

Sept. 12, 1967

W. L. WHITE ET AL

3,341,386

METHOD OF MAKING FRIEZE EFFECT FABRICS

Filed Jan. 11, 1966

3 Sheets-Sheet 1

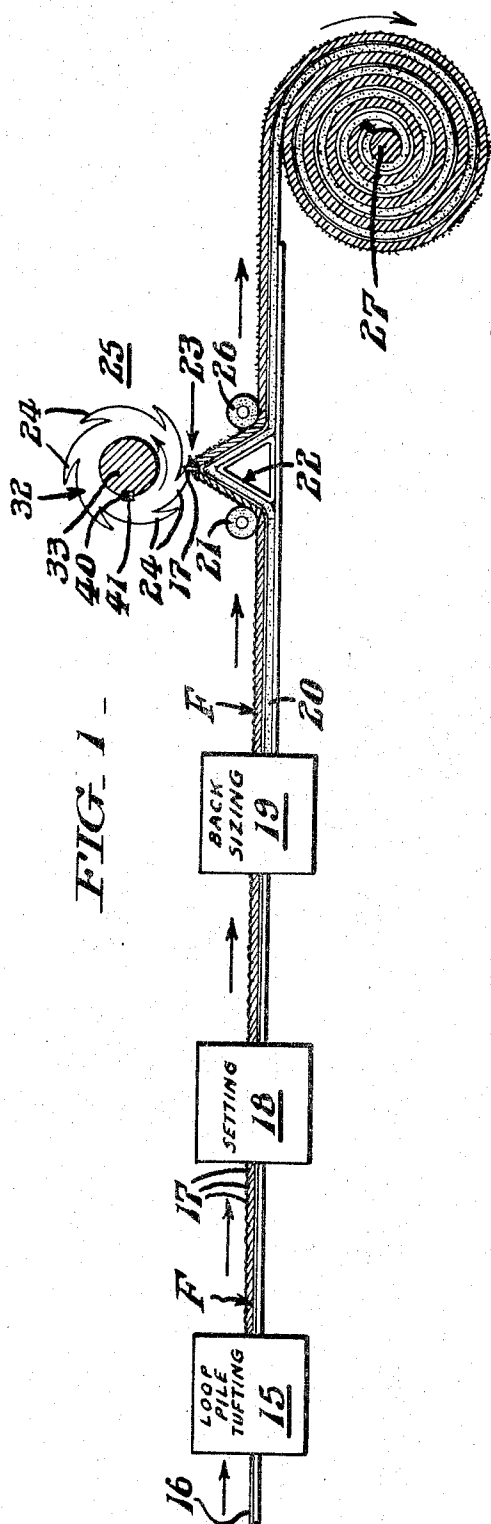


FIG. 2

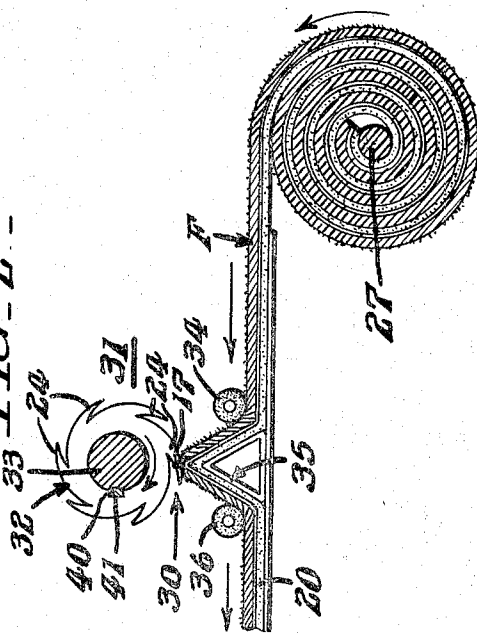
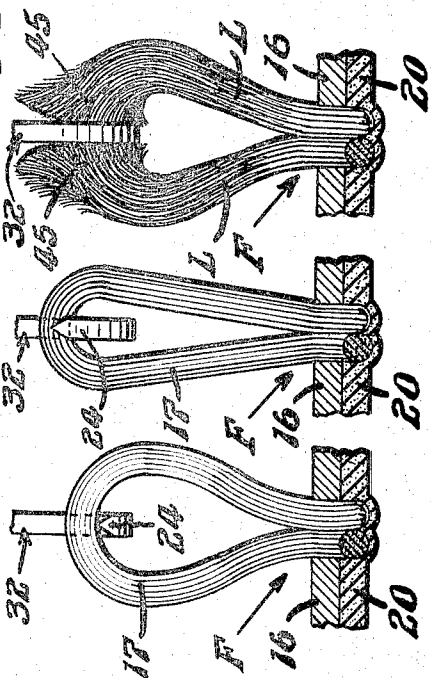


FIG. 3 - FIG. 4 - FIG. 5



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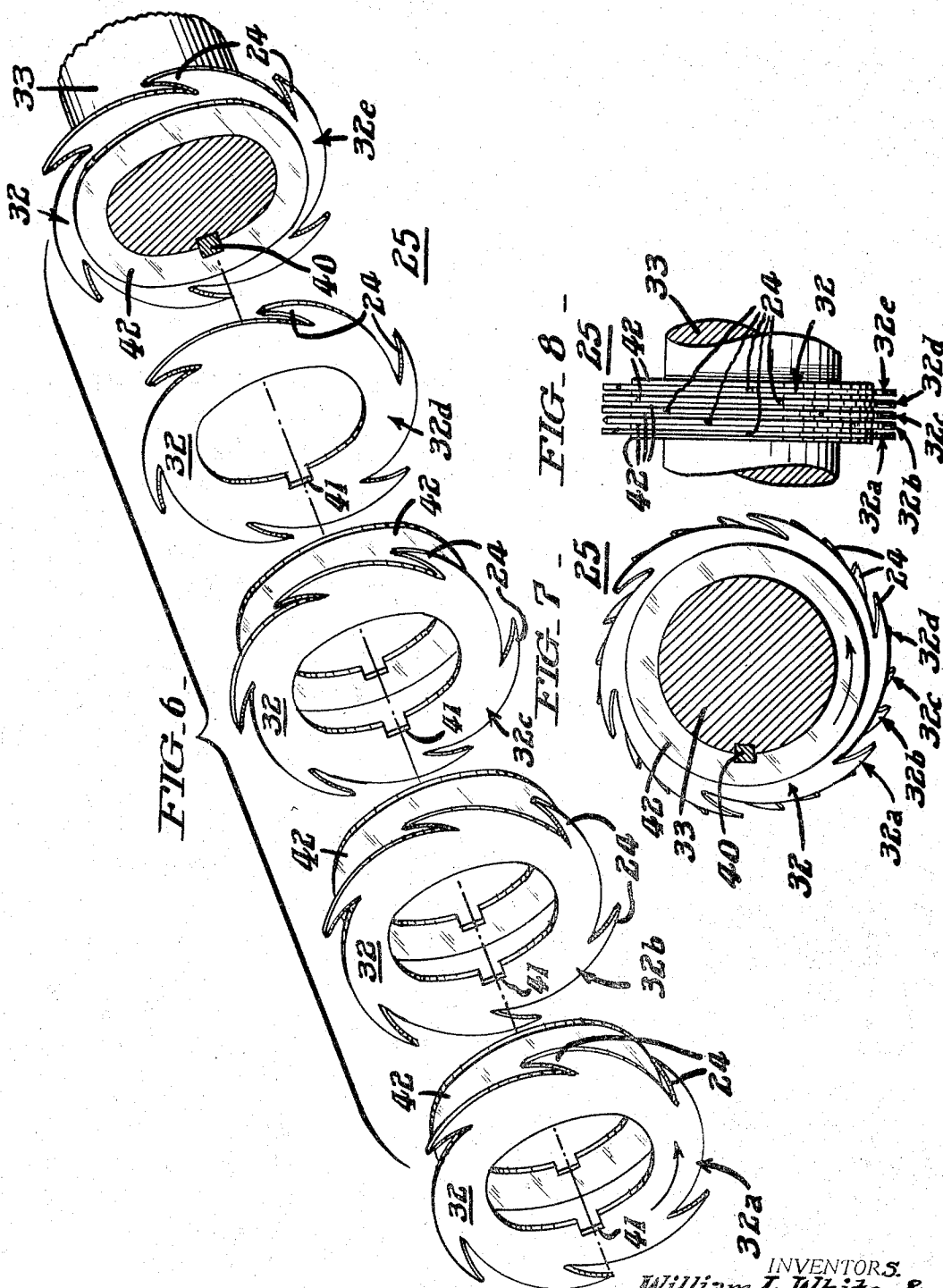
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FIG. 9 -

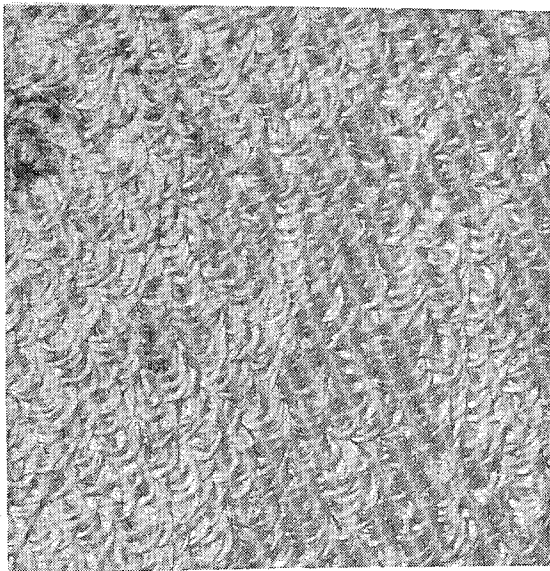
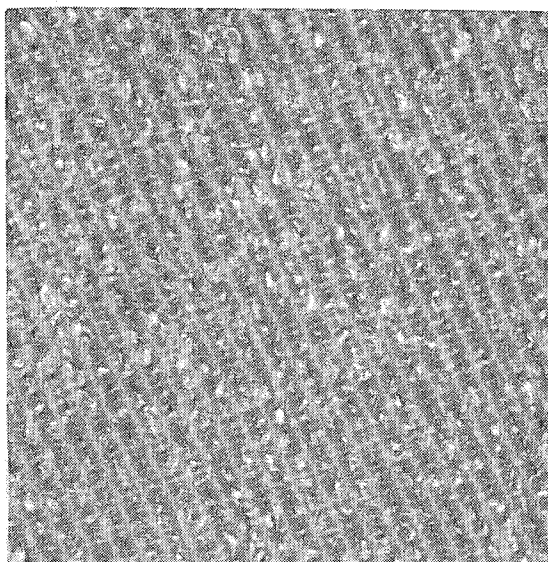


FIG. 10 -



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METHOD OF MAKING FRIEZE EFFECT FABRICS
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7 Claims. (Cl. 156-72)

This invention relates to the production of cut pile fabric and more particularly to an unusual and improved fabric and method of producing it in which a frieze effect is achieved with the use of a hook shear and heat set yarn of relatively low twist.

The present application is a continuation-in-part of our copending application Ser. No. 340,028, filed Jan. 24, 1964, now abandoned.

In the production of cut pile fabrics and particularly cut pile tufted fabrics, there are two commonly employed means for cutting all or selected areas of the pile surface. The first of these is a reel type shear using a ledger blade which removes a portion of the bight of the loop in each of the pile projections. The other is the use of cut pile loopers on the tufting machine which cooperate with oscillating knife blades positioned adjacent the base of the looper bills and which sever the pile loops as they progress backwardly on the bills to the cutting zone.

The instant invention is directed primarily to a tufted pile fabric which in the present state of the art is produced by moving a sheet of backing material, either woven or non-woven, across a throat plate where it is penetrated by a bank of oscillating needles carrying the pile yarns. The pile yarns are fed to the needles from a creel or beam and through various feed rollers, yarn guides and tension devices which may be so arranged as to provide differential feed for selected yarn ends, thus producing a patterned high and low pile, or the yarn feed may be uniform to provide level pile. In the conventional loop pile tufting machine the needles cooperate with loopers mounted on a rockshaft positioned underneath the throat plate which oscillates in such a manner that the loopers engage the yarn loops fed through the eyes of the needles. These loopers may be of the type to produce either cut or uncut pile, but the present invention is concerned with a tufting machine equipped to produce loop or uncut pile only. In this case the looper bills face in the direction of fabric travel so that as the fabric advances, the loops are pulled forwardly from the looper bills to provide either a uniform or a sculptured pile surface.

In accordance with the present invention, we have found that if thermoplastic pile yarns are used in producing a loop pile fabric as described above and if these yarns are subjected to a setting treatment either with or without simultaneous piece dyeing, and if the pile yarns are then locked in the backing material by means of an application of back-size or a secondary backing, and if a hook shear of the type to be described more fully hereinafter is used to cut the loop pile projections at the tips of their bights so that no portion of the yarn filaments is removed, the resulting fabric exhibits very interesting and desirable design characteristics. These may be attributed in part to the fact that the cut pile legs tend to resiliently resume the shape of the loop prior to cutting due to the previous setting operation which occurred after the formation of the pile loops.

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A primary object of our invention, therefore, is to provide an improved method for producing a cut pile tufted fabric which includes the steps of forming loop pile projections in a backing fabric using a thermoplastic synthetic yarn, setting the yarns in the form in which they are tufted into the backing fabric, anchoring the yarns in the fabric, and then cutting the loop pile projections solely under tension.

A further object of the invention is to provide an improved method of producing a cut pile tufted fabric in which a moving length of uncut pile fabric is opened up and simultaneously converted to cut pile by means of a hook shear without the loss of any pile material.

A further object of the invention is to provide an improved frieze pile fabric having the appearance of a twist pile yarn but which in effect contains yarn of zero or relatively soft twist which may be defined as less than 3½ turns per inch.

Further objects will be apparent from the specification and drawings in which

FIGURE 1 is a schematic view showing the various steps of producing the fabric of the present invention;

FIGURE 2 is a view showing an additional hook shearing operation but performed with the fabric traveling in the opposite direction with respect to the shear;

FIGURE 3 is an enlarged fragmentary section showing one of the pile loops as it is engaged by one of the hooks of the shear;

FIGURE 4 is a view showing the pile loop of FIGURE 3 as it is elongated due to the movement of the shear and just prior to cutting the loop;

FIGURE 5 shows the loop of FIGURES 3 and 4 just after cutting and indicates the manner in which the filaments of the yarn end bloom or blossom at the severed area and also in which the cut pile legs tend to snap back and resume the initial configuration of the loop prior to elongation and cutting;

FIGURE 6 is an exploded view showing a complete set of the rotary shear blades;

FIGURE 7 is an end view of the shear with a set of the blades in position;

FIGURE 8 is a side view of the structure of FIGURE 7;

FIGURE 9 is a photograph of the tufted pile fabric of our invention as it comes from the tufting machine; and

FIGURE 10 is a photograph of the fabric of FIGURE 9 after setting, back sizing, dyeing and hook shearing.

The invention comprises essentially the concept of producing a pile fabric using thermoplastic or heat-settable pile yarns, setting the yarns in the tufted condition, applying a backsize to the fabric to retain the yarns in the backing, opening the pile surface and simultaneously converting the uncut pile to cut pile by means of a hook shear. It must be pointed out that the term "hook shear" is actually a misnomer since there is technically no shearing action involved. Other types of cutters commonly employed for the production of a tufted cut pile fabric use a device in which the yarn filaments are actually sheared between two cooperating blades and this is equally so whether a reel type shear is used or whether loopers are provided with knives. It has been found that, contrary to expectation, considerably different effects and interesting designs can be achieved where the cutting action is produced solely by means of tension. In the present invention a multiplicity of cutters engage the loops

in a transverse area of the opened up pile fabric so that the individual loops are elongated by means of the cutters or blades until the filaments in each loop are cut solely by reason of tension as distinguished from the conventional scissors-like or shearing action. In practice it has been found desirable, if not extremely important, to subject the fabric to a multiple cutting operation in which the fabric is passed through the shear zone at least once in each direction. It has been preferred practice, however, to insure that the fabric travels in the same direction as the periphery of the shear. With the above description in mind, the terms "shear" and "hook shear" will be used hereinafter to denote a tension cutter and not a scissors-type cutter.

Referring now more particularly to the drawings, a tufted pile fabric F is produced at zone 15 by introducing either a woven or nonwoven backing material 16 into any type of well-known tufting machine which applies a series of pile loops 17 to the backing 16 in a manner described heretofore. The tufted uncut pile fabric is then subjected to a setting operation at 18 which may consist of passing the fabric through an oven to elevate the temperature of the thermoplastic pile yarns to a degree sufficient to produce a permanent set. The temperature required for this purpose may vary in accordance with the resin or type of material used for the pile yarns. Examples of such materials are nylon, polyester, olefin, acrylic, modacrylic, acetate, saran, vinyon and others. Furthermore, the setting may be concurrent with a dyeing operation in which case the fabric is tufted in the greige.

From the setting zone the fabric is conducted to a backsize zone 19 in which a backsize 20 is applied to the fabric by means of applicator rolls (not shown), or, if desired, a secondary backing may be laminated to the primary backing 16. After passing through suitable driers, the backsize fabric F is carried under a guide roller 21, over a conventional shear buck 22 and into a cutting zone 23 between the apex of the shear buck and the periphery of the various cutters 24 of the hook shear assembly 25. The fabric then passes along the opposite side of the buck 22 and under a guide roller 26 to a take-up roll or beam 27. The beam 27 is then transferred to another station so that the fabric may be unrolled from the beam 27 and passed through a second shearing or cutting zone 30 but with the opposite direction of fabric travel. Shear 31 shown in FIGURE 2 is identical to shear 25 of FIGURE 1 except that it may be reversed end for end or the individual discs 32 on which the cutters 24 are formed may be reversed on the shear shaft 33. As shown in FIGURE 2, the fabric F passes under a guide roller 34, over a shear buck 35 and under a guide roller 36 from whence it is carried to another driven take-up roll (not shown).

Referring now to FIGURES 6-8, the hook shear assembly or tension cutting apparatus 25 utilized in the present invention comprises a driven shear shaft 33 which is suitably journaled at each end and connected to a driving mechanism not shown. The shaft 33 is provided with a keyway for receiving keys 40. A series of discs 32 are formed in sets of 4 in such a way that the peripheral cutters 24 on each disc are staggered axially of each other as shown clearly in FIGURES 7 and 8. The discs 32a, 32b, 32c and 32d comprise a set of four and it will be observed that the location of the cutters 24 on each disc 32a-32d progresses counterclockwise as viewed in FIGURE 6 with respect to the keyways 41 in each disc. Disc 32e, however, is identical to disc 32a but is the first disc in the second set of four. The discs are separated on shaft 33 by means of spacers 42 as shown in FIGURES 6, 7 and 8. The shear assembly 25 of FIGURE 6 in effect comprises an entire series of staggered blades running from end to end along shaft 33 and of sufficient length to extend entirely across the width of the fabric F at the cutting stations 23 and 30. The peripheral speed of

the cutters 24 is controlled to provide optimum results in accordance with the invention without damaging the fabric. Likewise, the spacing between the top of the shear bucks 22 and 35 will be so calculated that optimum cutting is achieved without damaging the backing material 16.

As previously described, the cutting action achieved by means of the shear assemblies 25 and 31 produces a heretofore unobtainable effect in a tufted pile fabric. FIGURES 3-5 illustrate a single pile loop 17 in the fabric F which in this case has zero twist in the yarn. A cutter 24 engages the loop 17 which is set in the general arcuate shape shown in FIGURE 3. However, the loops 17 ordinarily have a random overlapping effect as may be seen in FIGURE 9. This is particularly the case in a soft twist fabric and, therefore, these loops will not stand upright as shown in FIGURE 3 until engaged by the cutters 24. Continued rotation of the shear 25 or 31, as the case may be, elongates each of the loops 17 as shown in FIGURE 4 so that they are stretched to a total length in excess of the total length of the loop shown in FIGURE 3. The degree of extensibility depends upon the material used for the yarns and also the degree to which these yarns may be drawn prior to the tufting operation. In any event, when continued rotation of the shear is sufficient to cut the loop 17 at its bight by means of tension only, there is a distinct snap-back of the cut legs L which induces the filaments to blossom as at 45 in FIGURE 5 and creates a non-light-reflective area in the fabric. In addition, the set configuration of each of the loops 17 not only with regard to the arcuate form shown in FIGURE 3, but also with regard to the overlapping or flattened condition shown in FIGURE 9, will be resumed by the cut legs of the loop as shown in FIGURE 10. In the case of a soft or zero twist yarn, this produces a frieze fabric effect due to the set curvature and random disposition of the cut pile legs. This effect is enhanced by the difference in light reflection as between the blossomed filament ends 45 and the filaments of the cut legs which in the fabric of FIGURE 10 are shown as having substantially flat areas on the face of the fabric.

The preferred embodiment of the invention has to do with a pile fabric tufted with soft twist yarns. However, it will be understood that the invention in its broadest aspects is also applicable to other types of pile fabrics such as woven and knitted. The effects produced can be achieved to greater or lesser degree by using higher twist yarns and may be varied as desired by using spun yarns, continuous filament yarns, as well as high and low bulk (crimped) yarns all of which are well known in the art.

The unusual and unexpected results that are achieved by means of the present invention are not entirely explainable but are thought to be due in whole or in part to the combination of tension cutting a yarn which has previously been set in a nonlinear configuration.

Having thus described our invention, we claim as follows:

1. The method of producing a frieze effect pile fabric comprising the steps of tufting a plurality of heat-settable loop pile yarns into a backing material, subjecting the fabric to elevated temperature sufficient to set the pile yarns, anchoring the pile yarns in the backing material, and tension cutting a plurality of pile loops in the fabric to form arcuate cut pile projections corresponding to the set shape of the uncut loops.
2. The method of claim 1 in which the pile yarns comprise filaments of a heat-settable thermoplastic material.
3. The method of claim 1 in which the anchoring step comprises the application of a backsize.
4. The method of claim 1 in which the cutting step is performed by means of a plurality of blades rotating at relatively high speed.
5. The method of claim 1 in which the fabric is subjected to a second cutting operation in which the loops

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of the fabric are cut in a direction opposite to the direction of the first cutting.

6. The method of claim 1 in which the yarns have less than $3\frac{1}{2}$ turns per inch of twist.

7. The method of claim 1 wherein the loops under 5 tension are elongated prior to cutting.

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