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WEAVING UNSIZED YARNS

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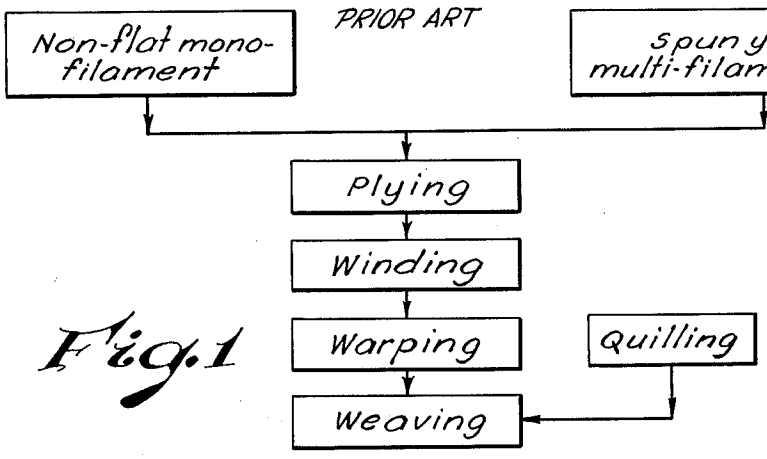


Fig. 1

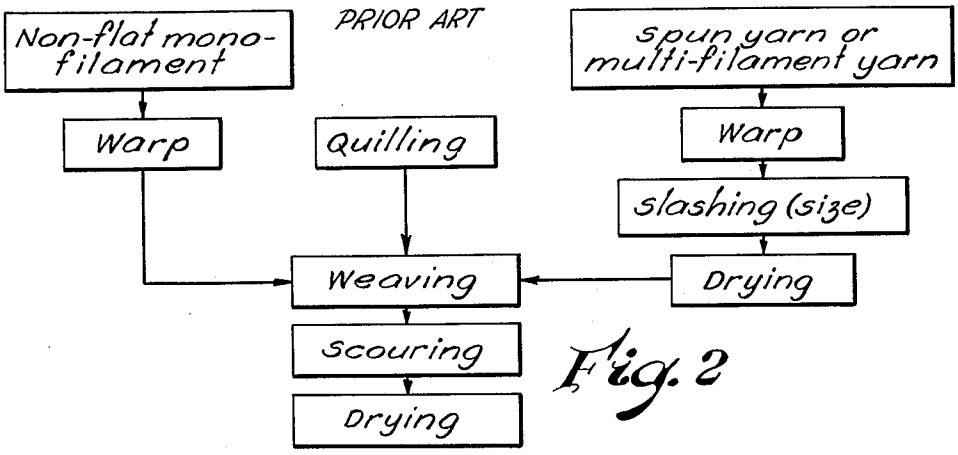


Fig. 2

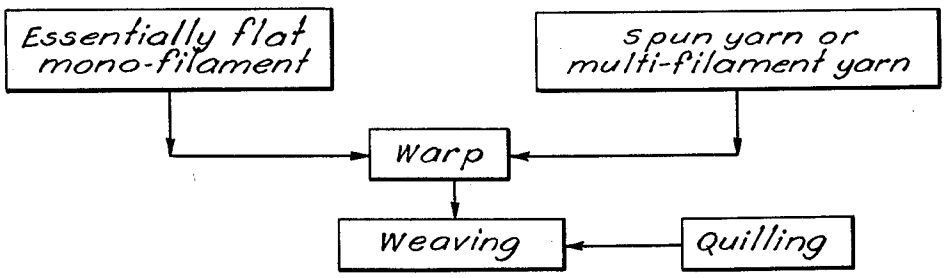


Fig. 3

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WEAVING UNSIZED YARNS

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This invention relates to a method of weaving yarn combinations. More particularly, it relates to a method of weaving a combination or blend fabric without requiring the need for a plying operation or the need to apply a protective coating or size to the single spun or multifilament yarns.

It has become common practice in the textile trade to make fabrics of two or more different types of fibers or fiber compositions. The reasons for making these blend or combination fabrics are predominately dictated by the end use for which the fabric is to be put. Principally, a blend is used to combine the more profitable properties of the individual fiber types, or somewhat conversely, to hide or make less apparent the failings of one of the component fibers. For instance, one fiber may be readily dyeable but lack in strength or wear resistance; another may be exceedingly strong and wear resistant but susceptible to rapid burning. Or, one fiber may have high ratings in most properties but be too costly for practical acceptance.

One particularly advantageous method of weaving a combination fabric of two or more fiber types, which can be adapted not only to take advantage of the individual inherent or latent fiber properties but also to take advantage of the general physical fiber structure, is to weave together a spun yarn with a continuous monofilament yarn. Another beneficial combination is obtained from weaving a multifilament yarn with a continuous monofilament yarn. Spun yarns are, of course, understood to be yarns derived by mechanical spinning from staple fiber. These, almost without exception, include the natural fibers (such as cotton and wool) as well as yarns mechanically spun from synthetic fibers that have been stapled after their initial production. Continuous monofilaments, as employed herein, are synthetic fibers that are not stapled after being formed and are usually handled as single ends in subsequent textile operations. Multifilaments, as understood in the art and used herein, are bundles of continuous monofilaments, each bundle being generally given a slight twist to hold the filaments together in the bundle. The fiber denier of continuous monofilaments, i.e., filaments handled as single ends, is usually considerably greater than the fiber denier of the continuous filaments employed in multifilament yarns.

When fabrics are woven in which a combination of continuous monofilament yarns and spun yarns or a combination of continuous monofilament yarns and multifilament yarns is used in the warp, one of the following two operations is ordinarily utilized in order to obtain satisfactory weaving efficiency and fabric quality:

(1) A required number of continuous monofilament yarn ends is first plied with a required number of spun yarn ends or plied with a required number of multifilament yarn ends before formation of the warp and the weaving operation;

(2) The plying operation is omitted with each spun yarn end or each multifilament yarn end being slashed or sized instead.

The plying operation may be employed merely for fabric appearance or structure, or it may be used to eliminate the requirement for sizing the yarn. The desire to eliminate the sizing operation is obvious, since this requires a tedious lacing-up of the yarns; immersion in the size solution; drying of the yarns (which may cause degradation); and a scouring operation after the fabric has been woven to remove the size; followed by yet another drying.

It is among the primary objects of this invention to provide a method for weaving fabrics having in the warp of the fabric a combination of continuous monofilament yarns and spun yarns or a combination of continuous monofilament yarns and multifilament yarns without the need for a plying operation or a slashing operation.

These and still further objects are accomplished in accordance with the practice of the present invention wherein a continuous monofilament yarn having a relatively flat cross-section, which can be characterized as a "microtape," is combined with a spun yarn or a multifilament yarn in a generally side-by-side relationship with the spun yarn or the multifilament yarn in a warper to form a warp end, and then weaving the warp end formed from the continuous monofilament yarn and spun yarn or multifilament yarn with a filling yarn.

Thus, the present invention takes advantage of the finding that highly efficient and beneficial weaving of combination fabrics utilizing single yarn ends in the warp direction can be accomplished without the need of a presizing operation if the cross-section of one yarn has a relatively flat cross-section. The invention further provides an advantageous and utile method of weaving combination fabrics without the need for a pre-plying operation.

The invention and its related advantages are further delineated in and by the accompanying drawing wherein:

FIGURE 1 schematically depicts the general number and sequence of operations of one method required when weaving combination fabrics using continuous monofilaments not in accordance with the present invention;

FIGURE 2 schematically depicts the general number and sequence of operations of another method required when weaving combination fabrics using continuous monofilaments not in accordance with the present invention; and

FIGURE 3 schematically depicts the general number and sequence of operations when weaving a combination fabric in accordance with the present invention.

The schematic portrayal in FIGURES 1–3 makes evident the outstanding advantages provided by the beneficial method of the invention. Thus, increases in efficiency and economy are brought about by elimination of: (1) intermediate steps in the weaving operation; (2) degradation of yarns through drying; and (3) afterscouring operations to remove size. In addition, the employment of fibers with a microtape structure according to the present invention provides fabrics with greater covering power with the end result of requiring, in general, less material in the fabric.

The essentially flat monofilaments, more descriptively referred to as microtapes, that may be used in the present method may be of any organic, thermoplastic, resinous material. These microtape structures may be fabricated by known methods. For example, they may be extruded or spun directly from a die that is adapted to provide a generally flat cross-section. They may also be slit from a film cast from a polymer melt or cast from a polymer dispersion that may be in the form of a latex and the like.

As materials which may be advantageously used are the normally crystalline polymeric materials. These are the polymers which have a tendency to form crystallites or sites where small segments of a plurality of the polymer chains are oriented and held in position by secondary valence forces. This crystallite formation or crystallinity is usually visible when the polymers are examined by X-ray diffraction.

Typical of the normally crystalline polymeric materials falling within the foregoing definition are the polymers

and copolymers of at least 70 percent by weight of vinylidene chloride with the remainder composed of one or more other monoethlyenically unsaturated comonomers that are copolymerizable with vinylidene chloride. Exemplary of these are vinyl chloride, vinyl acetate, vinyl propionate, acrylonitrile, alkyl and aralkyl acrylates having alkyl and aralkyl groups of up to about 8 carbon atoms, acrylic acid, acrylamide, vinyl alkyl ethers, vinyl alkyl ketones, acrolein, allyl esters and ethers, butadiene and chloropropene. Known ternary compositions also may be employed advantageously. Representative of such ternary polymers are those composed of at least 70 percent by weight of vinylidene chloride with the remainder made up of, for example, acrolein and vinyl chloride, acrylic acid and acrylonitrile, alkyl acrylates and alkyl methacrylates, acrylonitrile and butadiene, acrylonitrile and itaconic acid, acrylonitrile and vinyl acetate, vinyl propionate, or vinyl chloride, allyl esters or ethers and vinyl chloride, butadiene and vinyl acetate, vinyl propionate, or vinyl chloride and vinyl ethers and vinyl chloride. Quaternary polymers of similar monomeric composition will also be known.

Also operable in the present weaving method are essentially flat monofilaments, or microtapes, of polymeric materials, such as the polyolefins, including, for example, polyethylene, polypropylene, copolymers of ethylene and propylene, and polyisobutylene. Equally useful in the method are the condensation polymers, such as the polyamides (including polyhexamethylene adipamide) and the polyesters (including polyethyleneterephthalate). Also of utility are the microtapes of rubber hydrochloride, synthetic cellulose derivatives (including such cellulose esters as cellulose acetate and such cellulose ethers as methyl cellulose and hydroxypropyl methyl cellulose). As is apparent, any organic, thermoplastic resinous material which is capable of being formed into a flat monofilament or microtape will find utility in practice of the present invention.

The useful tapes for the present method are flexible tapes usually of about 1 to 6 mils in thickness and of about 5 to 100 mils in width. A mil is to be understood to be $\frac{1}{1000}$ of an inch. Ordinarily, microtapes with widths of 2–30 times the thickness are employed. The thickness and width to be used in any given instance will depend in large measure upon the end product desired. The above limits are those which would normally be associated with the manufacture of fibers and filaments.

It is not essential that the cross-section of the microtape be entirely flat. Indeed, excellent results are obtained when the microtapes have curled or folded edges such as those disclosed in the copending application of Lloyd E. LeFevre having Serial No. 84,682, filed January 24, 1961, for "Filamentary Microtapes and Process for Preparing the Same"; the copending application of Floyd E. Romesberg et al. having Serial No. 30,249, filed May 19, 1960, for "Process for Preparing Filamentary Microtapes of Labyrinthian Cross Section"; and the copending application of Lloyd E. LeFevre et al. having Serial No. 84,625, filed January 24, 1961, for "Novel Filamentary Microtapes of Folded Labyrinthian Cross Section." It is usually preferable, however, that the progenitor of the curled or folded microtapes be a narrow tape of essentially flat, rectangular cross-section.

The spun yarns or multifilament yarns that may be profitably utilized with the essentially flat monofilament yarns or microtapes in the practice of the invention can be of any suitable fiber-forming material. The naturally occurring fibers of cotton, wool, silk, etc., regenerated cellulose (i.e., rayon) and the synthetic fibers including the thermoplastic fibers discussed hereinbefore are all adequately suitable for use in either spun yarn or multifilament yarn form. With most natural fibers, of course, only spun yarns are available therefrom.

In order to obtain optimum results, it is usually desirable that the spun yarn or multifilament yarn have an implied twist developed from a twist multiplier range between about 3 and 7 to minimize formation of fuzz balls and the like.

When forming the warp ends, it is generally necessary to have combined in side-by-side relationship at least one microtape yarn end per yarn end of spun yarn or multifilament yarn in each warp end. A preferable arrangement is to have at least two microtape yarn ends per yarn end of spun yarn or multifilament yarn. The optimum number of microtape yarn ends will depend somewhat on the type of yarn employed in the spun yarn or multifilament yarn and somewhat on the type and the width of the microtape employed.

In order to further illustrate the invention, a warp beam was prepared for a number 10 Duck construction, i.e., 45 x 30, plain weave, 13/3 warp and filling yarns. The warping operation was performed on a horizontal silk warper in the following manner:

1880 ends of 400 denier microtape, i.e., 25 mils wide by 3 mils thick, consisting of a copolymer of about 96 weight percent vinylidene chloride and about 4 weight percent ethyl acrylate, and 940 ends of unsized 13/1 cotton (16 turns per inch) were warped in a 2 microtape, 1 cotton arrangement. These ends were drawn through the drop wires 1 end per wire and 3 ends (2 microtape/1 cotton) through the heddle eye. Two (2) harnesses were used on a Draper X–2 loom and the reeding plan dictated 6 ends per dent of a 22.5 reed. Normal weaving procedures were maintained with excellent weaving efficiency. The microtape ends tended to "carry" the unprotected spun cotton yarn through the weaving operation.

In contrast, when a continuous monofilament of normally round or semi-round cross-section is substituted for the microtape in the foregoing illustration, excessive breakage of the cotton yarn results and weaving efficiency is unacceptable.

What is claimed is:

1. A method of weaving fabrics containing single yarn ends in the fabric warp, which method comprises combining a thermoplastic continuous monofilament yarn characterized in having an essentially flat cross-section in essentially side-by-side relationship with another yarn selected from the group consisting of a spun yarn and a continuous multifilament yarn; forming a warp end from said thermoplastic continuous monofilament yarn and said other yarn; and subsequently weaving a plurality of said warp ends with a filling yarn.

2. The method of claim 1, wherein said thermoplastic continuous monofilament yarn has a width between about 5 and 100 mils and a thickness between about 1 and 6 mils.

3. The method of claim 1, wherein said thermoplastic continuous monofilament yarn has a width between about 2 and 30 times its thickness.

4. The method of claim 1, wherein said warp end consists of at least one of said thermoplastic continuous monofilament yarn ends per yarn end of said group consisting of a spun yarn and a multifilament yarn.

5. The method of claim 1, wherein said warp end consists of between about 2 and 4 of said thermoplastic continuous monofilament yarn ends per yarn end of said group consisting of a spun yarn and a multifilament yarn.

6. The method of claim 1, wherein said thermoplastic continuous monofilament yarn comprises a vinylidene chloride polymer containing in the polymer molecule at least 70 weight percent polymerized vinylidene chloride, any balance being another copolymerized ethylenically unsaturated monomer that is polymerizable with vinylidene chloride.

7. The method of claim 1, wherein said thermoplastic continuous monofilament yarn comprises a vinylidene chloride polymer containing in the polymer molecule between about 92 and 99 weight percent polymerized vinylidene chloride, any balance being another copolymerized ethylenically unsaturated monomer that is polymerizable with vinylidene chloride.

8. The method of claim 7, wherein said ethylenically unsaturated monomer is selected from the group consisting of acrylonitrile and methyl acrylate.

9. The method of claim 1, wherein said thermoplastic continuous monofilament yarn is comprised of a polyolefin.

10. The method of claim 9, wherein said polyolefin is selected from the group consisting of polyethylene, polypropylene and copolymers of ethylene and propylene.

11. The method of claim 1, wherein said spun yarn is cotton yarn.

12. The method of claim 1, wherein said multifilament yarn is regenerated cellulose.

13. A fabric prepared according to the method of claim 1.

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