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PRODUCTION OF PILE FABRICS

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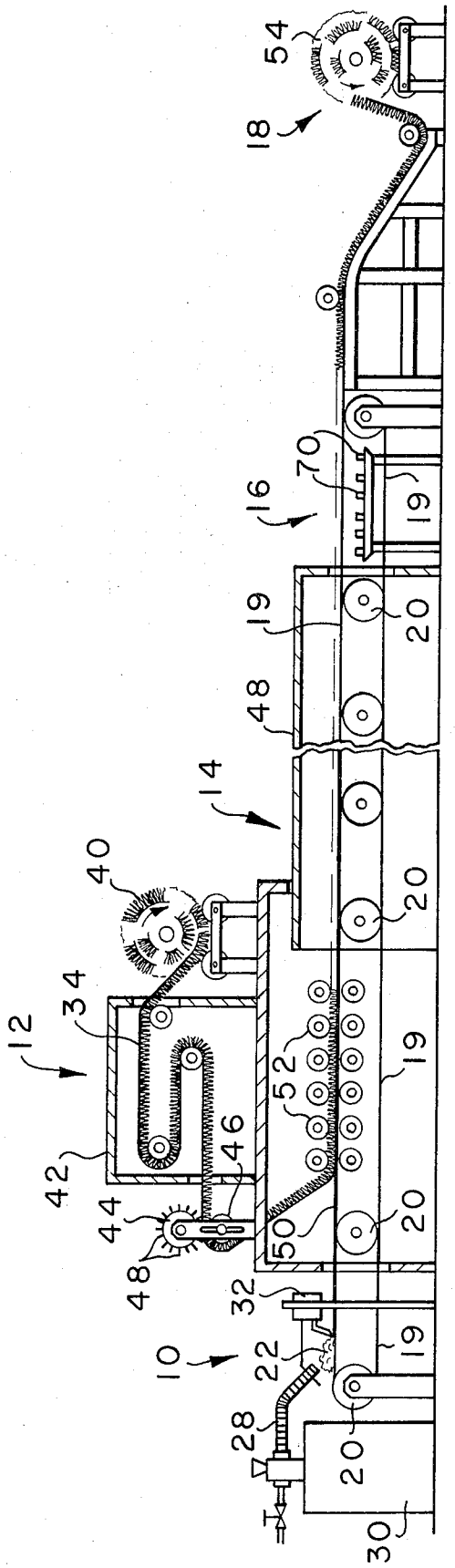

FIG. -1-

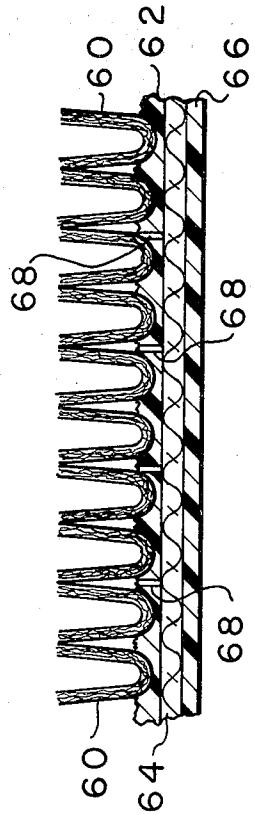

FIG. -2-

INVENTOR.
DAVID E. GORDON
BY
Luke J. Williams Jr.
ATTORNEY

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PRODUCTION OF PILE FABRICS

David E. Gordon, La Grange, Ga., assignor to Deering Milliken Research Corporation, Spartanburg, S.C.

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ABSTRACT OF THE DISCLOSURE

Method of back-coating pile carpet containing pile yarns bound by embedment in a relatively impervious polymer layer comprising the steps of perforating the impervious layer to permit passage of gases therethrough, and applying a heat bondable polymeric back-coating to the perforated carpet.

This invention relates to the production of pile fabric and, more particularly, to an improved method of back-coating a pile carpet.

It is known to apply a secondary polymeric backing, such as polyvinyl chloride, either foamed or unfoamed, to tufted carpets, rugs, mats, tiles, and the like. Such backing greatly improves the dimensional stability of the carpet, provides additional weight, imparts an anti-slip surface for contact with the floor, and insures retention of the pile yarn strands in the primary backing material. It has been a practice to apply the secondary backing by use of an intermediate adhesive between the primary and secondary backing surfaces to facilitate bonding of the two. More recently, it has been proposed in U.S. Pat. No. 3,518,102 to apply a foamed polyvinyl chloride secondary backing directly onto the primary backing of a carpet, and thereafter to heat and emboss the same to produce the bonded carpet product.

Recently, pile carpets and fabrics have been made by a process wherein pile yarns are adhesively bonded together to form an upstanding pile surface by embedding the bases of the yarns in a suitable adhesive layer. The adhesive layer may be applied to and be retained on the surface of a primary backing material, such as a woven or non-woven fabric or a polymeric sheet, or the adhesive layer itself may alone form the primary backing of the carpet or fabric. In the application of a secondary polymeric backing to such carpets and fabrics, difficulties have been experienced in obtaining a satisfactory application of the secondary polymeric backing because of the formation and entrapment of gas bubbles between the adhesive layer holding the pile yarns and the secondary backing during the heat bonding step. Due to the relatively impervious nature of the adhesive layer in which the pile yarns are embedded, volatile gases and vapors which may be evolved during the heat bonding of the secondary backing to the carpet are trapped between the layer and the secondary backing to cause the formation of "blisters" and air pockets. These blisters and air pockets not only produce surface imperfections in the secondary backing, but also contribute to delamination of the secondary backing from the carpet. In addition, when a primary backing of jute, cotton, rayon, and other cellulosic components are employed in the carpet, residual moisture contained in the backing is vaporized during heat processing of the secondary backing and also is entrapped between the pile yarn adhesive layer and secondary backing to add to the problems of gas bubble formation.

It is therefore an object of the present invention to provide an improved process for the polymeric back-coating of pile carpets and fabrics of the type just described.

It is a further object to provide an improved process for the back-coating of pile carpets in which the pile yarns are adhesively bonded by a relatively impervious bonding material to the top surface of the primary backing.

The above as well as other objects of the present invention are accomplished by perforating the impervious pile-bonding layer of the carpet prior to the application of the secondary polymeric backing material so that gases generated during the application of the secondary backing are free to escape through the perforations and thus avoid entrapment therebetween. More specifically, carpets containing pile yarns adhesively bonded by a relatively impervious layer to a primary backing, or those having a relatively impervious primary backing, may be subjected to a needle punching operation to perforate the impervious layer, anad thereafter be coated with the secondary polymeric backing. In the case where the primary backing is composed of a material containing residual moisture, such as jute and cellulosic yarns, it also has been found desirable to heat the primary backing prior to application of the secondary backing in order to vaporize and remove most of the residual moisture therefrom.

The process of the present invention may be best understood by reference to the accompanying drawings which illustrate the present invention.

FIG. 1 is a schematic side view of a carpet back-coating apparatus for carrying out the process of the present invention, and

FIG. 2 is a schematic sectional view of a pile carpet produced in accordance with the present process.

Referring more specifically to the drawings, FIG. 1 shows an apparatus having a first treating section **10** for forming the secondary polymeric backing layer, a second treating section **12** for heating and perforating the primary backed carpet and for combining the perforated carpet with the secondary backing layer, a heating section **14** for bonding the primary and secondary carpet backings together, a cooling section **16**, and a carpet collection section **18**.

Extending through the treating sections to transport the carpet therethrough is an endless conveyor belt **19** which is mounted for horizontal movement on support rollers **20** and driven by a power source, not shown. The belt may be composed of various heat resistant materials, such as woven glass strands or metal wire, flexible stainless steel sheeting, metal slats, plates or the like, and may be coated to reduce its friction characteristics if desired. Also, if desired, the belt may be foraminous, or vapor permeable, so as to facilitate the escape of volatile gases produced during the application of the secondary backing to the primary backing of the carpet. The support surface of the belt may be patterned to impart a surface pattern to the underside of the secondary polymeric backing, or embossing rolls might be employed at a suitable point in the process for this purpose.

As seen, a suitable polymer, such as a polyvinyl chloride plastisol **22**, is deposited by hose **28** from a supply tank **30** onto the surface of the moving belt **19** and metered into a desired thickness thereon by an adjustable blade or bar **32**. Although the secondary polymeric layer is shown and described as being cast and formed in situ on the surface of the belt **19** and thereafter combined with the primary backing while still in flowable form, the secondary polymeric layer could be partially or totally cursed or fused before combining with the carpet, in which case the apparatus shown might be modified to include heating means for hardening the backing layer before combining it with the preformed carpet layer. Alternatively, the backing layer could be in the form of a precast thermoplastic sheet and be combined with

and fused to the primary backing by heat sealing or adhesive bonding to the primary backing.

In section **12**, a pile carpet **34** composed of pile yarns adhesively bonded by a relatively impervious layer, such as polyvinyl chloride, to a primary backing of jute fabric is fed from a suitable supply **40** through a preheating oven **42** where the primary jute backing is heated to vaporize the residual moisture therefrom. The dry carpet is then fed between a pair of rolls **44**, **46** one of which **44** contains a plurality of radially disposed sharp pins **48**. Depending on the thickness of the carpet, the two rolls are positionally adjusted to insure that pins **48** perforate the relatively impervious adhesive layer bonding the pile yarns to the primary backing. The perforated carpet is then fed with its primary backing in contiguous relationship with the secondary backing layer **50** through a pair or series of pairs of nip rolls **52** which press the primary and secondary backings into intimate relation.

The resultant back-coated carpet is fed into the primary heating section **14** where an oven **48** having suitable heating means heats the secondary backing **50** to solidify and adhesively bond the same to the primary jute backing. Heating means may be located beneath the conveyor belt **19** to facilitate hardening of the secondary backing layer without excess heat being applied to the pile surface of the carpet, if desired. The carpet upon leaving the heating section may be cooled in cooling section **16** and is subsequently collected on a collection roll **54**.

FIG. 2 is a sectional side view of a carpet produced in accordance with the present process. As seen, pile yarns **60** are embedded at their bases in a normally relatively impervious adhesive layer **62**, which may be polyvinyl chloride, to firmly attach the same to the surface of a primary woven jute backing fabric **64**. Bonded to the undersurface of the primary backing is a secondary polymeric backing **66**, which also may be polyvinyl chloride. To avoid entrapment of gas and/or vapor bubbles between the impervious polymer layers, the layer **62** is perforated with a series of small openings **68** which permit escape of vapors and gases during the coating operation.

The following examples illustrate typical applications of the process of the present invention wherein a polyvinyl chloride secondary backing is applied to the primary backing of an adhesively bonded carpet.

EXAMPLE I

A polyvinyl chloride/polyvinyl acetate copolymer plastisol is prepared containing the following components by weight:

	Parts
92% polyvinyl chloride/8% polyvinyl acetate copolymer	100
Dioctyl phthalate plasticizer	90
Calcium carbonate (filler)	100
Zinc-cadmium stabilizer	3
Carbon black	1

The above plastisol composition is deposited on conveyor belt **19** in the first treating section **10** of the apparatus shown in FIG. 1. The composition was metered into a 60 mil thick film by passage on the belt beneath the adjustable blade **32**.

A primary backed carpet composed of pile yarns of acrylic-nylon blend fibers adhesively bonded to a woven jute backing by a relatively impervious adhesive layer of polyvinyl chloride is dried at 250° F. for ten minutes by convection heating in preheating oven **12** to vaporize residual moisture, and the adhesive layer thereof is thereafter perforated by passing the carpet through the pin rolls **44**, **46**. The perforated carpet is then fed onto the plastisol film and run under rolls **52** for intimate contact of the carpet with the secondary backing film. Thereafter,

the carpet assembly is heated for ten minutes at 300° F. in oven **48** to harden the secondary plastisol layer. The carpet assembly, on the belt, is cooled with water jets **70** impinging on the belt, and collected. The collected carpet exhibits no signs of blistering or delamination of the secondary backing.

EXAMPLE II

The procedure of Example I is repeated except that the primary backed carpet is predried by use of infrared heaters directed against the jute backing at a temperature of approximately 375° F. for 20 seconds, in lieu of convection drying. The remainder of the procedure is identical to Example I and the results are the same.

EXAMPLE III

The formulation for the secondary backing plastisol composition in Example III is as follows:

	Parts
92% polyvinyl chloride/8% polyvinyl acetate copolymer	100
Dioctyl phthalate	50
Diisodecyl phthalate	50
Calcium carbonate (filler)	125
Zinc-cadmium stabilizer	2
Carbon black	2

The procedure of Example I is followed, with the exception that the plastisol composition is metered on the belt to a thickness of 35 mils and fused at 285° F. for ten minutes. Immediately on exiting from the heating means, the secondary backing film is heated with infrared heaters to 350° F. Concurrently, the primary backed carpet is heated with an infrared source to 350° F., immediately perforated and brought into intimate contact with the heated secondary backing film and pressed to promote intimate lamination. After cooling, the carpet assembly is removed from the belt and no blisters were observed. Lamination of the secondary backing is good.

It can thus be seen from the foregoing detailed description that the present invention provides an improved and effective method of bonding a relatively impervious secondary backing layer to a pile carpet having a relatively impervious layer contained therein wherein the two layers would normally act to entrap gases and/or water vapor evolved during the heat processing and bonding of the secondary backing layer to the carpet. Although the unique features of the present invention have particular applicability to a process wherein a secondary backing is cast in situ and solidified and bonded to the primary carpet in a single heating operation, it is also applicable to the bonding of a partially cured or a preformed secondary backing layer to the primary backing of a carpet wherein gases would be evolved during the bonding operation. Similarly, although the present process is particularly applicable to the bonding of an unfoamed, or "hard-back," secondary polymeric layer to the primary backing of the carpet, the process could also be employed in the application of foamed secondary backing materials, if undesirable entrapment of evolved gases between the primary and secondary backing occurs.

That which is claimed is:

1. A method of back-coating a pile carpet containing pile yarns bound therein by embedment in a relatively impervious polymer layer comprising the steps of

(1) perforating the impervious layer at spaced locations thereover to permit passage of gases therethrough,

(2) applying a relatively impervious heat-bondable polymeric back-coating to the carpet, and

(3) heating the back-coated carpet to effect bonding of the back-coating thereto while permitting generated gases to pass through the perforations.

2. A method as defined in claim 1 wherein the pile carpet contains a primary backing fabric containing residual moisture secured to the polymer layer in which the pile yarns are embedded, and including the additional step of drying the fabric of a substantial amount of its residual moisture content prior to applying the back-coating to the carpet.

3. A method as defined in claim 2 wherein the polymeric back-coating comprises a polyvinyl compound and is applied to the carpet from a plastisol.

References Cited

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WILLIAM J. VAN BALEN, Primary Examiner

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