

1

3,153,106

PRODUCTION OF NOVEL EFFECT FABRICS AND FILAMENTS AND YARNS THEREFOR

Werner Schlick, Wuppertal-Barmen, Germany, assignor to Vereinigte Glanzstoff-Fabriken AG., Wuppertal-Elberfeld, Germany

No Drawing. Filed Oct. 8, 1962, Ser. No. 229,168

Claims priority, application Germany Oct. 11, 1961

1 Claim. (Cl. 264—78)

This invention, in general, relates to effect fabrics, and filaments and yarns used therein, made from thermoplastic polymers in which the thermoplastic filaments or yarns, or textiles made therefrom, are heat-treated at spaced intervals to bring about structural changes in heated segments of the thermoplastic polymer to provide dye affinity characteristics and/or shrinkage characteristics different from the unheated segments. Fabrics made from filaments or yarns which have been heat-treated as described prior to or after weaving, knitting, or the like have, after dyeing thereof, a streaked, color shade-variegated, usually irregular color pattern.

It is a known practice to produce patterns in textile fabrics, such as woven and knitted textiles, by using known, so-called effect yarns. Most of these effect yarns are yarns produced on effect twist machines. These yarns can be produced in great variety from natural or synthetic filaments or fibers by regulation, arbitrary within wide limits, of the nature of the individual yarns or filaments employed. Effect yarns of regenerated cellulose can also be obtained by special operations in the yarn formation of the spinning machine. They have a uniformly or nonuniformly fluctuating thickness, and yield, consequently, by uneven dyeing in the finished textile fabric, the desired variegated effect patterns. For the production of these known effect yarns, special mechanical equipment designed therefore is necessary.

This invention pertains to a new, simple technique for producing patterns in textile fabrics, such as, for example, woven and knitted products which are made at least in part of synthetic thermoplastic filaments or yarns. According to the invention, this is possible by heating, usually prior to dyeing, the thermoplastic filaments or yarns prior to or after fabrication into textiles over short or long segments of the filaments or yarns or areas of fabricated textiles with large or small, equal or different spacing between the heated stretches or areas.

The patterning effect in the textile fabric obtained by the invention is based on structural changes in the filaments or yarns at the heated segments, whereby dyes are absorbed differently from dye absorption at the unheated places, and the filaments or yarns shrink differently in the heated segments as compared with the unheated segments. There are obtained in this manner, among other things, patterning effects of Honan character. Pattern effects of Honan character are those similar in appearance to hand-woven Chinese gummed silk of irregularly spun native silk yarn, called "Honan silk." By changing the lengths of the heated segments and spacing therebetween, the patterns in the finished fabrics can be altered. Preferably, the lengths of the heated segments and spacings are different, but they may also be equal. Other patterns, in turn, can be obtained by varying the quantum of heat applied to heated segments. The quantum of heat in a given heated segment may be varied over the length of the segment, for example, by changing the spacing between the heating source and the filament or yarn in a given heated segment or by regulating the intensity of heat output of the heating source in a variable pattern. By simple experimenting, it is always possible to determine the special conditions according to the process of the invention for the particular patterning desired.

2

The length of the heated segments and the magnitude of their distance apart are governed according to the intended patterning effect as well as the form in which the filaments, yarns or textiles are exposed to the heat treatment—that is, whether there is heat-treated a running filament or yarn, a filament or yarn in the wound state on a cop, cone or spool, or filaments or yarns already woven or knitted into a textile. The heated and unheated filament or yarn segments may vary in length within wide limits, e.g., between about 2 and 60 cm.

The synthetic polymer filaments or yarns which may be treated in accordance with the invention to produce filaments, yarns or textiles having the aforesaid structural changes by which the filament or yarn segments have alternately different dye absorption qualities and/or shrinkage characteristics. Synthetic polymer filaments or yarns which may be treated to obtain the aforesaid structural changes are thermoplastic, synthetic polymer filaments or yarns of fibers of thermoplastic, synthetic polymer filaments. Examples of such thermoplastic filaments include the following:

(1) Polyamide polymers such as polyamides of dicarboxy acids of 4–10 carbons and diamines of 4–10 carbons, the most common of which is the polyamide of hexamethylene diamine and adipic acid, and polylactam polymers made from lactams of 5–11 ring carbons, the most common of which is poly-ε-caprolactam.

(2) Polyester polymers, the most common of which is polyethylene terephthalate,

(3) Polyolefin polymers made from mono-olefins of 2–4 carbons or mixtures thereof, e.g., high density polyethylene, low density polyethylene, polypropylene, etc.

(4) Polyvinyl polymers such as the copolymers of vinyl chloride and vinyl acetate, copolymers of vinyl chloride and acrylonitrile, copolymers of vinyl chloride and vinylidene chloride, copolymers constituting primarily acrylonitrile and minor amounts of other vinyl monomers such as vinyl pyridine, polyvinyl chloride, polyacrylonitrile, and polyvinyl alcohol treated with formaldehyde to give the polymer water resistance (vinylon). All of these polymers are described in greater detail in the text, "Artificial Fibres," by R. W. Moncrieff, John Wiley & Sons, Inc. (1954).

The temperature to which the segments of filaments or yarns of these thermoplastic polymers of the spaced areas of the woven or knitted textiles of these thermoplastic polymers are raised to achieve the structural changes in dye affinity and/or shrinkage characteristics is governed by the thermoplastic softening characteristics and the melting point for each polymer. In general, it may be stated that the minimum temperature to which the polymers are heated in accordance with the invention is the temperature at which the particular polymer begins to soften. The maximum temperature is a temperature just below the melting point of the particular polymer, preferably at least about 5° C. below the melting point. In all cases, the temperature should be never high enough to reduce tensile or other strength characteristics of the heated segments below strength limit tolerances for the particular fabric, filament or yarn.

The invention is illustrated in the following examples.

Example I

Polyethylene terephthalate yarn is run through a heating zone, and the yarn is heated to 150° C. at spaced intervals varying between 2 and 7 cm. per interval with spacings between heated intervals varying between 15 and 25 cm. per spacing. Fabric woven with the so-treated polyethylene terephthalate yarn upon dyeing with a conventional dye for polyethylene terephthalate has a streaked, shade-variegated pattern.

Example II

Poly-ε-caprolactam yarn is run over a heated rod, on which the yarn is heated to 190° C. in spaced segments of about 6 cm. with spacings between heated segments of about 11 cm. A textile woven with the so-treated poly-ε-caprolactam yarn upon dyeing with a conventional dye for poly-ε-caprolactam has a streaked, shade-variegated pattern.

Example III

Yarns made of the polyamide of hexamethylene diamine and adipic acid are run over a heated rod, on which the yarn is heated to 220° C. in spaced segments varying between 3 and 6 cm. per segment with spacings between heated segments varying between 10 and 20 cm. A knitted tricot made with the so-treated polyamide yarn upon dyeing with a conventional dye for nylon has a streaked, shade-variegated pattern.

Example IV

Polyethylene terephthalate yarn is run over a heated rod, on which the yarn is heated to 210° C. in spaced segments of 4-7 cm. with the spacings between heated segments of 10-15 cm. A fabric woven with the so-treated polyethylene terephthalate yarn upon dyeing with a conventional dye for polyethylene terephthalate has a streaked, shade-variegated pattern.

Example V

A bundle of polypropylene filaments is run through a heating zone, and the filament bundle is heated to 160° C. at intervals and spacings corresponding to Example I. Fabric woven with the so-treated polypropylene filaments upon dyeing with a conventional dye for polypropylene has a streaked, shade-variegated pattern.

Example VI

Polyacrylonitrile yarn is run through a heating zone, and the yarn is heated to 260° C. at spaced intervals varying between 2 and 7 cm. per interval with spacings between heated intervals varying between 15 and 25 cm. per spacing. Fabric woven with the so-treated polyacrylonitrile yarn upon dyeing with a conventional dye for polyacrylonitrile has a streaked, shade-variegated pattern.

The use of two or more different kinds of filaments or yarn in the process of the invention offers further possibilities for special pattern effects in woven or knitted fabrics. Thus, it is possible to use monofilament or multifilament filaments or also simple or mixed yarns. The heat treatment according to the invention of profiled filaments, e.g., filaments having noncircular cross-section, yields special effects. Further, filaments or yarns treated according to the invention can be twisted with normal filaments or yarns. Especially interesting are patterning effects produced according to the invention, in which color or color-shade differences are highlighted by a profiled fabric surface resulting through filament or yarn shrinkage of different degrees in the heat-treated segments and the unheated segments therebetween.

The process of the invention can be executed in combinations with any desired operation in the production of the textile fabric, as, for example, in the stretching process before, during or after the stretching, in coning, winding, shearing, weaving, knitting or other manipulations. The heat is applied by any known means, e.g., by a gas flame, by infrared rays, by contacting the filaments or yarns with hot air or superheated steam, by intermittent contact with a rod heated electrically or by other means, or by a tube heated by a heating liquid or vapor. The highest temperature to which the polymer filaments or yarns are heated depends on various factors, such as, for example, the denier of the filaments or yarns, the speed at which they pass through the heating zone, the nature of the particular polymer and also the desired patterning. In gen-

eral, this temperature lies between about 120° C. and 270° C., often between about 120° C. and 180° C.

The endless synthetic, thermoplastic polymer filament may be treated thermally either on a stretch-twist machine before the stretching, or on a spooling or winding machine just prior to winding or after winding the stretched filament by heat-treating the filament after it is wound on a cop or cone. The heating of the spaced segments may be done, for example, (a) either by means of an intermittent or intermittently shielded gas flame, in which case short, spaced segments of the running filament are briefly exposed to the heat, or (b) with a heated rod which is hot at one end and relatively cool at the other end, in which arrangement there is rapid traverse motion between the hot and cool parts of the rod and the filament passing thereover in contact with the rod, or (c) by intermittent irradiation of one side of the filament windings with infrared light so as to expose only short segments of the filaments to the heat of infrared radiation as the filaments are wound off the winding. In the case of infrared radiation of a winding during the winding off of filament layers, it is possible to irradiate the running-off yarn body in such a manner that in each case those filament layers which are turned toward the infrared rays are exposed to the infrared heat. The length of the heated segments and the spacings therebetween are governed by the kind of winding and structure of the winding bodies. Variations of the spacings and the length of the heated segments may be achieved by use of shielding templates, which are arranged between radiation source and winding.

In contrast to infrared radiation, which is preferably allowed to act on the wound layers, other types of heating, such as, for example, hot gases, steam, heated, filament-contacting surfaces, e.g., heated rods, are employed on running, endless filaments or yarns.

In another form of the process, the heating of the thermoplastic filaments or yarns is done only after the weaving or knitting thereof into a fabric. The finished, but still undyed, material is heated at regularly or irregularly spaced areas so that, after the dyeing, a patterning results through the differing dye affinities of the heated and unheated areas. The locally limited heating of the fabricated filaments or yarns may be carried out in this case, for example, by intermittent infrared radiation or by brief contact on spaced areas of the fabric piece with a hot stamp. Shielded or screened gas flames or electric incandescent wires may also be used to give the heat necessary for the fabric treatment.

The invention is hereby claimed as follows:

In a process for fabricating textiles having a pattern effect, the steps comprising passing thermoplastic polymer filaments through a heating zone and therein heating spaced segments of said thermoplastic polymer filaments to a temperature in the softening range of said polymer but below the melting point of said polymer, said segments being 2-60 cm. in length with spacings between said segments of 2-60 cm. in length, and thereby imparting to said heated segments of said filament a dye affinity different from the dye affinity of the filament portions comprising said spacings, and fabricating said heat-treated filaments into a textile having a shade variegated pattern, when said textile is dyed, similar in appearance to textiles of irregularly spun native silk yarn.

References Cited in the file of this patent

UNITED STATES PATENTS

2,715,363	Hoover	Aug. 16, 1955
2,917,779	Kurzke et al.	Dec. 22, 1959
2,975,474	Smith	Mar. 21, 1961

FOREIGN PATENTS

761,075	Great Britain	Nov. 7, 1956
---------	---------------	--------------