Dec. 27, 1966 C. G. EVANS 3,293,723

METHOD OF MAKING PILE FABRIC

Filed May 14, 1962

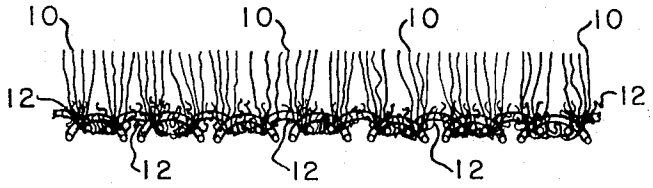


FIG. -1-

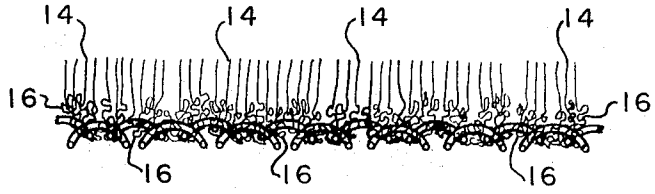


FIG. -2-

INVENTOR.
CYRIL G. EVANS
BY
Earle R. Marden
ATTORNEY

United States Patent Office 3,293,723 Patented Dec. 27, 1966

3,293,723

METHOD OF MAKING PILE FABRIC

Cyril G. Evans, Spartanburg, S.C., assignor to Deering Milliken Research Corporation, Spartanburg, S.C., a corporation of Delaware

Filed May 14, 1962, Ser. No. 194,721
2 Claims. (Cl. 28—72)

This invention relates to the preparation of pile fabric and more specifically to the preparation of novelty pile fabric such as artificial fur.

Pile fabrics are commonly prepared by weaving or knitting operations. The woven fabrics are usually of W locked-in construction using counts varying from 2/28 to 2/45 worsted count on the pile. They generally use a 3 to 5 inch staple processed into yarn on worsted system for the woven fabric. Knitted pile fabrics may employ a 1½ inch staple in roving form. Whether the fabric is woven or knitted, however, it must have certain characteristics in order to resemble fur. In general, these characteristics may be described as a pile having two separate and distinct heights. The upper or higher pile resembles the guard hair of natural fur. The lower pile resembles the under pelt of naturally occurring fur and is generally a denser and silkier pile than the upper or guard hair resembling pile. In order to achieve this effect of two distinct pile heights, the staple fibers of the yarn are usually subjected to a differential shrinkage treatment. The differential shrinkage treatment may consist of applying varying degrees of heat to preselected areas of a fabric having a pile consisting entirely of a shrinkable thermoplastic type yarn. An alternative form of obtaining a differential in pile height is to prepare a fabric from a yarn employing a variety of staple fibers. Yarns employed in this type of an operation must contain shrinkable staple fibers and nonshrinkable fibers. The nonshrinkable staple fibers may be fibers such as, for instance, preshrunk Arnel, preshrunk viscose, preshrunk Orlon and preshrunk Dacron. The shrinkable fibers may be staple fibers such as, for instance, spun Arnel and spun Orlon. A fabric woven from yarns of the foregoing type may then be subjected to heat treating operations. The result of the heat treating operations is that the shrinkable yarns will contract and produce a dense pile resembling under pelt, while the nonshrinkable staple fibers will remain unchanged and will form a high pile resembling guard hairs.

While synthetic fur pile fabrics produced from yarns consisting of staple fibers have resulted in satisfactory products, the synthetic fur fabrics still have certain characteristics which render them dissimilar from naturally occurring fur. This dissimilarity of the synthetic product is partially due to characteristics of the lower or dense pile of the synthetic product which is meant to resemble the under pelt of natural fur. The lower dense pile as previously explained is obtained by shrinking the shrinkable components of the staple fibers of the yarn. The shrinkage is the result of physical characteristics of the thermoplastic staple fibers. Thermoplastic continuous filaments may be subjected to crimping operations which will render the continuous filaments more shrinkable. A thermoplastic continuous filament which has been subjected to crimping operations, however, is not suitable for use as staple which can then be turned into a yarn. It has been found that staple fibers cut from the crimped continuous filament tend to curl to such an extent that balling or pilling is evident. The pile fabrics prepared from staple fiber yarns have therefore not employed crimped fibers even though the superior shrink characteristics of the crimped continuous filament are known.

It is therefore an object of this invention to prepare

a pile fabric from a crimped continuous filament thermoplastic yarn.

It is another object of this invention to weave a pile fabric from a crimped continuous filament thermoplastic yarn.

It is a further object of this invention to knit a pile fabric from a crimped continuous filament thermoplastic yarn.

Additional objects of this invention will become apparent from the following discussion.

FIGURE 1 is a cross-sectional schematic view of a knit pile fabric with the pile portion prepared from yarn which is a blend of wholly uncrimped and wholly crimped continuous filaments and

FIGURE 2 is a view similar to FIGURE 1 except that the pile portion is prepared from a yarn which consists entirely of continuous intermittently crimped monofilaments.

I have now discovered a method for the production of a pile fabric having a fur-like appearance. The pile portion of the fabric is prepared from a crimped thermoplastic continuous filament yarn of the type commonly known as elasticized or bulked yarn. The yarn may consist of a blend of wholly uncrimped and wholly crimped continuous filaments or the yarn may consist entirely of continuous filaments which are intermittently crimped. When a yarn consisting of crimped and uncrimped filaments is employed, the uncrimped filaments are preferably of a heavier denier than the crimped filaments. The individual monofilaments making up the yarn employed herein may be of the same thermoplastic polymer or may be of different thermoplastic polymers. The presence of a plurality of polymeric materials is often desirable where a differential dyeing effect is desired.

Looking now to FIGURE 1 the upper pile **10** is the wholly uncrimped continuous filament while the lower pile **12** which resembles the under pelt of naturally occurring fur is the wholly crimped continuous filament.

In FIGURE 2 the pile portion consists of an intermittently crimped continuous filament yarn with the uncrimped portions **14** representing the upper pile while the crimped portions **16** represent the lower pile portions.

It should be understood that the term crimped yarn as employed herein includes any of the commercially available elasticized or stretch yarns. These yarns are generally composed of synthetic organic filaments such as nylon, cellulose acetate or other cellulose ester or ether fibers, polyacrylonitrile, or polyacrylic fibers or polyethylene terephthalate or other polyester fibers capable of being heat set or otherwise distorted such that they assume a convoluted linear configuration when in a relaxed state. Such yarns can be prepared by any one of several methods such as, for example, the method disclosed in U.S. Patent No. 2,564,245 to Dillion, the method disclosed in U.S. Patent No. 2,575,839 to Rainard, and U.S. Patent No. 2,919,534 which comprises passing a thermoplastic strand under tension and at an elevated temperature about the sharpened edge of a blade member. If desired, elasticized yarns prepared according to the above methods can be given a preliminary heat treatment before being subject to weaving or knitting operations. The heat treatment has an advantage in many instances in that it increases the bulking ability of the yarns. When high bulk is desired such a heat treatment can be readily effected by overfeeding the yarn onto a contact heater or the like and can, in some instances, be combined with a drying operation or other preliminary operation necessary for placing the yarn in a desired condition for knitting or weaving operations.

The knitted fabric of this invention may be made by any of the well-known flat or circular knitting operations

such as, for instance, the flat knit laid-in plush type. As the fabric is a cut laid-in plush, a minimum of two needle beds and three guide bars are required. The front guide bar makes overlaps only on the front needle bed and the back guide bar makes overlaps only on the back needle bed. The two plain fabrics which are made separately on the two needle beds are connected together by the threads of a middle bar which makes overlaps on both the back and front needle beds. Special cutting machinery is used to separate the two ground structures and cut the thread from the middle bar to form the pile. When the yarn employed in this operation is of the type consisting of crimped and uncrimped filaments, a plush of any height and any frequency may be employed. When, however, the yarn employed is of the intermittent crimped type, the height and frequency of the plush must be carefully metered. Under ideal conditions, the plush resultant from the use of an intermittent crimped yarn will produce a majority of pile thread which are either wholly crimped or wholly uncrimped. It has been found that with careful control this result may be obtained with at least an 80% probability.

When the fabric of this invention is prepared by a weaving operation, the weaving may be carried out by any one of the velvet pile type weaving operations. In this type of operation, fabric may be woven as a single plush or as a loom severed double plush. The ground is usually cotton although it should be understood that any one of the wide variety of fabrics may be employed. Pile anchorage may be obtained by systems such as the 6-pick W tufted. This system, of course, may be varied depending upon the anchorage and surface coverage desired. When the pile yarns employed in this operation consist of wholly crimped and wholly uncrimped filaments, the setting of the pile height and surface coverage are not critical. When, however, the pile yarn employed is of the type having an intermittent crimp, it is important that the pile height and the surface coverage be carefully metered. If careful adjustments are made when employing an intermittently crimped yarn, a pile will result wherein the majority of the individual fibers of the pile are either wholly crimped or wholly uncrimped. This result may be obtained with about an 80% probability, a small portion of the fibers always being disposed in the form of a random pattern.

The fabric of the woven or knitted type may or may not be subjected to a heating operation. The application of a heating operation is dependent upon the type of crimp employed in the yarn making up the pile. If the yarn employed contains a crimp of the latent type, that is to say, a crimp which develops its maximum bulking tendencies upon being subjected to an operation subsequent to fabric formation, then a heating operation will be employed. The heating operation may utilize systems such as banks of infrared lamps, autoclaves, dry tumbling, or simple hot water laundering. Dry tumbling at a temperature of about 180° F. for a period of several minutes has been found to be particularly desirable.

The finished pile fabric is preferably subjected to a treatment known as electrification. This treatment consists of passing the fabric on a belt or other support member in a manner so as to pass beneath and in engagement with a roll having grooves which extend lengthwise of the roll. The roll which is usually heated beats and combs the fabric, thereby raising depressed pile areas and giving the fabric a more uniform appearance.

Coloration of the pile fabric may be produced by any of the systems well known to the art. The pile fiber may be produced from pre-colored yarns or may be produced from uncolored yarns and then subjected to dyeing or coating operations. It is usually desirable for the high pile layer which simulates the guard hair of fur to have a darker coloration than the low pile layer which simulates the under pelt of fur. The variation in coloration may be obtained by producing the pile fabric from a plurality of thermoplastic polymeric materials which have a differential in their affinity for a dye. A variation in coloration may also be obtained by simply spraying the finished pile fabric while those areas resembling under pelt are masked from heavy concentration of spray.

The following examples are given for purposes of illustration and should not be considered as limiting the spirit or scope of this invention.

Example I

A knitting machine of a type suitable for producing tubular fabrics such as, for instance, an L. L. P. Scott and Williams Knitting Machine having a 30-inch diameter and 8 needles per inch is fed with a cotton yarn for the production of the base fabric and a continuous filament elasticized nylon yarn for the production of the pile loops. The elasticized continuous filament nylon yarn consists of 70-denier 34 filament elasticized continuous filament yarn blended with 15-denier monofilament nonelasticized continuous filaments. The sinker nib arrangement of the knitting machine is set so that a one-inch pile loop is formed. After the fabric has been knitted in tubular form, it is slit so as to expose the inner pile surface. The loops composing the pile are then cut and the fabric is dry tumbled for a period of about ten minutes at a temperature of about 180° F. The finished product has a fur-like appearance resultant from a high pile of 15-denier nylon filament and a low under pile of 2-denier (on a monofilament basis) highly crimped filaments, the high pile 15-denier filaments resembling the guard hair of natural fur and the 2-denier crimped filaments resembling the soft under pile of natural fur.

Example II

A circular knitting machine having a diameter of about 30 inches with 8 needles per inch such as, for instance, the L. L. P. Scott and Williams Knitting Machine is fed with a cotton yarn for production of a base or holding fabric and with an elasticized nylon yarn for the production of a pile. The nylon yarn is intermittently crimped 20-denier 34 filament continuous nylon yarn. The sinker nib arrangement of the knitting machine is set so that a ½ inch loop is produced. After the tubular fabric has been knitted, it is slit open so as to expose the inner pile loops. The loops are then cut open and the fabric dry tumbled for a period of about five minutes at a temperature of about 170° F. The finished fabric has a novel appearance not unlike that of fur, the result being produced by extensive shrinkage in that portion of the nylon yarn which has been crimped while substantially no shrinkage takes place in that portion of the nylon yarn which is uncrimped.

Example III

A circular knitting machine of the type having a 30-inch diameter with about 8 needles per inch such as, for instance, an L. L. P. Scott and Williams Knitting Machine is fed with a wool yarn for the production of a base or holding fabric and an intermittently crimped 30-denier 34 filament elasticized nylon continuous yarn for the production of a pile. The sinker nib arrangement is set so as to produce a 1¼ inch nylon loop. The sinker nib arrangement is specifically set so as to produce loops which are entirely crimped or entirely uncrimped. The finished tubular fabric is slit open so as to expose the inner loop pile. The loops composing the pile are then cut open and the fabric dry tumbled for a period of about ten minutes at a temperature of about 180° F. The resultant fabric has a definite pattern, the pattern being produced by a high pile consisting of uncrimped nylon fiber and a low pile consisting of crimped nylon fiber.

Example IV

A circular knitting machine having a 30-inch diameter and at least 8 needles per inch is fed with a cotton yarn

for the production of a base or holding fabric and with an intermittently crimped nylon yarn for the production of a pile. The intermittently crimped nylon yarn is a 30-denier continuous monofilament yarn. The sinker nib arrangement of the knitting machine is set so that two loop lengths are formed, one loop length being about ½ inch in length, the other loop length being about 1 inch in length. After the tubular fabric has been knitted, it is cut so as to expose the inner loop piles. The fabric is then dry tumbled for a period of about fifteen minutes at a temperature of about 165° F. The resultant fabric is a novelty fabric having at least four distinct pile heights. The four distinct pile heights are the result of two loop heights each of which will produce two more distinctive pile heights when cut and subjected to heat treatment.

Example V

A double plush velvet loom of the Crompton-Knowles type having a jacquard head and two beams to each backing is fed with cotton yarn for production of a base fabric and with an elasticized nylon yarn for the production of a pile. The elasticized continuous filament nylon yarn consists of 70-denier 34 filament elasticized yarn blended with 15-denier monofilament nonelasticized yarn. The jacquard weaves the bottom shed and then the top shed. The two backings are then separated by passing a knife between them, thereby forming two separate plush fabrics. The fabrics are then dry tumbled for a period of about ten minutes at a temperature of about 180° F. The finished product is fur-like in appearance having a high pile of 15-denier nylon filament and a low pile of 2-denier (on a monofilament basis) highly crimped nylon filament, the high pile 15-denier filament resembling the guard hair of natural fur and the 2-denier low pile crimped filaments resembling the soft under pile of natural fur.

Example VI

A two-shot single plush velvet loom of the Crompton-Knowles type is fed with cotton yarn for the production of a base or holding fabric and with an intermittently crimped 70-denier 34 filament elasticized polyethylene terephthalate continuous filament yarn for the production of a pile. The base fabric is arranged so as to contain two stuffer warps with the pile loops being woven over razor-bladed pile wire. On completion of weaving operations, the razor-bladed pile wires are withdrawn cutting the woven polyethylene terephthalate loops and producing a pile face. The fabric is then dry tumbled for a period of about ten minutes at a temperature of about 180° F. The finished product is a novelty fabric having a pile composed of fibers which are wholly

crimped, wholly uncrimped, or partially crimped and partially uncrimped.

Example VII

A two-shot single velvet loom of the Crompton-Knowles type is fed with cotton yarn for the production of a base or holding fabric and with a continuous filament elasticized nylon yarn for the production of pile loops. The elasticized continuous filament nylon yarn consists of 70-denier 34 filament elasticized yarn blended with 15-denier monofilament nonelasticized yarn. The base fabric is prepared so as to contain two stuffer warps. The nylon pile loops are woven over razor-bladed pile wire. On completion of weaving operations, the razor-bladed pile wires are withdrawn thereby cutting the pile loops and producing a pile surface. The fabric is then dry tumbled for a period of about ten minutes at a temperature of about 180° F. The finished fabric is fur-like in appearance having a high pile of 15-denier filaments and a 2-denier (on a monofilament basis) highly crimped low under pile.

Having thus disclosed my invention, what I claim is:

1. The method of making a pile fabric which includes forming pile loops from a continuous elasticized thermoplastic intermittently crimped monofilament yarn having nonuniform latent shrinkage characteristics, cutting the loops and then developing the latent shrinkage characteristics by subjecting said pile fabric to a heat treatment whereby the crimped portion of the yarn shrinks extensively to provide a fur-like appearance.

2. The method of claim 1 wherein said thermoplastic yarn is nylon yarn.

References Cited by the Examiner

UNITED STATES PATENTS

423,781	3/1890	Landenberger	66—84
2,058,948	10/1936	Blumenthal et al.	28—78
2,414,800	1/1947	Charch et al.	28—78
2,815,558	12/1957	Bartovics et al.	28—78
2,857,652	10/1958	McNally et al.	28—78
3,013,325	12/1961	McNally et al.	28—78
3,024,518	3/1962	Newton	28—78
3,047,932	8/1962	Pittman et al.	28—1
3,097,415	7/1963	Davis.	

MERVIN STEIN, *Primary Examiner.*

RUSSELL C. MADER, DONALD W. PARKER, *Examiners.*

H. G. GARNER, H. S. JAUDON, *Assistant Examiners.*