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E. J. COGOVAN ET AL
METHOD OF MAKING PILE FABRICS

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FIG. 1.

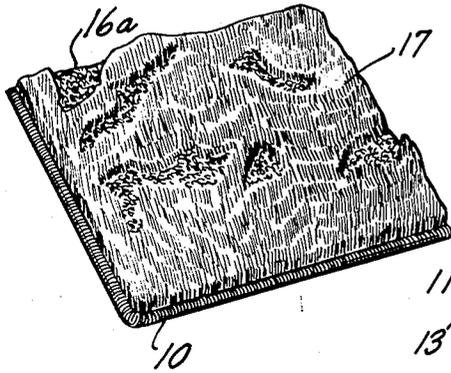


FIG. 5.

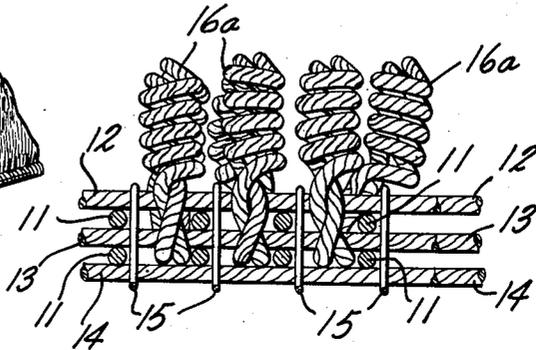


FIG. 2.

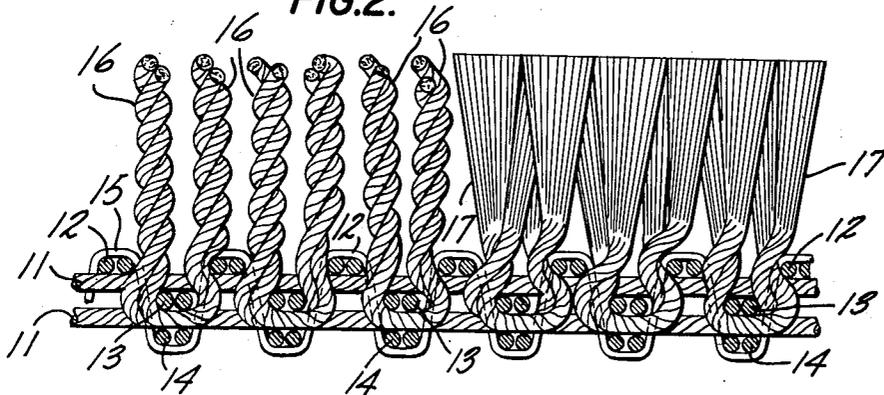
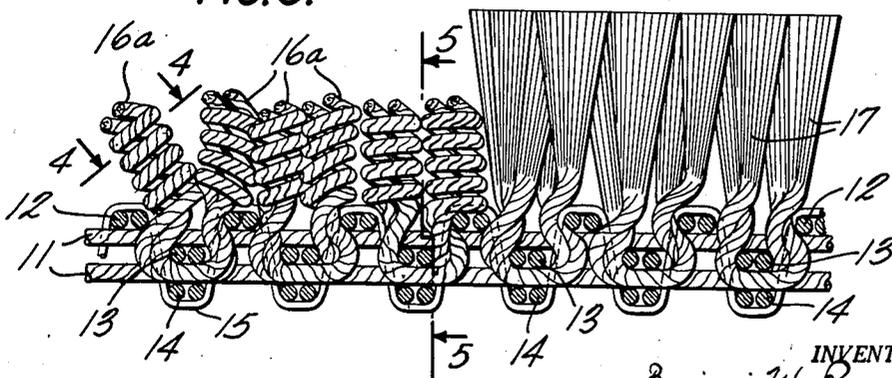


FIG. 3.



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METHOD OF MAKING PILE FABRICS

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7 Claims. (Cl. 28—72)

This invention relates to the production of pile fabrics and is concerned more particularly with a novel method of producing pile fabrics having a pile made up of high and low areas in accordance with a pattern, so that the pile appears to have been embossed or carved. The production of the pile fabric described by the method of the invention involves the use of conventional pile yarn for the high areas of the pile and of a special yarn prepared in accordance with the method for the low areas. The special yarn has the characteristic of uncoiling and shrinking, when exposed to an elevated temperature, and pile elements formed of the special yarn can thus be caused to pull down and expand in the pile, when a pile fabric containing the special yarn in the pile is subjected to the usual steam conditioning treatment forming part of the finishing operations. The new method may be employed in the production of pile fabrics suitable for the usual purposes, for which such fabrics are commonly used, and, since the method may be advantageously used in the production of pile fabric floor coverings, that application of the method will be illustrated and described for purposes of explanation.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which—

Fig. 1 is a view in perspective of a pile fabric floor covering made in accordance with the invention;

Fig. 2 is a longitudinal section on an enlarged scale of a pile fabric made in accordance with the invention at an intermediate stage in its manufacture;

Fig. 3 is a view similar to Fig. 2 showing the completed fabric; and

Figs. 4 and 5 are sectional views on the lines 4—4 and 5—5 of Fig. 3, respectively.

In the production of the fabric shown in the drawings, the pile yarn employed is spun from a blend of fibers of staple length containing a substantial quantity of a synthetic fiber, which shrinks when subjected to heat. There are numerous synthetic fibers having this characteristic, and a typical one is a form of polyvinyl chloride, which is sold commercially under the name "Fibravyl" and has a melting point of about 210° F., an adhesive point at about 170° F., and a softening point at about 158° F. Other heat-shrinkable fibers are made of various polymers and copolymers, examples being the fibers known commercially as "Vinyon HH," saran, dynel, and "Dow 274."

In a yarn for use in the practice of the method, such heat-shrinkable fibers may be employed with other fibers commonly used in the production of pile yarn. For example, a satisfactory yarn may be one spun from a blend, which includes from about 15% to about 30% by weight of the heat-shrinkable fiber with the remainder made of wool or of a mixture of wool and the other fibers, such as rayon, cellulose acetate, nylon, etc., commonly used in the production of pile yarn for use in carpet manufacture. When the amount of wool used is within the range of 50% to 85%, about 15% of the heat-shrinkable fiber is employed, but, if there is less than 50% of wool in the blend, it is usually advantageous to increase the amount

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of the heat-shrinkable fiber within the range specified up to about 30%.

A typical pile yarn for use in the practice of the method comprises a dyed fiber blend containing 50% of wool, 35% of cellulose acetate, and the remainder the heat-shrinkable fiber, while another contains 35% wool, 35% viscose rayon, and 30% heat-shrinkable fiber. The dyed stock is subjected to the usual preparing and carding operations and then spun into singles yarn containing approximately 5.6 turns per inch. Two ends of the singles yarn are plied together with 8.8 turns per inch of twist of the same hand as the singles twist. The plied yarn is subjected to a mild treatment to set the twist, while being prevented from shrinking. For this purpose, the yarn is wound on cores and the packages of yarn are exposed in a conditioning chamber to steam for a period of about two hours at a temperature of 212° F. The yarn is not soaked or immersed before being subjected to the conditioning treatment and thus enters the conditioning chamber in the dry state. With the yarn wound upon the cores, the exposure of the yarn to the temperature stated cannot produce shrinkage. Upon completion of the twist-setting operation, the yarn is unwound from the packages and twisted in a reverse direction, so that the twist passes through the zero point and the final plied yarn has about 4 turns per inch of twist of the hand opposite to that of the initial twist.

When the reversely twisted yarn is to be used in weaving operations on a pile wire loom, as, for example, in the production of Wilton and velvet fabrics, the yarn may be employed without further treatment, since the yarn is held straight during the weaving operation by the tension to which the yarn is subjected on the loom. When the yarn is to be used in the weaving of Axminster fabrics, it is given a temporary set in straight condition. For this purpose, the yarn is stretched until it is straight, and then moistened and dried while held straight.

In the weaving operation, the yarn is incorporated as pile or surface yarn in a backing of any of the usual constructions. In the drawing, the fabric 10 illustrated is a conventional Axminster weave and includes stuffer warp yarns 11 lying in upper and lower levels and crossed by weft shots 12, 13, and 14, which lie above the upper stuffer warp yarns, between the upper and lower stuffer warp yarns, and below the lower stuffer warp yarns, respectively. The weft shots are held in place by binder warp yarns 15, which cross over weft shots 12 and under weft shots 14 to hold them against the top of the upper and the bottom of the lower stuffer warp yarns.

In the production of the fabric, lengths of reversely twisted yarn containing the heat-shrinkable fiber are anchored in the backing to form tufts 16 in areas in accordance with a pattern, while the remaining tufts 17 are made of lengths of conventional yarn, which may, for example, be spun from wool or a blend of 50% wool and 50% rayon. As indicated in Fig. 2, the heat-shrinkable yarn has been subjected to a temporary set before being inserted into the fabric and its two plies lie in tight contact. The conventional yarn used in the tufts 17 is of relatively low plying twist, so that the ends of singles yarns open up after insertion of the tufts, as indicated somewhat schematically in the drawing. The fabric taken from the loom is sheared, so that the tops of all the tufts will lie at the same level, after which the fabric is subjected to the usual conditioning operation, during which it is passed through a conditioning chamber and subjected to the action of steam at atmospheric temperature. As a result of the action of the heat and moisture, the tufts 17 of the conventional yarns increase somewhat in fluffiness, while the tufts 16 made of the heat-shrinkable yarn pull down and the singles yarn ends therein uncoil, so that each tuft leg assumes the

form of a double helix of substantially greater diameter and less height than that leg before the conditioning treatment. Since the heat-shrinkable yarn was employed for tufts in areas determined by a pattern, the finished fabric comprises areas of high tufts 17 of conventional yarn and other areas of low tufts 16a of the heat-shrinkable yarn in double helical form. The fabric thus has the appearance of having been embossed or carved.

In the use of the reversely twisted heat-shrinkable yarn on an Axminster loom, it is necessary to give the yarn a temporary set while held stretched, since the unset yarn is bulky and highly elastic. If such a yarn without the temporary set were employed on an Axminster loom, the yarn would tend to spring back into its tube after the insertion of a tuft of the yarn and this might prevent the insertion of a second tuft of the yarn. Such action is prevented when the yarn is given the temporary set, as described. When the yarn is employed in weaving on a pile wire loom, the yarn is held straight under tension, as it is inserted to form loops over the wires, and, as each wire is withdrawn to cut the loops over it, the tuft legs thus formed pull down somewhat. Subsequently, in the steam conditioning operation, the tuft legs of the heat-shrinkable yarn shorten further and expand by uncoiling to form a double helix as above described.

By the use of the heat-shrinkable fiber in the blend, from which the pile yarn is spun, the desired pulling down of the tufts in the fabric is accomplished without subjecting the yarn to a severe twist-setting treatment. Such treatment degrades wool fiber and makes it brittle so that its durability is seriously impaired. When the heat-shrinkable fiber is employed, the twist-setting treatment may be so mild that the wearing qualities of wool present in the yarn are not affected to any significant degree. At the same time, the presence of the heat-shrinkable fiber causes the tuft legs to pull down and to expand and uncoil with a uniform action, so that the fabric is of improved appearance.

We claim:

1. A method of making a pile fabric which comprises spinning singles yarns from a blend of staple fibers including from about 15% to about 30% by weight of heat-shrinkable synthetic fibers, plying together at least two such singles yarns to form a multi-ply yarn, setting the twist in the multi-ply yarn while preventing it from shrinking, reversely twisting the multi-ply yarn through the twist zero point, weaving a pile fabric in operations, in which the multi-ply yarn, while held in straight condition, is utilized to form certain elements of the pile while conventional pile yarn is utilized to form other elements of the pile, and subjecting the fabric to moist heat sufficient to shrink the heat-shrinkable fibers and to cause pulling down of the pile elements formed of the reversely twisted yarn.

2. A method of making a pile fabric which comprises spinning singles yarns from a blend of staple fibers including from about 15% to about 30% by weight of heat-shrinkable polyvinyl chloride fibers, plying together at least two such singles yarns to form a multi-ply yarn, setting the twist in the multi-ply yarn while preventing it from shrinking, reversely twisting the multi-ply yarn through the twist zero point, weaving a pile fabric in operations, in which the multi-ply yarn, while held in straight condition, is utilized to form certain elements of the pile while conventional pile yarn is utilized to form other elements of the pile, and subjecting the fabric to moist heat sufficient to shrink the heat-shrinkable fibers and to cause pulling down of the pile elements formed of the reversely twisted yarn.

3. A method of making a pile fabric which comprises spinning singles yarns from a blend of staple fibers including from about 15% to about 30% by weight of heat-shrinkable synthetic fibers, plying together at least two such singles yarns to form a multi-ply yarn, winding the multi-ply yarn into packages upon cores, setting the twist

in the yarn in the packages, unwinding the yarn from the packages, reversely twisting the multi-ply yarn through the twist zero point, weaving a pile fabric in operations, in which the multi-ply yarn, while held in straight condition, is utilized to form certain elements of the pile while conventional pile yarn is utilized to form other elements of the pile, and subjecting the fabric to moist heat sufficient to shrink the heat-shrinkable fibers and to cause pulling down of the pile elements formed of the reversely twisted yarn.

4. A method of making a pile fabric which comprises spinning singles yarns from a blend of staple fibers including from about 15% to about 30% by weight of heat-shrinkable synthetic fibers, plying together at least two such singles yarns to form a multi-ply yarn, setting the twist in the multi-ply yarn while preventing it from shrinking, reversely twisting the multi-ply yarn through the twist zero point, weaving a pile fabric in operations, in which the multi-ply yarn, while held in straight condition, is utilized to form certain elements of the pile while conventional pile yarn is utilized to form other elements of the pile, and conditioning the fabric by steam at a temperature which causes shrinkage of the heat-shrinkable fibers and pulling down of the pile elements formed of the reversely twisted yarn.

5. A method of making a pile fabric, which comprises spinning singles yarns from a blend of staple fibers including, by weight, at least about 35% wool and from about 15% to about 35% of heat-shrinkable synthetic fibers, plying together at least two of said singles yarns to form a multi-ply yarn, setting the twist in the multi-ply yarn while preventing it from shrinking, reversely twisting the multi-ply yarn through the twist zero point, weaving a pile fabric in operations, in which the multi-ply yarn, while held in straight condition, is utilized to form certain elements of the pile while conventional pile yarn is utilized to form other elements of the pile, and subjecting the fabric to moist heat sufficient to shrink the heat-shrinkable fibers and to cause pulling down of the pile elements formed of the reversely twisted yarn.

6. A method of making an Axminster fabric, which comprises spinning singles yarns from a blend of staple fibers including from about 15% to about 30% by weight of heat-shrinkable synthetic fibers, plying together at least two such singles yarns to form a multi-ply yarn, setting the twist in the multi-ply yarn while preventing it from shrinking, reversely twisting the multi-ply yarn through the twist zero point, imparting a temporary set to the reversely twisted yarn while holding it straight, weaving a pile fabric on an Axminster loom with the reversely twisted yarn and conventional pile yarn used, respectively, to form different pile tufts in different areas in accordance with a pattern, and subjecting the fabric to moist heat sufficient to shrink the heat-shrinkable fibers and to cause pulling down of the tuft legs formed of the reversely twisted yarn.

7. A method of making a pile fabric, which comprises spinning singles yarns from a blend of staple fibers including from about 15% to about 30% by weight of heat-shrinkable synthetic fibers, plying together at least two such singles yarns to form a multi-ply yarn, winding the multi-ply yarn into packages upon cores, exposing the packages to steam at a temperature of about 212° F. to set the twist in the multi-ply yarn, unwinding the yarn from the packages, reversely twisting the multi-ply yarn through the twist zero point, weaving a pile fabric in operations, in which the multi-ply yarn, while held in straight condition, is utilized with conventional pile yarn to form the elements of the pile, and subjecting the fabric to heat sufficient to cause shrinking of the pile elements formed of the reversely twisted yarn.

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