

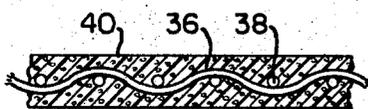
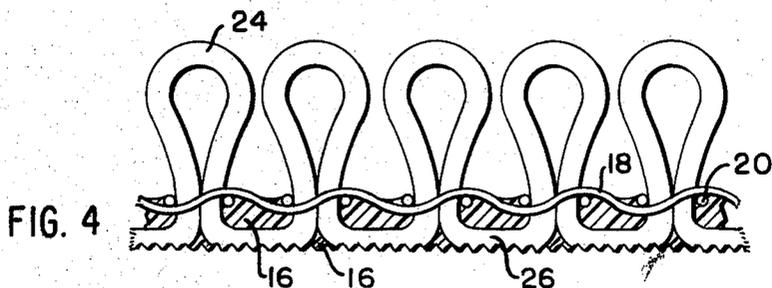
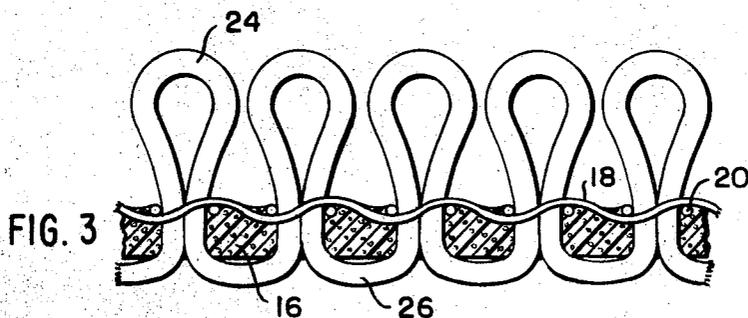
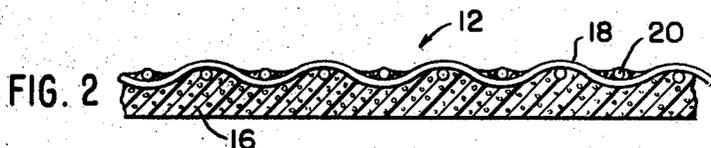
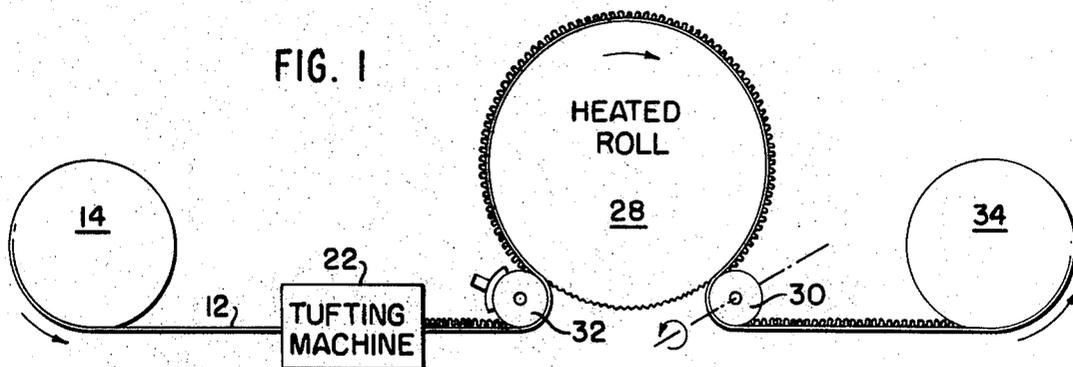
Jan. 12, 1971

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3,554,824

METHOD OF MAKING A TUFTED FABRIC

Filed Oct. 21, 1966



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3,554,824

METHOD OF MAKING A TUFTED FABRIC

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Filed Oct. 21, 1966, Ser. No. 588,444

Int. Cl. D05c 15/04, 17/02

U.S. Cl. 156—72

2 Claims

ABSTRACT OF THE DISCLOSURE

A tufted fabric having the loops that connect the tufts intimately bound in a focused thermoplastic material. In preparation for the tufting operation, this material is coated upon and caused to penetrate a sheet of interlocked reinforcing fibers, and then fused. The yarns are tufted through the reinforcing fibers, after which heat and pressure are applied to cause the thermoplastic coating to flow about the connecting loops.

The present invention relates generally to tufted textiles and methods of producing the same. More particularly, it concerns the novel use of primary backings comprising reinforced thermoplastic sheets to improve and simplify the tufting and subsequent steps of manufacture, and to provide an improved end product characterized by superior tuft and fibre bundle lock with adequate body and hand to resist buckling, and also including desirable non-skid characteristics, dimensional stability and resistance to various aging conditions.

Tufter textiles supply a rapidly growing market as an inexpensive substitute for traditionally woven fabrics. The range of fabric extends from tufted drapery materials and upholstery plushes and the like to carpets and rugs including scatter rugs.

The conventional tufting process begins with a backing, often in web form, which comprises a layer of interlocking fibers. These fibers may be woven, non-woven or felted, or knitted. Most commonly in rug manufacture they are woven with a mesh open enough to facilitate the entry of tufting needles carrying the pile loops. The backing is tufted in a multiple needle tufting machine. A row of needles penetrate the backing from the backside and form pile loops on the face of the fabric with connecting loops lying across the backside, whereby each needle forms a chain of pile loops. In some cases the pile loops are uncut as in terrycloth, and in other cases the loops are cut to form a cut pile. After the tufting has been completed a backsize coating is applied to the backside of the fabric. The purposes of the backsize are primarily (a) to provide tuft lock, that is, adhesion or anchoring between the connecting loops and the backing, (b) to impart dimensional stability to the backing, (c) to increase its body and stiffness or hand to resist kicup or buckling especially in scatter rugs, and (d) to provide skid resistance. The backsize materials most often employed are latex compounds.

One of the difficulties encountered in current practice is the tendency for lightly secured tufts in open mesh backings to become displaced in or from the backings before the backsize compound is applied, for example during movement of rolled up material. In some cases, as for example when smooth ribbon plastic yarn is tufted into woven polypropylene ribbon backing fabric, the displacement of tufts is an acute problem.

It is a principal object of this invention to provide a novel backing and method of tufting the same, whereby the pile yarns are held relatively firmly as the material leaves the tufting machine, and handling and movement of the material does not tend to pull out the tufts.

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A second object is to provide means and method for treatment of the tufted backing to increase the tuft lock further to the point of providing a very durable product suitable for use as carpets and rugs, and wherein there is not only firm anchorage for each tuft, but also improved fibre bundle lock whereby each fibre within the tuft is firmly held, thus preventing pilling such as that often seen in nylon tufting yarns.

Another object is to simplify the manufacture of tufted textiles including rugs by the elimination of the back-sizing step.

Having in view the foregoing and other objects hereinafter appearing, the features of this invention reside in the use of a novel primary backing consisting of fibrous reinforcement united with a thermoplastic binder material. The fibrous reinforcement is preferably a relatively loose, open structure that is easily displaced by the tufting needles, and the thermoplastic material is in a fused pliable state of sufficient firmness to retain the tufts frictionally, and specifically to resist the tendency of the tufts to pull out of the backing in handling.

According to another feature, the tufted fabric is completed by heating the thermoplastic material to the point of rendering it flowable with the simultaneous application of pressure to the back of the fabric, whereby the connecting loops of the pile become intimately embedded in the thermoplastic material with a bond that often exceeds in strength that of the pile yarn.

According to another feature, the thermoplastic material may be of cellular structure to facilitate the entry of tufting needles. In the heating and pressure step the resultant cells may be substantially collapsed to produce a densely united composite fabric.

Other features of the invention reside in details of fabrication, methods of manufacture and structural relationships that will be evident from the following description.

Referring to the drawings, FIG. 1 represents the principal parts of apparatus used for carrying out the method of this invention with a backing in web form;

FIG. 2 is a cross section of one form of improved backing taken on a line parallel to the warp threads;

FIG. 3 is a similar cross section showing the backing of FIG. 2 after the tufting has been applied and before the heating and pressure step;

FIG. 4 shows the completed product made from the backing of FIG. 2, in cross section with the connecting loops of the pile thoroughly imbedded and bound in the backing; and

FIG. 5 is a cross section similar to FIG. 2 showing a second form of backing.

Referring to FIG. 1, the invention is described with reference to a continuous process for tufting a backing in web form, although it will be obvious that the process may be carried out in disconnected steps if desired. A web 12 of backing is supplied from a roll 14, and may contain fibers of jute, cotton, paper, or other natural or synthetic fibers including wool, rayon, vinyls, saran, polyethylene, polypropylene, or various combinations of any of the foregoing fibers or their equivalents. The fibers may be interlocked by felting, knitting or weaving. For purposes of illustration a woven backing is shown. For rugs, this is preferably a jute burlap, a cotton duck or scrim, a woven paper fabric, or materials similar to these. As supplied from the roll 14 the fibers have a coating consisting of fused, pliable thermoplastic material 16 as shown, for example, in FIG. 2. This coating will have been applied to the fibrous backing while in a liquid state by any of the conventional methods such as knife coating, roller coating, dipping or spraying, and the liquid will have substantially penetrated the interstices between the warp fibers 18 and weft fibers 20 leaving a

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substantial thickness on one side of the material. After coating the thermoplastic material will have been heat hardened to a non-tacky, fused state, in which form it is supplied from the roll 14.

The fused material 16 is of the type which softens without serious degradation upon application of heat and becomes flowable, this being an inherent property of the material in the fused state. Preferably, the material is a vinyl plastisol, namely, a material which in the unfused liquid state is a dispersion of vinyl chloride polymer or copolymer resins in a liquid plasticizer. Upon heating to its fusion point, it becomes a fused, solid solution of resin in plasticizer. After cooling the fused plastisol has the requisite pliability to permit the penetration of tufting needles, while having at the same time sufficient firmness and resiliency to bind the tufts frictionally. When the fused plastisol is reheated to its fusion point as described below, it may be softened to a flowable state under relatively slight pressure of the order of about two or three pounds per square inch. It will be understood that any other thermoplastic coating material of like properties may be similarly employed.

The web 12 is supplied to a conventional multiple-needle tufting machine 22 in which the pile is sewn or tufted to form pile loops 24 and connecting loops 26 as shown in FIG. 3. Preferably, the connecting loops 26 lie closely upon the backside of the backing. The pile material may take any conventional form such as yarn, threads, strands, cord, or filaments formed of slightly twisted rovings or slivers, either natural or synthetic. The loops 24 may be either cut or uncut, depending upon the desired end product.

As the web leaves the tufting machine 22 the tufts are firmly and resiliently held in the pliable, adherent thermoplastic material 16, and if desired the tufted material may be taken up in rolls for storage prior to the final heating step. As illustrated in FIG. 1, the web passes over a heated roll 28 having a textured surface with the backside having the connecting loops 26 held in contact with the surface of the roll. The temperature maintained on this surface is sufficient to elevate the material 16 to its fusion point, and pressure is applied to the backside of the fabric to produce the end product illustrated in FIG. 4. To assist in providing this pressure, a pull roll 30 driven by a suitable motor pulls the web over the roll 28 against the reaction of a brake roll 32. While this does not put pressure upon the face, or pile, side of the web or crush it down in the region where fusion occurs, it does produce a pressure on the backside in that region sufficient to force the connecting loops 26 into the thermoplastic material 16 so that they are substantially completely surrounded by and bound in this material which saturates the fibers of each tuft and intimately binds the tufts and the warp and weft threads together, and also sufficient to impart the texture of the roll surface to the backside. At the same time the material 16 is sufficiently viscous to prevent it from striking through the face or pile side in excessive quantity, thereby detracting from the appearance of the finished product.

The tufted web passes from the roll 30 to a take-up roll 34 in finished condition. No backsize compound is applied; nor is it ordinarily necessary to apply a second backing to achieve the properties ordinarily required for rugs and carpets. Since no latex is employed for sizing, the large dryers normally employed for the elimination of water are eliminated and replaced by a relatively simple heating roll 28. This method is not required to make provision for the elimination of solvents, since solvents are not employed in plastisol formulations, the plasticizers therein being nonvolatile and forming a normal constituent of the fused material.

The tufted product not only has a remarkably strong tuft lock, but also exhibits a strong fiber bundle lock wherein the individual fibers of the tuft yarn are firmly held. The combination of the fibrous backing material

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and tufted yarns, firmly imbedded and integrated in the thermoplastic material 16, provides adequate density to resist buckling or curling. The product is also dimensionally stable and exhibits superior aging qualities.

The roll 28 may be heated in any known manner. A number of infrared or other heating elements may be used, for example; or dielectric heating may be employed using high frequency currents flowing in the web, in accordance with known techniques. It will be obvious that other alternative forms of heat may also be employed with a view to obtaining uniform heating of the web to control the viscosity of the material 16 within the limits previously indicated.

EXAMPLE

A square woven nylon mesh backing fabric having approximately a 16 x 16 thread count, weighing approximately 6 ounces per square yard, was knife coated with a vinyl plastisol liquid composition containing a small amount of blowing agent. The formulation was as follows:

	Parts by weight
A polyvinyl chloride paste resin	100
A plasticizer-dioctylphthalate	50-70
A chemical blowing agent or frothing agent	
azodicarbonamide	2-6
A stabilizer-calcium stearate	1-3

The coated backing was passed through an oven at 375° F., in which the plastisol was cured and the blowing agent decomposed to form a closed cellular structure as shown in FIG. 2. The resultant sheet had a thickness of about one-sixteenth inch, and has a soft, pliable hand.

This reinforced, slightly blown, vinyl foam sheet was then tufted using a standard 12-needle bench type tufting machine which sewed typical nylon yarn cut pile stitches into the sheet to produce an appearance like that shown in FIG. 3.

The tufted fabric was then placed on a textured heated belt, yarn face upwards so that the connecting loops 26 exposed on the back side were in contact with the belt. A moderate pressure of about two to three pounds per square inch was applied to the face of the fabric by means of a flat metal plate to assure even contact of the back of the fabric with the belt, for approximately thirty seconds. This resulted in a completely fused structure substantially as shown in FIG. 4, in which the fine bubble structure in the vinyl portion of the backing was substantially collapsed. The back of the fabric had no connecting yarn loops protruding therefrom, and contained a surface texture conforming to that of the belt and such as to impart satisfactory non-skid properties to a carpet or rug.

FIG. 5 illustrates a variant of the web 12 shown in FIG. 2. Warp threads 36 and weft threads 38 represent a woven backing similar to that of FIG. 2, while a coating 40 of thermoplastic material like the material 16 is shown as having a substantial thickness on both sides of the woven backing. The method steps described above are applied in the same manner as for the form in FIG. 2.

It will be appreciated that while the invention has been described with reference to specific examples, this has been done for illustrative purposes only, and numerous variations including those discussed herein and others that will be evident to those skilled in this art can be accomplished in the application of the teachings hereof to specific combinations of backing fibers, tufting yarns and binder compositions with a view to producing specific end products, without departing from the spirit or scope of this invention.

Having thus described the invention, I claim:

1. The method of making a fabric tufted with yarns, which consists in coating a sheet of interlocking reinforcing fibers with a liquid coating of heat fusible thermoplastic material to cause said material to penetrate the interstices of

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said fibers and to form on a back side of said sheet a layer at least as thick as said yarns, fusing said coating by the application of heat, tufting the coated sheet with said yarns to form a pile side and connecting loops overlying said layer, applying pressure by means of a heated surface against said back side at a temperature and pressure and for a time period allowing said material to retain sufficient viscosity to resist striking through to said pile side but sufficient to soften said material and to force said connecting loops into said layer so that they are surrounded by and bound in said material, and withdrawing said heated surface from said sheet and allowing the sheet to cool.

2. The method of claim 1, in which the thermoplastic material is chemically blown to a cellular form in the fusing step and the cellular structure is collapsed in the pressure applying step.

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R. H. CRISS, Assistant Examiner

U.S. Cl. X.R.

15 112—410; 156—79; 161—66, 67, 96, 159

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,554,824 Dated January 12, 1971

Inventor(s) Francis G. Callahan

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 13, cancel "focused" and substitute --fused--

Column 1, line 33, cancel "Tufter" and substitute --Tufted--

Column 1, line 35, cancel "fabric" and substitute --fabrics--

Signed and sealed this 22nd day of June 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents