

Jan. 18, 1955

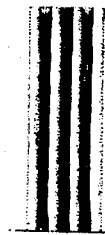
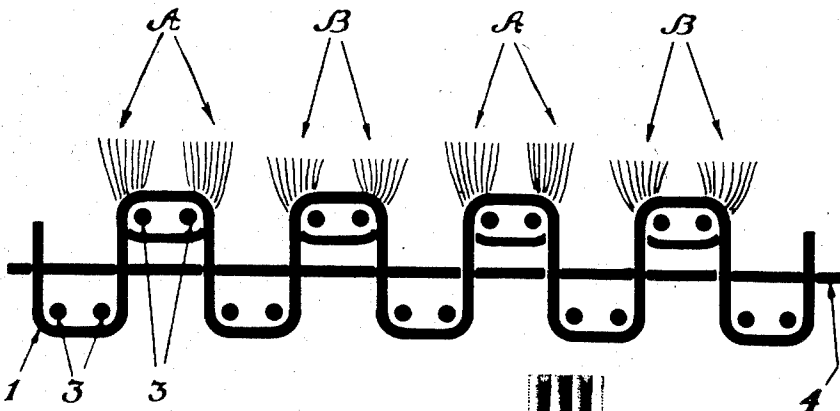
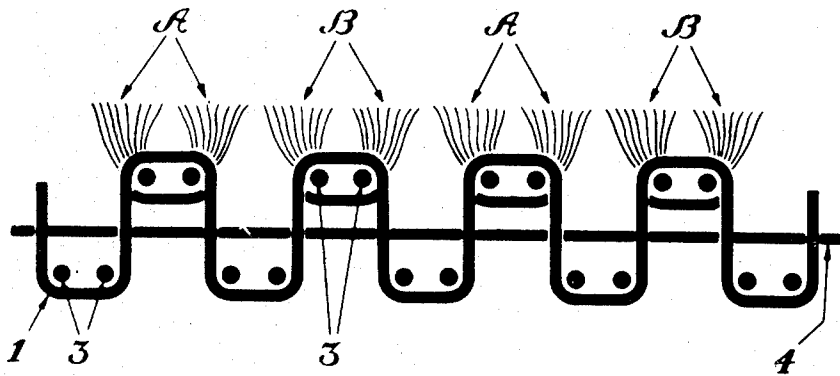
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2,699,593

PILE FABRIC AND METHOD OF MAKING SAME

Filed Dec. 7, 1951

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

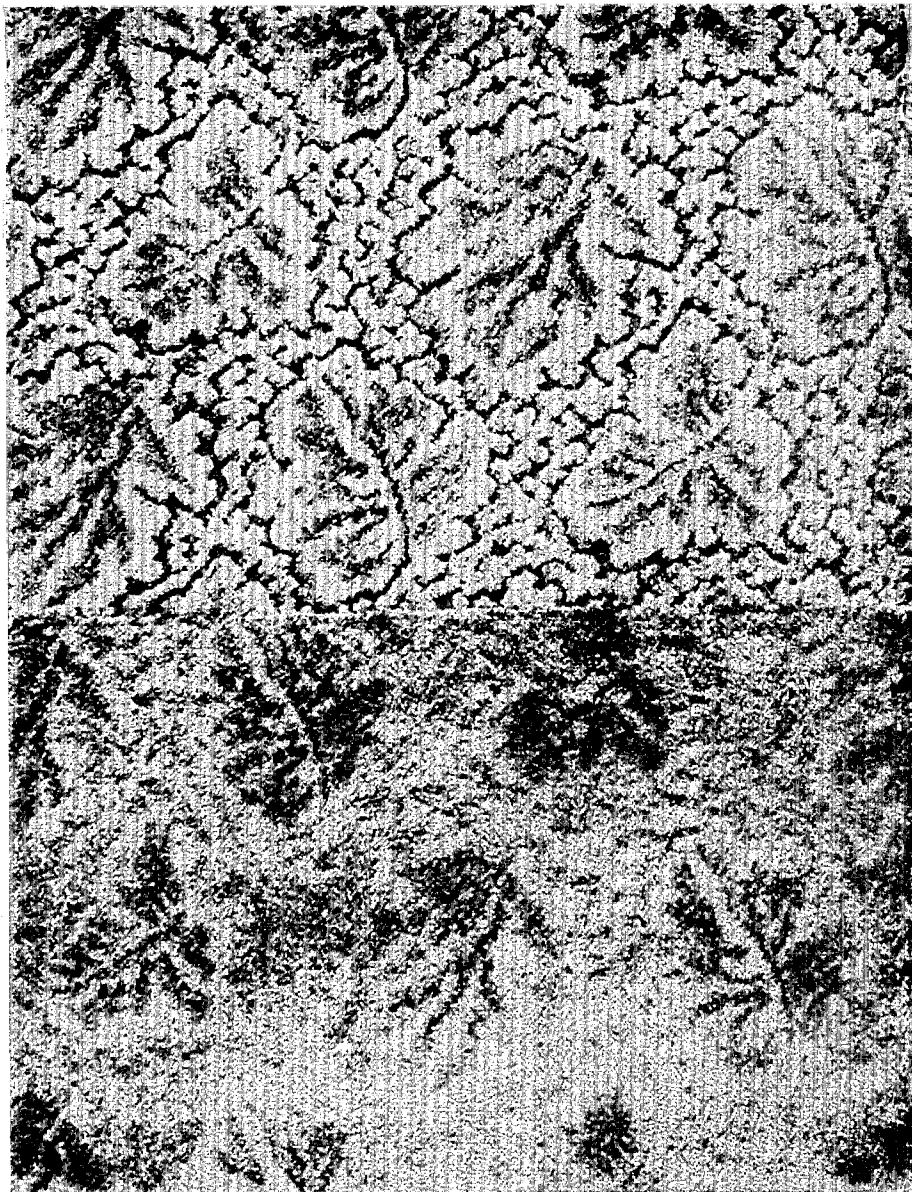


Fig. 5

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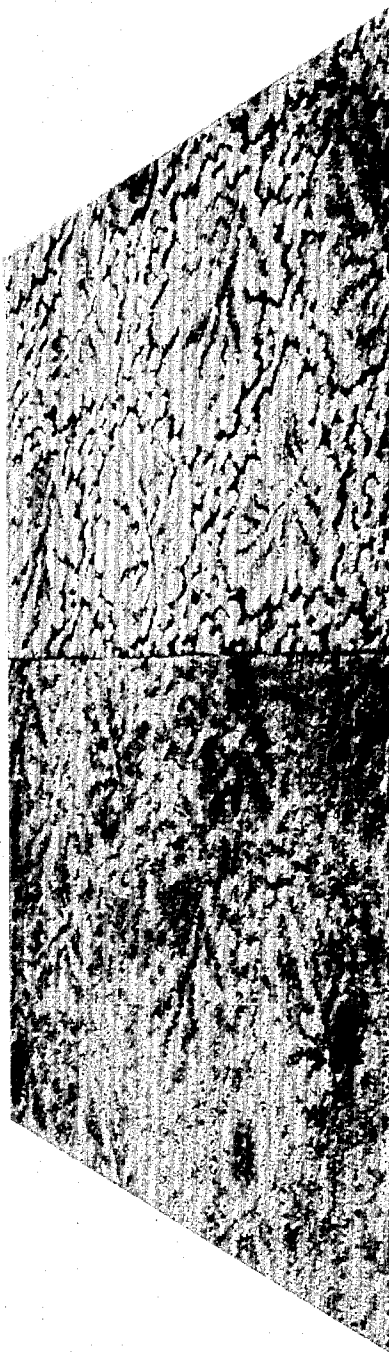


Fig. 6

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PILE FABRIC AND METHOD OF MAKING SAME

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Application December 7, 1951, Serial No. 260,502

16 Claims. (Cl. 28—72)

This invention relates to a pile fabric. It is applicable to pile fabrics which are of woven or non-woven construction; and if woven it may be produced as Wilton, velvet, Axminster, chenille, terry, frieze or other types either with all the pile cut or some of it uncut as surface appearance or utility may be dictated by the use for which the fabric may be intended, and if the pile is put onto the backing by sewing or adhesive or other means the pile yarn may be set in position and oriented by mechanical or electrostatic methods without departure from the present invention. The mechanical pile setting method is exemplified by Underwood Patent No. 1,902,921 and the electrostatic method by Meston et al. Patent No. 2,152,077.

According to the invention a fiber or fibers of one character are combined with a fiber or fibers of another character to form the pile facing of the fabric. The substance of this facing may be continuous or non-continuous filaments of different characters twisted into a composite yarn, single or plied. In the one case, such a pile surface may be in the form of some tufts wholly of one kind of fiber or filaments, while in another case the pile surface may have tufts of a combination of filaments or fibers of different characters in appropriate percentage ratios to achieve different effects as will be hereinafter set forth.

In another form of the invention, filaments of one kind may be the core of a tuft having a casing or covering of filaments of another kind.

More particularly stated, the invention is a pile surface material wherein the pile is comprised of upright tufts of more than one kind, as for instance, pile tufts of wool yarn, single or plied, and composite pile tufts, including a yarn of a synthetic fiber, such as a thermoplastic vinyl resin, which lacks dimensional stability dependent on conditions of temperature, or is dependent on inherent ability to resume an original dimension after once being elongated by stretching.

The vinyl resin in the form of a continuous filament can be combined with a woolen thread as well as spun into a yarn after blending of the fibers.

An example is a vinyl resin yarn commonly known as "Vinyon," which will shrink at 65 degrees C., and at 75 degrees C. has a shrinkage of about 12% without the tendency of the fibers to adhere to each other, or in which the fibers may be prestretched so that they may be prepared to shrink as much as 50%, with heat treatment. The tufts may be set into the backing in a predetermined pattern, one area being comprised of tufts which will shrink to a lower level than the tufts that contain no "Vinyon" or a lesser percentage of "Vinyon," so that when the "Vinyon" shrinks the predetermined pattern will be emphasized, to thus provide a carved or an embossed effect throughout, even though the tufts when originally set in place may have been of the same pile height or depth.

This invention does not rely upon an adhesive bonding of vinyl resin and wool fibers, because their forming into a yarn creates an engagement such that the vinyl resin in shrinking will pull down only a portion of the wool, leaving the rest exposed.

The essential thing is to provide a process whereby the effect of a carved or embossed pattern can be obtained in a pile fabric woven with piles of equal height by the use of pattern delineating piles of composite yarn that may be simply treated to produce an overall and

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differential shrinkage that leaves a coating layer on these piles.

In the above manner, for instance, it is practical to produce in an Axminster or Wilton weave, a carpet or rug having an embossed or carved effect.

The drawings

Figure 1 is a weftwise sectional view of an Axminster weave before the shrinking treatment.

Figure 2 is a similar weftwise cross section of the same weave as in Figure 1, after the vinyl resin fibers have shrunk and delineated a pattern simulating an embossed or carved effect.

Figure 3 is a diagrammatic view showing a vinyl resin fiber which has been stretched and entwined with a wool fiber.

Figure 4 is a diagrammatic view illustrating the effect obtained when the dimensional instability of the vinyl resin has been utilized to crimp the wool.

Figure 5 is a photolithograph plan view of two pieces of Axminster carpet woven in accordance with this invention, the piece on the left showing the uniform pile height before shrinking treatment, and the piece on the right side showing the carved effect obtained by the shrinking treatment.

Figure 6 is a photolithograph top perspective view of the two pieces of carpet of Figure 5 in the same relation showing the depth of the carved effect in the treated piece on the right and the relation of the carved effect to a dark pattern figure that is relatively unshrinkable.

Figure 7 is a greatly magnified somewhat diagrammatic side view representation of a single tuft of composite yarn from the left piece of Figures 5 and 6 before shrinkage.

Figure 8 is a similar side view of the tuft of Figure 7 showing the effect of the shrinkage treatment.

In Figures 1 and 2 of the drawing, which, as previously stated, represent a pile fabric of an Axminster weave, I have shown the type of weave in which there are two double shots of weft to each row of tufts, this weave being but one of the many types of weaves used in fabrics of pile type, with which the invention may be practiced.

The tufts A and B are, of course, in this instance, of the inserted type, and are held in by the chain warp 1, usually of cotton, which binds the tufts A and B at their base with the jute filling weft 3, the stuffer 4 being intermediate as shown.

The tufts A may be formed of a relatively unshrinkable natural fiber yarn, such as wool, single or plied, while the tufts B may be formed of a yarn, which is all "Vinyon" or of a composite yarn of "Vinyon" and natural fibers such as wool. A pattern of tufts is arranged in the manner usual to Axminster carpet production, by the number and sequence of spools of each type of yarn to the row, and thus, as with a pattern of different colors, the types of tufts, either all wool, all "Vinyon," or a composite of "Vinyon" and wool, will occur in the preselected repeat of the pattern.

In this invention I have turned to advantage the lack of dimensional stability characteristic of vinyl resin and which caused it to be termed the plastic with an elastic memory. Once stretched vinyl resin has the ability to recover its original or some other shorter length, dependent on the degree and conditions of original elongation or stretching.

The vinyl resin, commonly known as "Vinyon" is a thermoplastic copolymer of vinyl chloride and vinyl acetate having from 70% to 95% by weight of vinyl chloride, with the vinyl acetate comprising the remainder. It has a critical temperature range of from 65 to 150 degrees C., is permanently water resistant, is non-inflammable, has good chemical resistance, and is not susceptible to bacteria and fungi.

Since the shrinkage of the thermoplastic "Vinyon" filament or fiber takes place only once, provided it is heated to the temperature exceeding the critical range of 65 degrees to 150 degrees C., the operations preceding the weaving or forming of the pile, insofar as the yarn containing the "Vinyon" fibers are concerned, are held at a temperature lower than the ultimate shrinkage temperature required to achieve the final patterning result.

Following the finishing operation in weaving, the sur-

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face of the rug, or other pile fabric, is subjected to a heat operation, which contracts and thickens the "Vinyon" containing tufts B down to the required length, lower than the tufts A, and the preselected pattern is thereby brought out or delineated in simulation of an embossed or carved effect. A similar embossed or carved effect is produced in Wilton or velvet weaves by having the face yarn forming the pile tuft over the wires, either with cut or uncut pile, in which some of the face yarn may contain "Vinyon" fibers, and other portions, natural or other fibers, which do not shrink to the same degree as "Vinyon" when subjected to temperature or release of pre-stretching. In this case also the pattern is brought out by the natural or accelerated return of the "Vinyon" fibers to a shorter length following weaving, even though all tufts had initially the same pile height.

Chenille, in which a weft fabric is first woven, is given a pattern by the selected use of "Vinyon" yarn in the weft fabric, where some of the yarns may be composite and contain "Vinyon" fibers and relatively less shrinkable fibers, and other yarns may be of natural fibers, such as wool, so that when the weft fabric is cut and ironed up to V-form the "Vinyon" will be shrunk to the required length. Thus when the weft shots are set in place, the fabric will have a pattern of shorter and longer pile as in a carved effect, but without any cutting to produce this result.

It is within the scope of the invention that in forming the yarn "Vinyon" fibers may be entwined with fibers of some other substance, such as wool, in such manner that the shrinking of the "Vinyon" fibers will draw down the height of the wool or other pile fibers adjacent, so that a tuft, for instance which is to be below the surface in the eventual product may be a combination of wool and "Vinyon" fibers, in such ratio that the shortening effect operates on the wool fibers to pull them down. This effect is indicated in Figures 3 and 4 where the contraction of the "Vinyon" fiber 6 gripping the rough or scaly surface of the wool fiber 5 causes a crimping effect pulling down the composite wool pile segment.

It is to be understood that the higher piles, such as tufts A of Fig. 2, can be of wool, of rayon, of true synthetics, of any natural fiber, or any blend of fibers having a non-shrinkage or nominal shrinkage property under heat treatment. The pile tufts B can be of any of the fiber compositions used for tufts A, provided that they are blended with fibers like "Vinyon" which have a high degree of dimensional instability when subjected to heat treatment. As a specific example of this, the pile tufts A may consist entirely of acetate rayon, and the pile tufts B may be a combination of acetate rayon and "Vinyon."

The nature of my invention will be further disclosed with reference to the specific embodiment illustrated by Figures 5, 6, 7 and 8. The carpet illustrated was made on a conventional Axminster loom. The unique result of producing a combination of high and low pile yarn on this loom depends on the use of yarn of special shrinkage characteristics for the low pile or selected background, for setting off the pattern, and the shrinking treatment given the uniform height pile surface after removal from the loom.

The leaf pattern shown was woven of wool yarn with the vein portion of contrasting color as shown in all photolithographs. The background part of the pattern was woven of a composite yarn containing shrinkable and unshrinkable fibers. In this instance a natural fiber, wool of a much softer finer character than usual carpet wool strengthened by a small amount of fine nylon fiber, was spun with "Vinyon" into a single yarn. The "Vinyon" fiber used for the blending was capable of shrinking approximately 50% in length when heat treated as herein-after described. Such shrinkage was accompanied by a swelling or fattening of the composite tufts. Figures 7 and 8 illustrate the effect of this heat treatment on a tuft of composite yarn. These figures have been simplified for greater clearness by following the scheme of Figures 1 and 2 which ignores the low twist that characterizes the particular composite yarn. After the tuft of Figure 7 has been shrunk to the condition shown by Figure 8, there is a reduction in overall tuft height, a great increase in the base portion of "Vinyon" and compressed wool fibers, and a distinct layer of wool fibers above the base portion.

In addition to steaming or ironing, heat may be ap-

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plied in any other effective manner that will not damage the fibers or their backing, radiant heat having also been found entirely satisfactory.

The heat treatment comprised applying dry steam from a source at 105 pounds per square inch (gauge) to the pile surface of the carpet exposed to the atmosphere. The background tufts of composite yarn contracted immediately to delineate the pattern. The steam temperature being above 150 degrees C. exceeded the setting temperature of the "Vinyon."

The observed changes in the composite yarn were remarkable. The wool fibers were only partially pulled down by the rapidly shrinking "Vinyon." A soft surface or plating of wool could be seen and felt on the uppermost surfaces of these now shrunken tufts. The yarn itself had approximately doubled in thickness as the contraction of the vinyl resin fibers compressed the yarn, thereby producing a greater concentration of vinyl resin fibers at the base portion of the tuft. The heat treated vinyl resin fibers in moving downward contracted the tuft to approximately double its original thickness and withdrew downwardly through the wool. An enlarged, more dense covering surface was thus produced over the adjacent backing of the carpet, and the wool plating surface was firmly supported. The appearance and feel of the now high and low pile carpet was very pleasing.

The color change produced by heat treatment is quite striking. Before heat treatment the cut ends of the pile in which "Vinyon" fibers are blended shows the natural white of the "Vinyon" fibers, but after heat treatment the "Vinyon" fibers pull downward, exposing only the dyed fibers of wool or other nominal shrinking material.

It has been demonstrated new and valuable design effects can be obtained on Axminster looms without carving and at very little increase in cost. The same inventive principles are applicable to Wilton looms operated with all wires of one height. Two or more heights of wire can also be used in the Wilton constructions. Two heights of wire would give four pile heights.

In the foregoing I have described preferred embodiments of the invention which I have practiced. However, it is to be understood that the invention is subject to a number of different practical embodiments falling within the scope of the appended claims defining the invention over the prior art.

This application is a continuation in part of my prior application Serial No. 68,220, filed December 30, 1948.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A process of producing carved or embossed effects in a pile fabric formed with piles of equal height, which comprises making some of said piles of a composite yarn containing natural fibers and thermoplastic fibers of a vinyl resin having a large potential shrinkage when heated, said natural fibers not being subject to substantial shrinkage when similarly heated, making the other of said piles of fibers not subject to substantial shrinkage when similarly heated, and heating said pile fabric to a temperature exceeding the setting temperature of said vinyl resin fibers to differentially shrink and set the vinyl resin fibers and leave a distinct layer of said natural fibers on the upper pile surface.

2. A process of producing carved or embossed effects in a pile fabric formed with piles of equal height, which comprises making some of said piles of a composite yarn containing natural fibers and thermoplastic fibers of a copolymer of vinyl chloride and vinyl acetate having a potential shrinkage of the order of 50% when heated, said natural fibers not being subject to appreciable shrinkage when similarly heated, making the other of said piles of fibers not subject to shrinkage when similarly heated, and heating said pile fabric to a temperature exceeding the setting temperature of said copolymer fibers to differentially shrink and set the copolymer fibers and leave a distinct layer of said natural fibers on the upper pile surface, said layer being below the level of piles not subject to shrinkage.

3. A process of producing carved or embossed effects in Axminster and Wilton carpet, which comprises forming the carpet with tufts thereon of the same height, some of said tufts being formed of a blended composite yarn comprising wool fibers and vinyl resin fibers having a large potential when heated, and heating the tufts at a

temperature and for a time such as to shrink the vinyl resin fibers and thus produce tufts of reduced height having a plating of wool supported by a base portion of said vinyl resin material and compressed wool, whereby to delineate the pattern.

4. A process of producing carved or embossed effects in Axminster and Wilton carpet, which comprises forming the carpet with tufts thereon of the same height, some of said tufts being of wool fibers and fibers of a copolymer of vinyl chloride and vinyl acetate having a potential shrinkage of the order of 50% formed into a single composite yarn and defining a pattern, the other of said tufts being of wool yarn, and treating the tufts with steam at a temperature exceeding 150 degrees C. to shrink and set the polymeric yarn and thus produce tufts of reduced height having a plating of wool supported by a more dense base of said polymeric material and compressed wool, whereby to delineate the pattern.

5. A process of producing carved or embossed effects in a pile fabric having certain tufts of equal height which comprises making some of said tufts of a composite yarn containing a blend of fibers relatively unshrinkable by heat and thermoplastic fibers having a large potential shrinkage when heated, making the other of said tufts of fibers not subject to shrinkage when similarly heated, and heating the tufts at a temperature and for a time such as to shrink said thermoplastic fibers to differentially shrink the thermoplastic fibers and thus produce tufts of reduced height having at their upper ends exposed projecting lengths of said relatively unshrinkable fibers.

6. A process of producing carved or embossed effects in a pile fabric formed with piles of equal height which comprises making some of said piles of a composite yarn containing soft unshrinkable fibers entwined with thermoplastic fibers having a large potential shrinkage when heated blended therewith, making the other of said piles of yarn relatively less subject to shrinkage when similarly heated, and heating said pile fabric to a temperature exceeding the setting temperature of said thermoplastic fibers to differentially shrink and set the thermoplastic fibers and leave a layer of said soft unshrinkable fibers on the upper pile surface.

7. A process of producing carved or embossed effects in a pile fabric formed with piles of equal height which comprises making some of said piles of composite yarn containing thermoplastic fibers of a vinyl resin having a large potential shrinkage when heated and fibers relatively less subject to shrinkage when similarly heated, making other of said piles of fibers relatively less subject to shrinkage when heated, and heating said fabric to a temperature exceeding the setting temperature of said vinyl resin fibers to reduce the height of said piles of composite yarn by differentially shrinking said vinyl resin fibers and forming thereby an enlarged, more dense base portion of set vinyl resin material and compressed fibers less subject to shrinkage, with a layer of said last-mentioned fibers on the upper pile surface.

8. A pile fabric of Axminster weave having high and low tufts providing a carved or embossed effect, said high tufts being composed of wool, and said low tufts being a composite of wool fibers and fibers of a copolymer of vinyl chloride and vinyl acetate, each composite tuft having a base portion of said copolymer and compressed wool fibers with a distinct plating of wool fibers on the upper surface thereof.

9. A pile fabric having high and low tufts providing a carved or embossed effect, said high tufts being composed of fibers having the property of little or no shrinkage under heat treatment, and said low tufts being a composite of fibers of a copolymer of vinyl chloride and vinyl acetate and of other fibers relatively less shrinkable under heat treatment, each composite tuft having a base portion of said copolymer and less shrinkable fibers with a distinct plating of less shrinkable fibers on the upper surface thereof.

10. A process of producing carved or embossed effects in a pile fabric which comprises forming the fabric with tufts thereon of the same height, some of said tufts being formed of a blended composite yarn comprising wool fibers and vinyl resin fibers having a large potential shrinkage, and heating the tufts at a temperature and for a time such as to shrink the vinyl resin yarn and thus

produce tufts of reduced height having a plating of wool supported by a base portion of said vinyl resin fibers and wool fibers.

11. A process of producing carved or embossed effects in a pile fabric which comprises forming the fabric with tufts thereon of the same height, some of said tufts being formed of a composite yarn containing fibers relatively unshrinkable by heat and thermoplastic fibers having a large potential shrinkage when heated, other of said tufts being formed of yarn comprising fibers relatively unshrinkable by heat, and heating the tufts at a temperature and for a time such as to differentially shrink the thermoplastic fibers and thus produce thickened tufts of reduced height having exposed projecting lengths of said relatively unshrinkable fibers supported by a base portion of said thermoplastic fibers and fibers relatively unshrinkable by heat.

12. A pile fabric having high and low tufts providing a carved or embossed effect, said high tufts comprising essentially fibers having the property of little or no shrinkage under heat treatment, and said low tufts being a composite of heat shrunk thermoplastic fibers and other fibers having the property of little or no shrinkage under heat treatment, each composite tuft having a base portion of said thermoplastic fibers and said other fibers with exposed projecting lengths of said other fibers at the upper end of the tuft.

13. A process of producing pattern effects in a pile fabric, which comprises forming the fabric with tufts thereon, some of said tufts being of composite yarn containing fibers relatively unshrinkable by heat and thermoplastic fibers having a large potential shrinkage when heated and other of said tufts being formed of yarn relatively unshrinkable by heat, and heating the tufts at a temperature and for a time such as to differentially shrink the thermoplastic fibers and thus produce tufts of reduced height having exposed projecting lengths of said relatively unshrinkable fibers supported by a base of said thermoplastic fibers and fibers relatively unshrinkable by heat.

14. A process of producing pattern effects in a pile fabric, which comprises forming the fabric with tufts thereon, some of said tufts being of a blended composite yarn comprising wool fibers and vinyl resin fibers having a large potential heat shrinkage and other of said tufts being composed of wool fibers, and heating the tufts at a temperature and for a time to differentially shrink the vinyl resin fibers and thus produce composite tufts of reduced height having exposed projecting lengths of wool fibers supported by a base of wool fibers and vinyl resin fibers.

15. A process of producing carved or embossed effects in a pile fabric which comprises forming the fabric with tufts thereon of the same height, some of said tufts comprising composite yarn of blended wool fibers and vinyl resin fibers having a large potential heat shrinkage and other of said tufts comprising yarn of wool fibers and having small or no potential heat shrinkage, and heating the tufts at a temperature and for a time such as to shrink the vinyl resin yarn and thus produce tufts of reduced height having exposed projecting lengths of wool at their upper ends.

16. A pile fabric having high and low tufts providing a carved or embossed effect, said high tufts comprising yarn of wool fibers, and said low tufts each comprising a composite base portion of wool fibers and heat shrunk vinyl resin fibers with exposed projecting lengths of wool fibers at the upper end of the base portion.

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