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PROCESS OF PRODUCING A SPUN YARN

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11 Claims. (Cl. 57—157)

This invention relates to processes of producing novelty yarns similar to Kasha yarns, as well as to such novelty yarns and fabrics containing the same. This application is a division of United States patent application Serial No. 75,133, filed December 12, 1960, now Patent Number 3,153,315.

A Kasha yarn as known in the art is a blend of staple fibers which are present in different proportions, the major component of the yarn being generally referred to as the base fiber, and the minor component being generally referred to as the effect fiber. In the usual case, the base and effect fibers are of different colors, but they may be of different composition so as to produce color differences upon cross dyeing of the yarn or the fabric produced therefrom. Kasha yarn, although of substantially uniform weight per unit length, has a mottled appearance due to a random variation, within controlled limits, of the proportion of the effect fiber in the yarn at spaced points therealong.

In accordance with standard techniques, staple fiber yarns are produced by formation of a picker lap or fleece with a small amount of orientation of fibers in the longitudinal direction of the lap. The lap passes to a card or carding machine which produces a web having an appreciable amount of longitudinal orientation. The web passes into and through a girt trumpet which condenses it into a card sliver, i.e., a heavy untwisted rope of low strength, which is deposited loosely into a can as coiled sliver. The sliver is then drawn, doubled with other slivers, no a drawing frame and taken up with no twist in a can. The sliver is then drawn and slightly twisted on a slubber or roving frame. The material is now a roving, lighter in weight and stronger than a sliver. The roving is then drawn and twisted in one or more stages, along with other rovings if desired, to produce spun yarn of high uniformity.

As hereinafter stated, Kasha yarn is a combination yarn produced from two staple fibers differing in color or dyeing characteristics from one another, for example by feeding a roving of the effect fiber to the girt trumpet simultaneously with a carded web of the base fiber so as to form a cored sliver. The latter is then doubled, drawn and twisted as previously described for conventional staple yarns to form a roving of the two fibers, whereupon the said roving is further drawn and twisted to form the ultimately desired Kasha yarn. Heretofore it has not been possible, however, to produce Kasha yarn in which the effect fiber component of the yarn is made of continuous filaments. Where such a yarn is to be produced from synthetic fibers originally in continuous filament form, it is always necessary to cut the filaments into staple lengths which must then be formed into fleeces adapted to be carded and drawn to form the ultimate spun yarn. This represents a substantial expenditure of time, labor and money which correspondingly increases the cost of the ultimate yarn and fabric products.

It is, therefore, an object of the present invention to provide a process of producing Kasha-type yarns in which the effect fiber can be composed of continuous filaments modified so as to be draftable and/or rupturable.

Another object of the present invention is the provision

of such a process which enables the continuous filament structure designed to constitute the effect fiber to be combined with the spun staple lengths of the base fiber in existing machinery without any substantial modification of the latter, whereby the process as well as the resultant prdoucts are rendered more economical than the known Kasha yarns and processes of making the same.

A more specific object of the present invention is the provision of a process as aforesaid in which the modified continuous filament component can be fed into the spun yarn process at any stage of the latter and in such a manner as to minimize contamination of the cotton or spinning equipment.

Still another object of the present invention is to provide a draftable and/or rupturable continuous filament structure which is capable of being used as the effect fiber in a Kasha-type yarn.

A further object of the present invention is the provision of a Kasha-type novelty yarn in which the effect fiber component is constituted by a draftable and/or rupturable continuous filament structure.

The foregoing and other objects, characteristics and advantages of the present invention will be more fully understood from the following detailed description thereof and from the appended claims.

According to one aspect of the present invention, the modified effect fiber structure is produced by passing continuous filament yarn initially having a tenacity in excess of about 1 gram per denier into and through an apparatus adapted to weaken the yarn along its entire length. This may be effected either by weakening the individual filaments or by operating upon the yarn so that not all of the filaments contribute simultaneously in bearing a load. One apparatus for effecting such weakening may, for example, comprise a device commonly known as a jet, for example of the type shown in Patent No. 2,042,402, into an inner chamber or relatively confined space of which is admitted a high pressure stream of a suitable treating fluid such as air or steam. The continuous filament yarn is fed at a suitable overfeed rate through the said chamber where it is subjected to the turbulence of the aforesaid stream of fluid. In this man ner, the filaments are whipped about considerably within the chamber so as to form a great number of small loops, curls and whorls spaced at random from one another on each filament and at the same time randomly on each filament with respect to the loops and curls on the other filaments. Concurrently, the various filaments become intertwined with one another to a certain extent, and where desired the resultant bulked yarn may be given some twist in order to ensure that the filaments do not come apart when they leave the jet and to provide the desired drafting and/or breaking characteristics.

The operating conditions of the jet may, of course, be preset to any desired values leading to the optimum results of yarn bulk and tenacity. Preferably, the pressure of the treating fluid should be within a range from about 20 to 100, e.g. 30 to 60 p.s.i.g., while the rate of overfeed of the yarn may range from about 0 to 50%, depending on the initial denier of the yarn, so that the final bulked yarn, which is the draftable structure adapted to constitute the effect fiber of the ultimate Kasha-type spun yarn, has a denier ranging from about 50 to 600 and in particular has a tenacity of less than 0.5 gram per denier.

The final Kasha-type yarn is now produced by feeding the bulked, modified continuous filament structure into any suitable staple processing system in which the staple base fiber can be processed in the manner set forth hereinbefore. For example, the modified filament structure may be fed into the girt trumpet simultaneously with a carded

web of the base fiber, as a result of which there will be formed a sliver containing the modified continuous filament structure according to the present invention as the core. In subsequent doubling, drafting and twisting the embedded bulked continuous filament structure drafts and/or breaks depending on the introduced properties of the modified filament structure so as to produce the desired Kasha effect. Alternatively, the modified filament structure may be blended with the staple base fiber structure at the roving frame, by being fed into the latter under either the front roll or the back roll thereof. The embedded modified continuous filament structure, composed of one or more ends of the bulked yarn, may be present in one or more of the staple fiber slivers being doubled, and the number of doublings of sliver or the rovings produced therefrom may be varied, as required, to produce a final yarn having the desired content of effect fiber. For the purposes of the present invention, the effect fiber component constituted by the bulked continuous filament structure may comprise as much as 25% or more of the Kasha-type yarn or less than about 1% thereof, e.g. as little as about 0.25%.

The staple length of the base fiber may vary widely, ranging preferably between about 1 and 3 inches, as is customary in the manufacture of conventional spun yarns. The base fiber as used in the present invention may be of the same composition chemically as the continuous filament structure but of a different color to yield the Kasha effect, or they may be of the same color originally and of different chemical composition, in which case the Kasha effect is obtained upon cross-dyeing of either the yarn or the fabric produced therefrom. Alternatively the base fiber may have both the same chemical composition and color as the effect fiber and the novelty effect would be that of a linen type yarn, i.e. a slub.

The continuous filament effect fiber component is preferably made of such synthetic fibers as nylon, polyesters such as polyethylene terephthalate, polymers and copolymers of vinylidene compounds such as ethylene, propylene, vinyl chloride, vinyl acetate, vinylidene nitrile, acrylonitrile, and the like, rayon and especially organic acid esters of cellulose such as cellulose acetate, cellulose propionate, cellulose butyrate, cellulose acetate propionate, cellulose acetate butyrate, and the like, either of high or low free hydroxyl content; it could also comprise a natural continuous filament fiber such as silk. The staple base fiber component may be made of the same fibers as enumerated above or of natural fibers such as cotton, wool and linen. Especially good results are obtained when the effect fiber is composed of cellulose acetate while the base fiber is either rayon or cotton. The individual base fibers may have deniers ranging from about 1 to about 8 and preferably between about 1.5 and 5. The effect fiber may have a filament denier greater or less than the base fiber but the best results are obtained with filament deniers about equal to those of the base fiber.

The combination of the spun staple fiber component as the base fiber with the draftable or rupturable continuous filament structure according to the present invention results in the formation of a composite Kasha-type yarn in which the continuous filament effect component is distributed irregularly throughout the spun yarn. Thus, reaches of the draftable filament structure of random length and thickness or diameter will be intertwined with the base fiber component at random intervals along the length of the yarn, and some of the various portions of the effect fiber will appear to be darker or more intense in color than other portions. The appearance of the product and the distribution of effect fiber therein will, of course, depend on a number of different factors. Among these are the degree to which the continuous filament yarn was weakened by the jet treatment, i.e. the draftability or rupturability of the continuous filament structure, the point at which the same is introduced into the staple fiber process, the settings of the staple fiber processing machinery, such as the draft, twist, roll settings in the roving frame, etc., through which the combination yarn is passed, and the like. The exact nature of the product and the disposition of the effect fiber therein will depend upon whether the weakened bulked yarn broke cleanly or was drafted on the spinning frame which in turn is dependent upon the twist level in the bulked yarn. For example, a 200/2Z/80 cellulose acetate yarn bulked to a tenacity of 0.5 gram per denier will break and draft out in a staple drawing process giving a number of fibers from the filament structures spread throughout the spun yarn.

By contrast, a 200/2Z/80 cellulose acetate yarn bulked as above with addition of 3 turns per inch, i.e. a total of 5 turns per inch, will break into clearly defined lengths in a staple drawing process with little or no drafting out of any fibers of the filament structures and, therefore, little or no distribution of filaments in the spun yarn other than the clearly defined lengths of effect yarn.

Between the twist levels of 2 turns per inch and 5 turns per inch the relative degree of drafting follows the twist level. The higher the twists within these limits, the sharper the break and the less distribution of individual effect component filaments. A zero twist effect component yarn will give maximum drafting effect for a given degree of bulking (weakening). Advantageously the continuous filament structure has at least about 0.2 turns per inch, inserted either before or after bulking, since this facilitates processing. The ability to control the action of the effect component gives a great degree of versatility and a wide range in product possibilities ranging from the true Kasha effect on one hand to the slubby linen effect on the other.

If the effect component is fed into the process as early as the front roll of first drawing subsequent operations result in a great degree of blending which should nullify any variability in the final yarn due to differences which might be found in the bulked filament component.

Heretofore a spinner specializing in cotton fibers, for example, would be reluctant to make Kasha-type yarns with cellulose acetate effect fibers since it would entail processing such cellulose acetate fibers from bale to picker lap to card sliver with attendant contamination of his cotton equipment. By means of the present invention the cellulose acetate does not have to be processed on the equipment and the spinner is thus afforded greater latitude in the production of blend yarns.

It is possible to avoid such contamination of the opening and carding equipment by using pre-formed yarns or tows of effect fibers but only rupture, rather than drafting, is possible and even then it is not possible to use a conventional cotton type spinning frame. Instead it is necessary to use heavy structures and great roll pressures on what is known in the trade as "direct" spinning equipment.

The principles of the present invention are further illustrated by the following examples.

Example I

A black 200/2Z/80 cellulose acetate yarn having an initial tenacity of 1.40 grams per denier is passed through a jet at an overfeed rate of 25%. Air at a pressure of 25 p.s.i.g. is fed into the plenum chamber of the jet so as to form a highly turbulent stream therein for the purpose of whipping the yarn filaments violently about into a multitude of randomly spaced and intertwined loops and curls. The yarn emanating from the jet is found to have increased in bulk by 20% and to have a denier of 240 as well as a tenacity of 0.45 gram per denier. The yarn, with a twist of 2.0 turns per inch, is so weakened, as compared with its initial state, that it drafts readily on a spinning frame.

Example II

A silver formed of 1.5 denier 1 inch white cellulose

acetate staple and weighing 50 grains per yard is fed to a roving frame together with 1 end of the bulked continuous filament structure of Example I, the filament structure being fed in under the back roll of the roving frame. The resulting combination is drawn and given a twist of 0.7 turn per inch to yield a 1.0 hank roving. The roving is then further drawn and twisted to produce a spun Kasha-type yarn having a cotton count of 12/1, a twist of 10 turns per inch, weighing 0.69 grain per yard, and comprising 0.75% of black cellulose acetate. The spun yarn is characterized by longitudinally spaced reaches of intertwined white staple and black filament structures of slightly irregular length, diameter and frequency. This yarn may be woven as filling with any suitable warp yarns to form a Kasha-type fabric or woven as warp and filling to give unusual effects of crossed slubs. The slubs are soft to the touch.

Example III

The process of Example II is repeated except that the staple structure is combined with 3 ends of the bulked continuous filament structure of Example I which are fed into the roving frame under the back roll thereof. The resulting combination is drawn and given a twist of 0.7 turn per inch to yield a 1.0 hank roving. The roving is drawn and twisted to produce the desired Kasha-type yarn having a cotton count of 12/1 a twist of 10 turns per inch, weighing 0.69 grain per yard, and comprising 2.2% of black cellulose acetate. The spun yarn has the same appearance as the yarn produced by the process of Example II, except that the intensity and frequency of black regions are generally more pronounced.

It is to be understood that the foregoing description of the present invention is given for the purpose of illustration only and that many changes may be made in the invention without departing from the spirit thereof.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. The process of producing a draftable continuous filament structure, comprising bulking continuous filament yarn initially having a tenacity in excess of about 1 gram per denior until the tenacity thereof is less than about 0.5 gram per denier.

2. The process of producing a modified continuous filament structure, comprising bulking continuous filament yarn initially having a tenacity in excess of about 1 gram per denier by means of a turbulent stream of fluid under a pressure sufficient to reduce the tenacity of the yarn below about 0.5 gram per denier.

3. The process of claim **2**, wherein said high pressure fluid is air under a pressure between about 20 p.s.i.g. and about 100 p.s.i.g.

4. The process of claim **2**, wherein said high pressure fluid is air under a pressure between about 30 p.s.i.g. and about 60 p.s.i.g.

5. The process of producing a spun yarn, comprising combining modified continuous filament structure having a tenacity of less than 0.5 gram per denier with a spun staple fiber structure, drafting and twisting the same whereby a composite spun yarn is formed.

6. The process of claim **5**, wherein said continuous filament structure has fewer than about 5 turns per inch.

7. The process of claim **5**, wherein said continuous filament structure has about 0.2 to 5 turns per inch.

8. The process of producing a spun yarn, comprising combining a fluid jet-bulked continuous filament structure having a tenacity of less than 0.5 gram per denier as an effect fiber with a spun staple fiber structure as a base fiber, and drafting and twisting the same whereby a composite yarn is formed in which said effect fiber constitutes from about 0.25% to 25% of the composite spun yarn.

9. The process of claim **8**, wherein said effect fiber comprises cellulose acetate.

10. The process of producing a spun yarn, comprising bulking continuous filament yarn by means of a turbulent stream of high pressure fluid so as to reduce the tenacity of said continuous filament yarn to less than about 0.5 gram per denier and transform said continuous filament yarn into a modified filament structure, combining said filament structure with a staple fiber structure, and drafting and twisting the combined filament and staple fiber structures to form a spun yarn.

11. The process of claim **10**, wherein said modified filament structure has about 0.2 to 5 turns per inch.

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