United States Patent

Gasaway et al.

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[54] CARPET BACKING

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[73] Assignee: **Johnson & Johnson**

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[52] **U.S. Cl.**.....**117/65.2**, 117/76 T, 117/126 GB, 161/93

[51] **Int. Cl.**.....**B32b 17/04**, B44d 1/16, C03c 25/02

[58] **Field of Search**.....161/93; 117/126 GB, 76 T, 65.2

[56] **References Cited**

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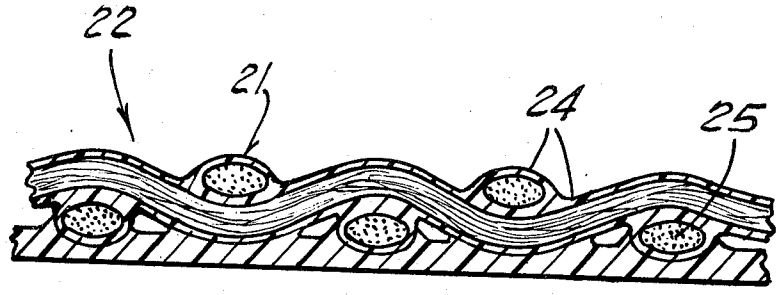
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[57] **ABSTRACT**

An improved heat and dimensionally stable carpet backing comprising crossing fiberglass yarns with each of the yarns coated with a vinyl plastisol and a substantially uniform adherable and noncompatible second coating of acrylic-acetate resin uniformly distributed over the vinyl coated yarns with the bond strength of the second coating to the vinyl coating on the yarns being less than the bond strength of the vinyl coating to the fiberglass.

17 Claims, 5 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

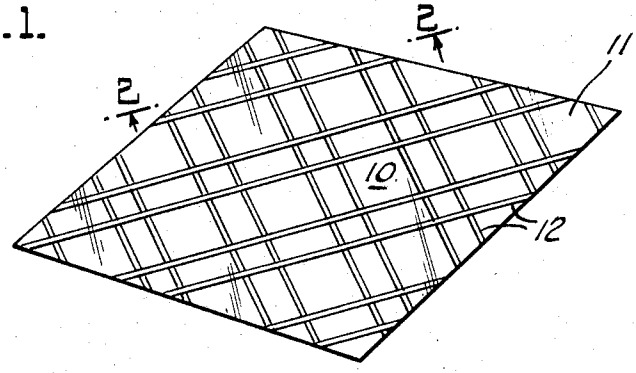


Fig. 2.

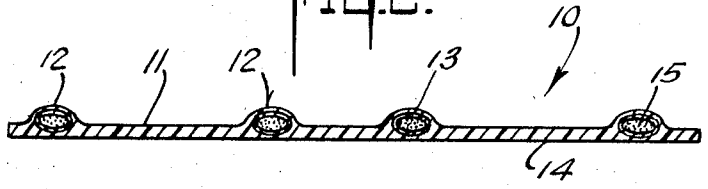
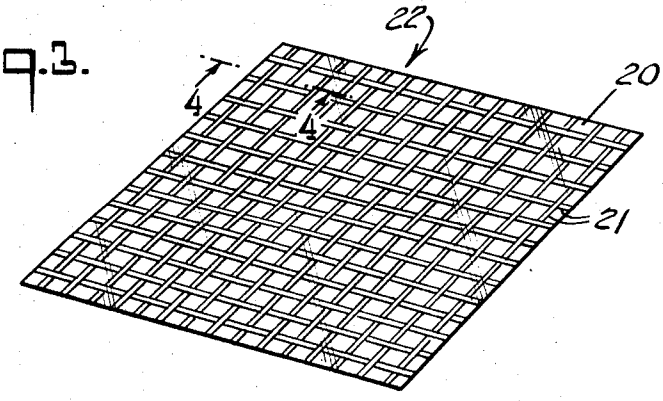


Fig. 3.



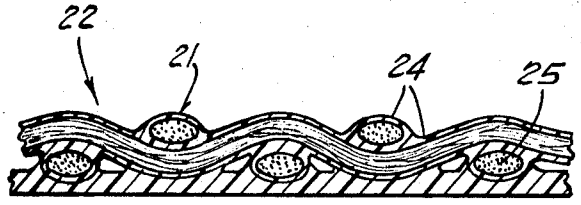


Fig. 4.

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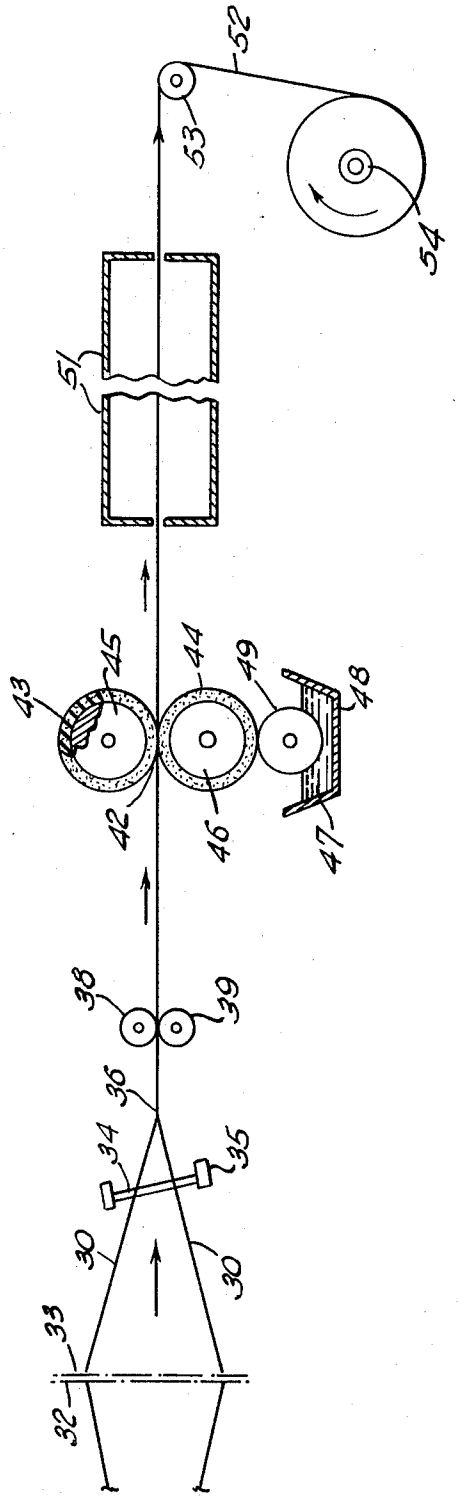


FIG. 5.

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CARPET BACKING

This invention relates to an improved carpet backing material comprising vinyl coated fiberglass yarns releasably secured together by a secondary coating to provide a substrate from which carpets can be made.

In the manufacture of carpets the carpet material is tufted or needled into a backing material to produce the desired carpet. In many instances this backing material may be further laminated to an underlay to provide stronger, more durable and stable carpets. In many methods of manufacturing carpets the surface carpet material is tufted by a needling operation into a backing and though this backing is strong enough initially to handle the tufting this high speed needling operation greatly reduces the strength of the backing material and, hence, after tufting the backing material is precoated to provide it with stability. A vinyl or similar film may be laminated to the backing material to produce the final carpet. The more tufts per inch or the more needling per inch the more rugged the backing material has to be to withstand handling during the processing. Also, depending upon the type of yarn or fiber used to form the carpet the greater or less the stresses upon the backing material during the tufting operation. For example, it is more difficult to tuft with cotton yarns than it is with synthetic yarns such as nylon because of the frictional surfaces of the yarns.

The carpet, especially those being used outdoors, must have excellent dimensional stability, that is, they must not shrink or ripple or place undue stressed in the carpet when exposed to outdoor weather conditions. Carpets must also have a good degree of heat stability so that when laminated to a vinyl film or further processed they do not ripple or shrink.

In order to provide the desired properties in a carpet backing jute fibers, which are quite strong and reasonably stable, have been used. In recent years many of the synthetics, such as, polypropylene, also have been used as carpet backing material because of the unavailability of jute and the economics of polypropylene. One material which is dimensionally stable and resistant to heat is fiberglass and there is no doubt that fiberglass, when considering the properties of dimensional and heat stability, should make a good carpet backing material. Fiberglass, though being strong, is very brittle, hence, when fiberglass is used as the base of a carpet backing material the extreme forces placed upon the fiberglass by the needles or in the tufting operation will readily break yarns because of the brittleness. The carpet backing will not be sufficient to allow all of the handling and processing required to make the final carpet. This problem is true even though the fiber yarns are individually coated with a vinyl coating to reduce the problems of abrasion which are always present whenever fiberglass meets fiberglass. For example, one readily available fiberglass fabric is a reasonable open weave fabric made from fiberglass yarns which have all been coated with a vinyl coating and the final woven fabric fused so that the vinyl coating adheres to itself at crossover points to produce a very stable final fabric. However, this fabric is not suitable for carpet backing material because its rigidity at the crossover points is sufficient enough that the tufting forces produced during the tufting operation readily breaks the coating, exposing the fiberglass yarns which then are broken. Furthermore, such a fabric will only hold and lock the largest tufts and has very little use as a carpet backing material. If the woven fiberglass yarn is not fused after being woven it is not a sufficiently stable fabric to even start the tufting operation.

We have now discovered a new carpet backing material which is suitable as a backing for any of the various synthetic yarns as well as the natural yarns such as cotton, and may be used wither when making tufted carpets or making needled carpets. Furthermore, our improved backing material utilizes fiberglass as one of its basic ingredients and, hence, has very good dimensional stability and heat stability and is not subject to mildew and rot from outdoor exposure. Although out new carpet backing does use fiberglass material it is constructed in such a way that the extreme forces placed on it during the tufting operation do not break any substantial number of yarns yet the fabric is quite stable and may be handled throughout the manufacture of the carpet. In many instances our improved carpet backing material may be sufficiently stable so that once the yarns are tufted into the carpet backing material there need be no further precoat of the material but it may be used as is or a suitable heavy vinyl backing placed on it in a single step as desired.

In accordance with our invention our improved, weather resistant, heat and dimensionally stable carpet backing material comprises two sets of fiberglass yarns. The yarns of one of the sets are disposed at angles to the yarns of the other set. Each of the individual fiberglass yarns is coated with a vinyl plastisol. This vinyl plastisol coating eliminates the abrasion problems wherever the fiberglass yarns cross each other. The sets of coated yarns have a substantially uniform second coating uniformly distributed over the sets. The second coating must adhere to the vinyl coating but not be compatible with the vinyl coating. The bond strength of the second coating to the vinyl plastisol on the fiberglass yarns is less than the bond strength of the vinyl plastisol to the fiberglass so that the yarns in the carpet backing material are releaseably secured to each other and are movable within the backing material without substantial disruption of the vinyl plastisol on the fiberglas yarns. Hence, in use the backing material is very stable yet when a force is applied to it, such as in the tufting operation, any single yarn will move with respect to its adjacent yarns rather than be broken when struck by the needle. After the tufting needle is withdrawn there is sufficient tendency for the displaced yarns to return to their original position and lock the tuft in place. The bond strength measured at the crossover points of our new improved carpet backing material is about 0.2 to 0.25 pound. The bond strength measured at the crossover points of a fused vinyl plastisol coated fiberglass fabric is 0.35 pound or greater. In comparing the tufting force required to tuft each of these fabrics our new fabric unexpectedly requires from 25 percent to 45 percent more force than the fused fabric even though the bond strength is less. It is believed that the increased tufting force required in our new carpet backing material improves the locking of the tufts into the backing.

The invention will be more readily understood by reference to the following detailed description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a view in perspective of one embodiment of the improved carpet backing of the present invention;

FIG. 2 is an enlarged cross section view taken along line 2—2 of FIG. 1;

FIG. 3 is a view in perspective of another embodiment of an improved carpet backing in accordance with the present invention;

FIG. 4 is an enlarged cross-sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is a schematic view of apparatus for carrying out the process of the present invention.

Referring to the drawings, FIGS. 1 and 2, there is shown an improved carpet backing material 10 in accordance with the present invention. The carpet backing comprises an acrylic resin film 11 reinforced with cross-laid yarns 12. The yarns run in two directions approximately 90° to each other. All of the yarns are coated with a vinyl plastisol. As is more clearly shown in the cross-sectional drawing the vinyl plastisol coating 13 on the yarns completely surrounds the fiberglass yarns 15 which are substantially in the center of the carpet backing material and the coating maintains the yarns in this relationship.

In FIGS. 3 and 4 there is shown another embodiment of the improved carpet backing according to the present invention. The acrylic coating is reinforced with vinyl plastisol coated fiberglass yarns. The vinyl coated fiberglass yarns are woven with the yarns running in the cross and long direction of the carpet backing. As is more clearly shown in FIG. 4 the film of vinyl coating and yarns are an integral unit in the final backing.

The reinforcing used to manufacture our new improved carpet backing material may be woven or nonwoven. It must comprise at least two sets of yarns with one set running at an angle to each other. This may be at a right angle or it may be at any other angle as desired, preferably one set of yarns runs the length of the backing while the other set will run the width of the backing; however, the sets may run at 45° to the length of the carpet as desired.

In producing the coated fiberglass yarns virtually any core yarn may be used such as a 90/1/0 or a 150/1/0. A vinyl plastisol is then substantially uniformly applied lengthwise of the core yarn by standard techniques well known in the industry. In applying the vinyl plastisol to the core it may be applied in varying amounts to give yields of the coated yarn of 2,000 yards per pound to 10,000 yards per pound. The coated fiberglass yarns are then laid down at angles to each other either by weaving or cross-laying as desired. The reinforcing fabric must have a construction of from about 4 yarns per inch in both directions to about 30 yarns per inch in both directions and may have various combinations of constructions, that is, 10 ×10's, 20 ×20's, 18 ×14's, etc. The diameter of the vinyl coated yarns should be about 13 mils or less in order to produce a suitable carpet backing.

The fiberglass yarns usually have from about 30 to 60 percent by weight of the yarn of the vinyl plastisol coating. In some instances it may be preferred that the yarns running in one direction have less vinyl plastisol coating on them than the yarns running in the other direction or in other instances it may be desired to have the yarns running in all directions having an equal amount of coating.

If desired, the reinforcement layer may be either lightly heated to give some adhesion to crossover points but it must not be fused so as to make the yarns rigid with respect to one another at their crossover points.

This may be controlled quite readily either by the temperature to which the layer is raised or the time at which it is raised to a given temperature.

The yarn count of 4 to 30 yarns per inch is important to provide suitable strength in the carpet backing. If too few yarns are used the backing does not have sufficient strength and does not lock tufts in place whereas if too many yarns are used the needling or tufting operation will lose considerable efficiency in that some of the yarns will be broken even if coated in accordance with the present invention. The vinyl plastisol coating has excellent adhesion to the fiberglass core and in most instances the bond strength between the coating and the core, measured at crossover points, will be in the range of from about 0.35 pound to 0.8 pound.

After the reinforcing layer is formed it is then over-coated with a resin which adheres to the vinyl plastisol but is not compatible with the vinyl plastisol. Examples of suitable, adherable, noncompatible coatings are those made from acrylic-acetate latices, flexible acrylic resins, and vinyl acetate emulsions. The acrylic-acetate latices have been found most satisfactory for the purposes of the present invention. Such latices are copolymers or mixtures of homopolymers of cross-linking acetate-acrylate resins. The resin may be applied by any of the various standard techniques or, in fact, if desired a film may be formed from the resin and then the film laminated to the reinforcing layer by heat provided the temperature of lamination is less than the temperature at which the vinyl plastisol coating will fuse the yarns together.

The resin must be film-forming and must have an adhesion to the vinyl coating of less than about 0.35 pound and preferably about 0.2 pound. The coating should also have lubricity so as not to create too much frictional heat during the tufting operation.

In coating, utilizing an overcoat, it is extremely desirable that window panes are formed between the fiberglass yarns as this will give better gripping during the tufting operation although the window panes need not be uniformly formed throughout the fabric. The closer the yarn spacing the easier it is to fill the opening and form these panes. Of course, the most viscous the coating the easier to form the panes also. In all instances whether produced by a coating technique or by lamination of film the thickness of the film must be less than 4 mils in order to produce a suitable carpet backing. If the film thickness is greater than 4 mils there is too much friction generated in the tufting operation and produces an inefficient process.

The amount of coating applied may vary from about 5 ounces per 100 square yards of reinforcing layer to about 22 ounces per 100 square yards of reinforcing layer.

The coating must have good adhesion and be flexible in order to operate satisfactorily in the film-forming operation.

Referring to FIG. 5, in the drawing warp yarns **30** according to this invention are shown passing through a loom at the left of the figure. Since the loom represented is conventional it is shown schematically and in part. For instance, the harnesses are represented by a pair of vertical center lines **32** and **33** passing through the peak of the shed; and a reed **34** and a transversely extending race board **35** are shown schematically to the right of the harnesses. The race board carries a shuttle, not shown, and which in turn lays fill yarns, also not shown, across the warp yarns and the reed beats up or positions the fill yarns at the fell **36** of the fabric. The warp yarns are spaced from one another in the loom and the fill yarns are positioned with respect to adjacent fill yarns in such a way as to form an open fabric **37** in which the yarns are substantially uniformly spaced from one another in the warp and in the fill directions to form openings between them which are substantially uniform in size and shape as well as a multiplicity of yarn crossovers at the corners of the openings.

The warp yarns and the fill yarns are coated glass yarns. When the term "glass yarns" is used in this application it means twisted or untwisted strands or yarns formed of glass filaments or fibers. The glass yarns are coated with a wear-resistant vinyl plastisol capable of being fused at fairly moderate temperature, in the neighborhood of about 350° to **400°** F. for vinyl chloride resins. When the term "vinyl plastisol" is used in this application it means the dispersion of a vinyl resin in a plasticizer for the resin with or without a small amount of a solvent for the resin, the solvent being mainly for the purpose of adjusting viscosity. When the term "vinyl resin" is used in this application it means a polymer or copolymer or other polymerization product of a vinyl compound or compounds such as vinyl chloride, vinyl acetate, vinylidene chloride, acrylic compounds, and the like. Preferably, the vinyl plastisol is a vinyl chloride plastisol, i.e., a plastisol wherein the predominant constituent of the vinyl resin is a vinyl chloride polymer or copolymer. The coating normally is applied by dip coating the glass yarn. The coating is applied substantially uniformly lengthwise of the yarns even though it may be thin in some spots and discontinuous in others and nonconcentric with respect to the base yarns.

Due to the tension applied during the weaving the yarns may be slightly crimped where they cross one another. These crimps, to some extent, prevent the yarns from shifting from the positions in which they originally were placed during the weaving and thereby provide the fabric with a low degree of stability which may be sufficient to prevent displacement of the yarns during subsequent processing.

At the right of the fell of the fabric the fabric passes through a positioning nip comprising a pair of positioning rollers **38** and **39**. The fabric is passed from the nip into a second nip **42** formed between opposes flexible elastic and resilient surface layers **43** and **44** carried by a pair of steel coating rolls **45** and **46**. The coating rolls are suitable mounted for rotation in bearings not shown which are adjustable for moving the rolls toward and away from one another and regulating the pressure in the nip.

A supply of the secondary coating material **47** is maintained in a pool held in the trough **48** located below the nip formed by the coating rolls. A small feed roll **49** in rotatable contact with the surface layer of the lower coated roll is mounted for rotation partially immersed in the pool so that its surface con-

tinually carries a film of the secondary coating material up to the surface of the lower coated roll.

The two coating rolls and the feed roll may be driven from a common power source, not shown. The coated rolls and the feed roll may be driven through separate drive belts or chains connected to an electric driving motor in the conventional manner. Rotation of the rolls is sychronized so that the outer surfaces of the layers carried by the rolls move at the same linear speed. If desired, there may even be relative motion between the surface of the rolls as this will tend to have a wiping effect and will cause the openings in the fabric to tend to move fully fill with the secondary coating. The coated fabric then passes through an over **51** being maintained at a temperature less than the fusion temperature of the vinyl plastisol coating but at a sufficient temperature to set the secondary coating. The backing material **52** passes about an idler roll **53** and is wound on a standard windup mechanism **54**.

The resultant carpet backing material should contain from about 30 to 70 percent of resin, that is, of the vinyl plastisol yarn coating and of the secondary coating with the remainder being fiberglass. Preferably, the final fabric will contain at least 50 percent by weight of resin.

The vinyl coated fiberglass reinforced resin may be used with virtually any tufting machine to tuft any carpet material and produce a very uniform and dimensionally heat stable carpet.

We claim:

1. An improved weather resistant, heat and dimensionally stable, carpet backing material comprising two sets of fiberglass yarns, the yarns of one set being disposed at an angle to the yarns of the other set, each individual fiberglass yarn being coated with a vinyl plastisol whereby abrasion between the fiberglass yarns at their crossover points is substantially eliminated, said sets of coated yarns having a substantially uniform, adherent, second coating of an acrylic-acetate resin noncompatible with said vinyl plastisol uniformly distributed over both sets, the bond strength of said second coating to the vinyl plastisol on said fiberglass yarns being less than the bond strength of the vinyl plastisol to the fiberglass yarns whereby the yarns are releaseably secured to each other and are movable within the backing material without substantial disruption of the plastisol coating on the fiberglass yarns.

2. An improved carpet backing material according to claim **1** wherein the two sets of fiberglass yarns are woven.

3. An improved carpet backing material according to claim **1** wherein the yarns of one set are disposed at an angle of 90° to the yarns of the other set.

4. An improved carpet backing material according to claim **1** wherein the fiberglass yarns of one set have more vinyl plastisol coating than the yarns of the other set.

5. An improved carpet backing material according to claim **1** wherein the adhesion strength between the second coating and the vinyl plastisol coating is less than 0.35 pound and the adhesion strength between the vinyl plastisol coating and the fiberglass yarns is greater than 0.35 pounds.

6. An improved carpet backing material according to claim **1** wherein there are from about 4 to 30 yarns per inch in each set of fiberglass yarns.

7. An improved carpet backing material according to claim **1** wherein about 30 to 70 percent by weight of the backing material is vinyl plastisol coating and the second coating and the remainder is fiberglass.

8. An improved carpet backing material according to claim **1** wherein 50 to 70 percent by weight of the backing material is vinyl plastisol coating and the second coating and the remainder is fiberglass.

9. An improved carpet backing material according to claim **1** wherein the coated fiberglass yarns have a diameter of from 10 to 13 mils.

10. An improved carpet backing material according to claim **1** wherein the thickness of the second coating is less than 4 mils.

11. An improved carpet backing material according to claim **1** wherein the two sets of fiberglass yarns are woven and the adhesion strength of the second coating to the vinyl plastisol coating is from about 0.2 pound to 0.3 pound and the adhesion strength between the vinyl plastisol coating and the fiberglass yarns is more than 0.35 pound.

12. An improved carpet backing material according to claim **1** wherein each set of fiberglass yarns contains from about 4 to 30 yarns per inch and the adhesion strength between the second coating and the vinyl plastisol coating is less than 0.35 pound and the adhesion strength between the vinyl plastisol coating and the fiberglass is more than 0.35 pound.

13. An improved carpet backing material according to claim **1** wherein the adhesion strength between the second coating and the vinyl plastisol coating is from 0.2 pound to 0.3 pound and the adhesion strength between the vinyl plastisol coating and the fiberglass is more than 0.35 pound and from about 30 to 70 percent by weight of the backing material is vinyl plastisol and the second coating and the remainder is fiberglass.

14. An improved carpet backing material according to claim **1** wherein the two sets of fiberglass yarns are woven, the second coating is an acrylic-acetate resin, there are from 4 to 30 yarns per inch in each set of fiberglass yarns, the adhesion strength between the second coating and the vinyl plastisol coating is from 0.2 pound to 0.25 pound, the adhesion strength between the vinyl plastisol coating and the fiberglass is from 0.35 pound to 0.8 pound and from about 30 to 70 percent by weight of the backing material is vinyl plastisol coating and acrylic-acetate resin and the remainder is fiberglass.

15. A method of manufacturing carpet backing material comprising: forming a layer of vinyl plastisol coated fiberglass yarns, said yarns running in at least two directions at an angle to each other, applying an adherable, noncompatible second coating of an acrylic-acetate resin substantially uniformly over the entire layer while said layer of fiberglass yarns is in an unfused state and heating said coated layer of vinyl plastisol coated fiberglass yarns to a temperature below the fusion temperature of the vinyl plastisol to set the second coating and form a stable carpet backing material.

16. A method according to claim **15** wherein the layer of vinyl coated fiberglass yarn is calendered to stabilize the layer without fusing the coating at the crossover points of the yarn.

17. A method according to claim **15** wherein the layer of vinyl coated fiberglass yarns is formed by weaving.

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