture including about 20% to about 40% by weight thereof of a rubberlike butadiene-styrene copolymer and about 60% to 80% by weight thereof of a resinous polymer of styrene.

4. A flexible, hard-surface floor covering comprising a saturated felt backing, a first coating obtained by depositing from an aqueous dispersion containing a resinous polymer of butadiene and styrene containing a major portion of styrene, and a fused top coat deposited from an aqueous dispersion containing about 50% to about 65% polyvinyl chloride and about 35% to 50% of butadiene-acrylonitrile rubber.

5. A flexible, hard-surface floor covering comprising a saturated felt backing carrying a film deposited from an aqueous slurry containing about 60% to 70% solids, including about 4 parts filler and 1 part binder, the binder being a resinous vinyl polymer, and a fused top coat deposited from an aqueous slurry containing 50% to 75% solids, including about 25% to 35% filler and a binder containing about 20% to 50% by weight thereof of a rubberlike butadiene polymer and about 80% to 50% by weight of a reinforcing vinyl resin of the group consisting of polymers of vinyl chloride and polymers of styrene.

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