

Jan. 26, 1971

M. KURZ
FABRIC CONTAINING MELTED AND UNMELTED YARNS AND
METHOD FOR MAKING THE SAME

3,558,412

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2 Sheets-Sheet 1

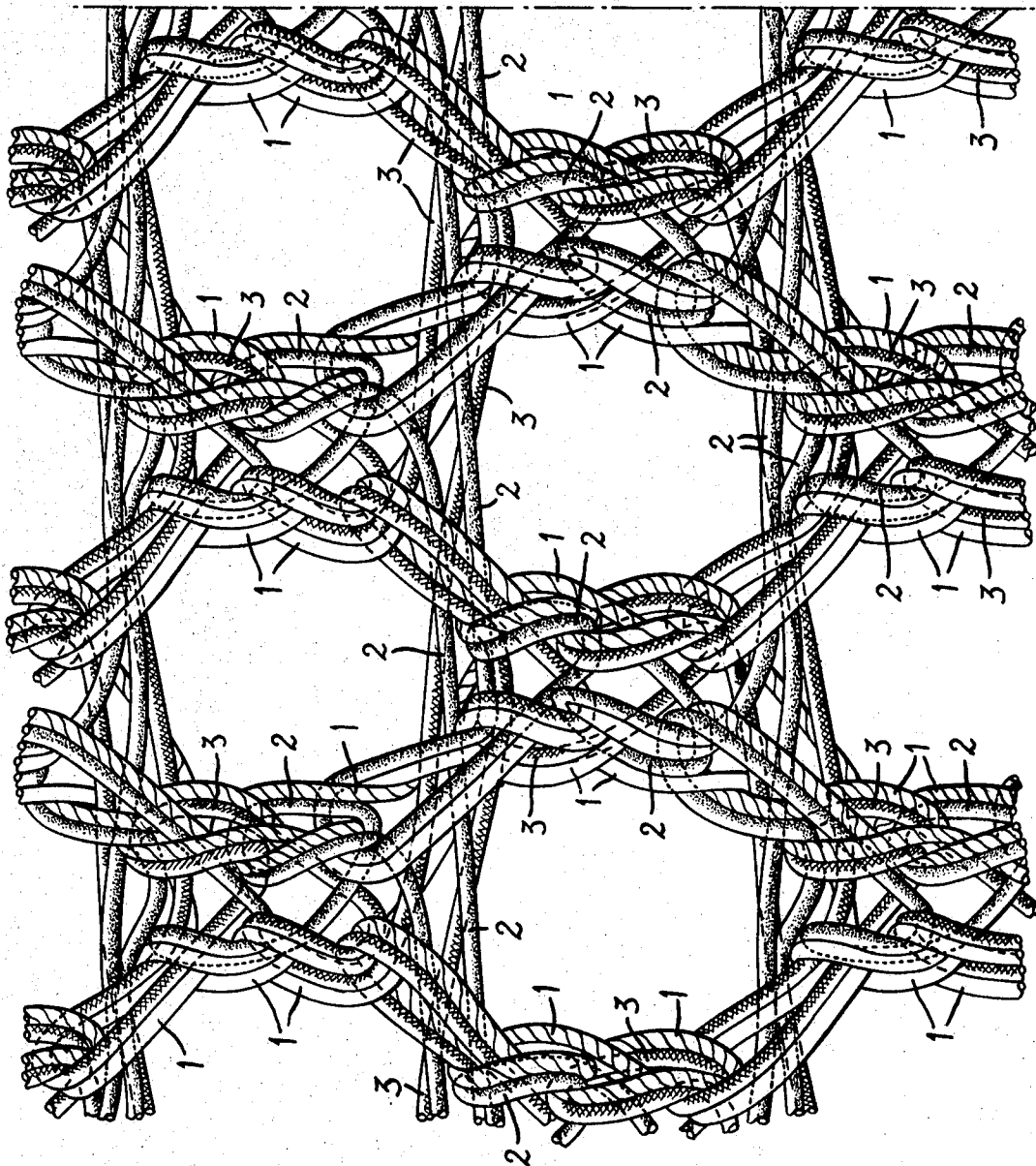


FIG. 1

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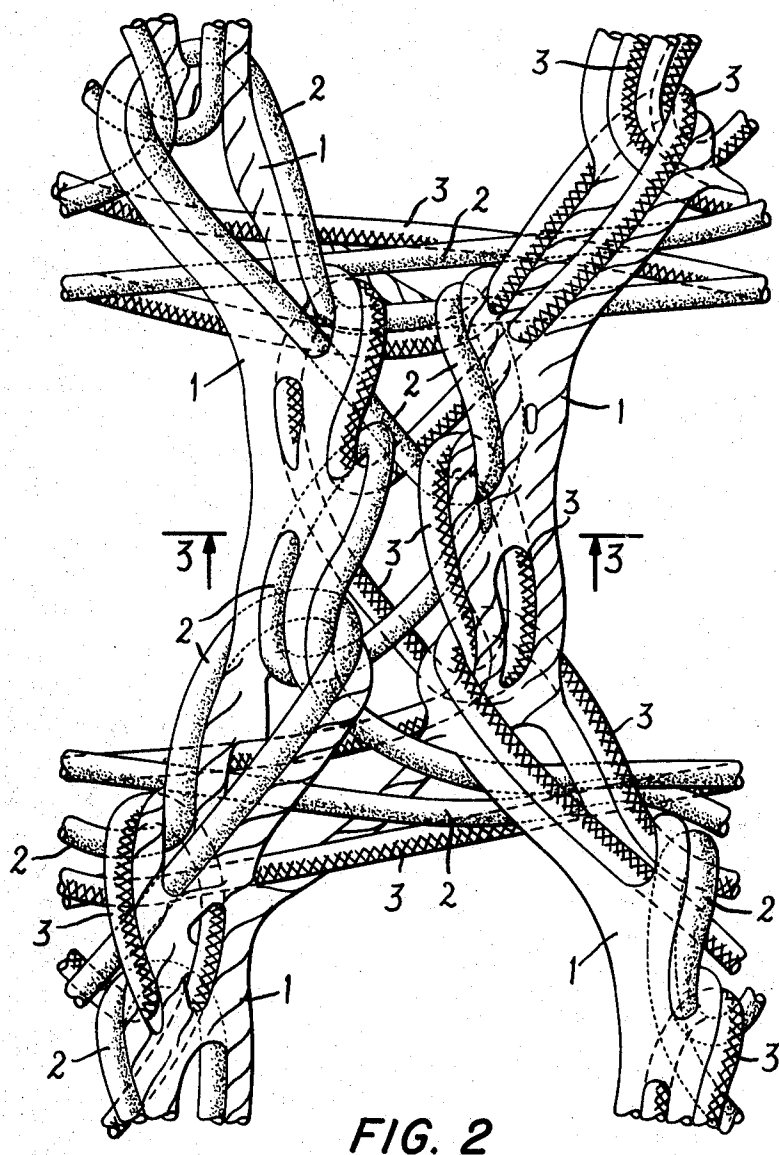


FIG. 2

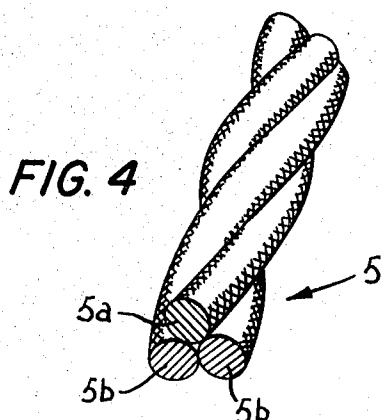


FIG. 4

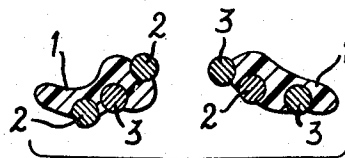


FIG. 3

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FABRIC CONTAINING MELTED AND UNMELTED YARNS AND METHOD FOR MAKING THE SAME

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7 Claims

ABSTRACT OF THE DISCLOSURE

The specification describes a fabric and a method of making a fabric containing throughout both meltable elements and nonmeltable elements or elements having a higher melting point, and in which the fabric is subjected to a temperature sufficient to soften or melt only the meltable or lower melting point elements and then cooled, thereby imparting to the fabric increased stability, stiffness, shape retention, abrasion resistance, tensile strength and longevity by reason of interlocking by the low melting point elements with the other elements while retaining desirable characteristics of the said other elements.

The specification also describes a novel yarn which embodies both the meltable elements and either nonmeltable elements or elements having a higher melting point than the meltable elements.

The invention relates to fabrics, yarns used in making fabrics and a method of making a fabric which includes meltable elements and nonmeltable elements or elements having a higher melting point than the meltable elements. The fabric is heated to soften or melt the meltable elements and then cooled. The meltable elements fuse and become bonded to each other and entrap other elements, imparting to the fabric increased stability, stiffness, protective encasement and shape retention while retaining characteristics of the elements which were not softened or melted.

Woven and knitted fabrics have been treated heretofore by impregnation and coating with certain resins, for example, melamine formaldehyde and urea formaldehyde, to impart, inter alia, stiffness, crease resistance and nonslip characteristics to the fabric. Such impregnations and coatings decrease the tensile strength and longevity of the fabric. More specifically, when these resins are used in conjunction with nylon or polyester fibers in order to obtain a reasonably stiff finish, about 70% of the tensile strength of the fabric is lost. The same problem exists in resin treating other fibers, such as cotton, rayon and acetate. Moreover, the chemical treatment of fabrics to impart to them permanent press characteristics considerably reduces the life of the fabric.

The principal object of the present invention is to provide a fabric having the desired stability, stiffness and shape retention characteristics and at the same time to increase the strength, abrasion resistance and longevity of the fabric.

In one type of fabric made according to the present invention the softened or melted elements impart to the fabric the desired stability, stiffness, shape retention, increased tensile strength, increased abrasive resistance, nonslip characteristics, etc., by interlocking the unmelted elements within the melted elements.

Depending on the combination of the elements used, stiffened, shape-retaining fabrics of vastly different characteristics can be produced. For example, by utilizing lower melting point polypropylene with higher melting point polyester to make a fabric which is then heated to a temperature intermediate the melting points and then

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cooled, the resulting fabric will have the stiffening and shape retention characteristics imparted to it by the bond of the melted polypropylene with itself and the polyester yarns while retaining the high tensile strength and at least in part the appearance and feel of the polyester. Also, by combining meltable polypropylene or polyethylene with cotton or other absorbent elements, it is possible to produce a fabric having the stability, stiffness and shape retention characteristics of the melted element while retaining at least in part the absorbent and other characteristics of the unmelted elements.

The fabric of the present invention can be woven or knitted using both meltable yarn and either nonmeltable or higher melting point yarn, or by using yarn composed of both meltable and either nonmeltable or higher melting point fibers, filaments or other elements. The stability, stiffness, abrasion resistance, longevity and shape retention of the fabric can be controlled as functions of the ratio of melted to nonmelted elements, the temperature at which the fabric is heated and the duration of exposure of the fabric to the heating temperature.

In knitted fabrics one of the yarns (the front bar yarn of conventional knitting machines) is more often looped around the other yarns, and therefore over a given area of the fabric is more often found on the outside of the fabric. But making this the meltable yarn, a fabric having a protective sheath can be produced. On the other hand, by utilizing the nonmeltable or higher melting point yarn for these outer loops, the outer surface of the fabric will take on more of the characteristics of the unmelted yarn, with the melted yarn imparting the requisite stability, stiffness, abrasion resistance, longevity and shape retention.

Yarns composed of both meltable elements and either nonmeltable or higher melting point elements are believed novel and are within the scope of the present invention. These yarns can be composite yarns made by combining meltable yarns with nonmeltable or higher melting point yarns, or they can be made by interspersing meltable fibers or filaments with nonmeltable or higher melting point fibers or filaments.

A novel yarn of the present invention can also be produced by concentrating meltable elements on the outer periphery and also dispersed within the interior high melting point or nonmeltable fibers or filaments thereof. A particular application of this would be to use glass fibers as the high melting point fiber. After heating and then cooling a fabric made from such a fiber to the softening or melting point of the low melting fiber, not only would the glass fibers be encased in the low melting point fibers, but the interior glass fibers would be entrapped within the softened or melted fibers. Such a fabric possesses the extreme high tensile strength of the glass elements without the interior abrasion action of glass filaments against glass filaments. One application for such fabrics would be for fragmentation protection garments.

For a complete understanding of the present invention reference is made to the detailed description which follows and to the accompanying drawings in which

FIG. 1 illustrates a fabric knitted from three yarns, one of which is a meltable yarn;

FIG. 2 is an enlarged view of a portion of FIG. 1 showing the fabric after it has been subjected to a temperature above the melting point of one of the yarns;

FIG. 3 is a cross sectional view of the fabric shown in FIG. 2 taken along the line 3—3; and

FIG. 4 is a perspective view of one embodiment of yarn containing both meltable and nonmeltable or higher melting point elements.

The fabric illustrated in FIG. 1 is produced by a conventional three bar knitting machine, for example, a knit-

ting machine of the Raschel type, in which a yarn 1 is supplied by the front bar, the yarn 2 is supplied by the middle guide bar, and the yarn 3 is supplied by the back guide bar.

The fabric of the present invention can be knitted, woven, needled or fabricated by other methods, and the particular knit shown in FIG. 1 is for illustrative purposes only. The yarn 1 in the particular knit illustrated is preferably the meltable yarn and made of meltable or thermoplastic fibers or filaments. The yarns 2 and 3 are either made of nonmeltable material, for example, cotton thread, or a material having a higher melting point yarn 1. The lower melting point yarn, for example, might be an olefin, such as polypropylene or polyethylene, and the nonmeltable or higher melting point yarn a polyamide, such as nylon, or a polyester, such as polyethylene terephthalate polymer (Dacron). The lower melting point yarn can also be a polyamide or polyester if the other yarn has a higher melting point. The desired stiffening and shape retention effects are achieved by melting one of the yarns but not another, thereby retaining the characteristics of the unmelted yarn.

After the fabric is knitted or woven it is stretched on a tenter frame to the desired configuration. The fabric is then subjected to heat at a temperature at or above the softening or melting point of the lower melting point yarn. For this purpose the tenter frame may be placed in an oven long enough to insure softening or limited melting of the lower melting point yarn and causing it to interlock with the other yarns. If the yarns 2 and 3 are higher melting point yarns, the temperature to which the fabric is subjected should not reach or exceed their melting points.

The fabric after this treatment is shown in FIGS. 2 and 3. The lower melting point yarn has fused and come into contact with the other yarns so that upon cooling it will entrap many portions of the yarns 2 and 3 and fuse with many other portions of the yarn 1.

The resulting fabric will have increased stability, stiffness, shape retention, abrasive resistance and longevity. That is to say, the fabric will have increased resistance to creasing and wrinkling, increased resistance to stretching and the formation of runs, less tendency to pull out of shape since the individual filaments and the strands of the low melting point yarns will fuse together, and then when cooled will form an interconnected mass which acts as a shield to the high melting point fibers, thus making the fabric abrasive resistant and increasing the fabric longevity. On the other hand, the fabric will retain the strength and at least in part the appearance and feel of the unmelted yarn or yarns.

The fabric has general application for use inter alia in wearing apparel, household fabrics and industrial fabrics.

The stability, stiffness, abrasion resistance, longevity and shape retention characteristics of the fabric can be controlled by controlling the ratio of melted to unmelted materials, the heating temperature and the duration of exposure of the fabric to the heating temperature.

The characteristics of the fabric can also be changed by changing the guide bar which is threaded with the lower melting point yarn. Since the front bar yarn loops around the middle and back bar yarns, it will be more often on the top and bottom (i.e., the outside) of the knitted fabric. Thus, when the yarn which is to be melted is fed from the front bar, this yarn after melting tends to form an outer protective sheath for the fabric. In other instances, however, it may be preferable that the unmelted yarns constitute a greater part of the outer surface. For example, in the manufacture of absorbent fabrics, such as underwear, it may be preferable that cotton or other absorbent yarns form more of the outer surface, and this effect could be achieved by feeding an absorbent yarn from the front bar and the meltable yarn from either the middle or back guide bars.

In one example of a fabric made according to the present invention, the front bar yarn 1 is a 165 denier

yarn made from polypropylene filaments (yarn of approximately 40 filaments) and the middle and back guide bar yarns 2 and 3 are 250 denier yarns made of polyester filaments. The polypropylene yarn softens at about 265° F. and has a melting point of about 333° F. and the polyester yarns have melting points in excess of 400° F., so that the desired result can be obtained by heating the fabric at a temperature intermediate the melting points of the yarns. The fabric heated at 380° F. for two minutes has greater stiffness, and consequently greater crease resistance, than the same fabric heated at 340° F. for the same period of time. The polyester imparts strength to the fabric and the melted polypropylene imparts crease resistance, stability, shape retention, stiffness, abrasion resistance and increased longevity. The particular fabric has various applications, one an industrial application for protecting dyeing rolls in finishing plants.

A knitted fabric of approximately 35% polypropylene and 65% polyester by weight (using 165 denier polypropylene yarn of approximately 20 to 70 filaments per yarn) heated to a temperature of approximately 350° F. for 30 seconds provides a firm, resilient, crease-resistant mesh fabric suitable for use in women's hats.

The fabric of the present invention lends itself to permanent pressing by creasing it at a temperature above the melting point of the low melting point yarn. Before pressing the fabric a thin insulating or nonmeltable sheet or cloth should be placed between the folded layers of the fabric to prevent the meltable yarns in the layers from being welded together. The fabric of the present invention also lends itself to repressing by heating the fabric above the softening temperature of the meltable elements, pressing out a permanent press and then repressing to produce another permanent press.

The fabric of the present invention also is capable of being bonded together with another similar fabric to produce a laminate by bringing two plies of the fabric together at a temperature high enough to fuse the meltable elements of both plies and to entrap the unmelted elements of both plies with the meltable elements.

Instead of using melted and nonmelted yarns, the fabric can be made of a composite of a meltable yarn and one or more nonmeltable or higher melting point yarns. In the embodiment illustrated in FIG. 4 of the drawings, a composite yarn 5 is made up of a low melting point yarn or filament 5a and a plurality of nonmeltable or higher melting point yarns or filaments 5b. If a composite yarn of the type illustrated in FIG. 4 is used in producing the fabric illustrated in FIG. 1, all three of the yarns 1, 2 and 3 will have both meltable and nonmeltable or higher melting point components, and heating a fabric made thereof to a temperature high enough to melt only the meltable components and then cooling the fabric will tend to lock the meltable and other components to impart the desirable characteristics to the fabric.

In lieu of the composite yarn 5 illustrated in FIG. 4, the yarn can be composed of interspersed meltable and nonmeltable or higher melting point fibers, filaments or other elements in a ratio by weight, for example, of 1:2. The meltable elements can be concentrated at either the core or outer periphery of the yarn or they can be interspersed throughout the yarn. For example, it would be possible to spin a yarn consisting of olefin fibers or filaments, for example, polypropylene, around glass fibers or filaments to produce a fabric of exceptionally high strength with the coarser glass elements encased in the melted olefin material to reduce the allergic properties of the glass components and give the fabric the strength of the glass components. Such fabrics could be used in fragmentation garments or vests.

The invention has been disclosed in preferred forms and by way of example only and many modifications and variations are possible within the spirit of the invention. The invention, therefore, should not be limited to any

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specific form or embodiment except insofar as such limitations are specified in the appended claims.

I claim:

1. A knitted fabric comprising at least two yarns interlaced throughout the fabric in a pattern of loops in which repeat portions of the two yarns are in intimate contact through out the fabric while leaving substantial portions of the two yarns separated from each other, said yarns including a melted yarn and an unmelted yarn, the melted yarn being fused with and entrapping the unmelted yarn to maintain the said repeat portions in intimate contact while leaving substantial portions of the unmelted yarn free of the melted yarn to impart to the fabric stiffness and shape retention while retaining the characteristics imparted to the fabric by the unmelted yarn.

2. A knitted fabric as set forth in claim 1 comprising three yarns interlooped in a pattern throughout the fabric in which one of the three yarns is a melted yarn which is more often looped around the other yarns so that over a given area of the fabric it is more often the exterior yarn, the said melted yarn imparting a protective sheath to the fabric.

3. A knitted fabric as set forth in claim 1 in which the melted yarn is an olefin and the unmelted yarn is selected from a group which includes polyesters, polyamides and glass having melting points higher than the melted olefin.

4. A knitted fabric as set forth in claim 3 in which the melted olefin is selected from the group of polypropylene and polyethylene and the unmelted yarn is selected from the group of nylon and polyethylene terephthalate.

5. A method of making a knitted fabric having stiffness and shape retention characteristics comprising interlacing at least two yarns in a pattern of loops throughout the fabric in which repeat portions of the two yarns are in contact throughout the fabric while leaving sub-

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stantial portions of the yarns separated from each other, said yarns including a meltable yarn and a yarn which is not meltable at the temperature of the meltable yarn, heating the fabric to soften only the meltable yarn, causing the meltable yarn to fuse with and entrap portions of the unmeltable yarn with which it comes into contact while leaving substantial portions of the unmeltable yarn free of the meltable yarn, and then cooling the fabric to bond the meltable and unmeltable yarns to produce a fabric having increased stiffness and shape retention characteristics while retaining the characteristics imparted to the fabric by the unmeltable yarn.

6. A method as set forth in claim 5 including the step of creasing the fabric at a temperature high enough to soften only the meltable yarn.

7. A method of making a knitted fabric as set forth in claim 5 in which three yarns, one of which is a meltable yarn, are interlaced in a pattern of loops throughout the fabric and including the step of looping the meltable yarn about the other yarns to impart a protective sheath to the fabric at each such loop.

References Cited

UNITED STATES PATENTS

1,903,960	4/1933	Dreyfus	161—91X
2,306,781	12/1942	Francis	161—92
2,308,593	1/1943	Brew	161—89
2,313,058	3/1943	Francis	161—89
2,864,151	12/1958	Bihaly	161—175X

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66—170; 156—148, 306; 161—92, 93, 98, 150