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YARN MANUFACTURE

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This invention relates to the manufacture of yarns, particularly yarns having a basis of regenerated cellulose, having the appearance of spun yarn or yarn made of staple fibre, and also relates to fabrics made therefrom, and is a continuation in part of U. S. application S. No. 651,847 filed 14th January, 1933.

The parent specification describes a process for the manufacture of artificial spun yarn, particularly from materials containing cellulose acetate or other organic derivatives of cellulose, in which a bundle of filaments in a softened state is subjected to an operation such that individual filaments are broken while the continuity of the main filament bundle is maintained. As is described therein, a particularly valuable method of carrying out the invention comprises subjecting the filament bundle in a softened state to a stretch which is greater than individual filaments are capable of supporting, but is not sufficient to break the filament bundle as a whole. In this manner a yarn having a number of broken ends may be obtained which resembles yarn obtained by the spinning of staple fibre.

It has now been discovered that the invention is also of value in the production of imitation spun yarn containing materials having a basis of regenerated cellulose, such as are obtained, for example, by the viscose, cuprammonium and nitrocellulose processes. According to the present invention, therefore, an imitation spun yarn having a basis of regenerated cellulose is obtained by subjecting a bundle of filaments in a softened state to an operation, and preferably to a stretching operation, such that individual filaments are broken, while the continuity of the main filament bundle is maintained.

Breakage of the individual filaments may be effected at any suitable stage in the manufacture of the imitation spun yarn, either during or continuously with the spinning operation or as a subsequent step separate from the production of the artificial filaments. Thus in the cuprammonium process the filaments may be subjected to a stretch which is greater than individual filaments are able to withstand at any stage of their production, e. g. in the first bath in which stretching is mainly effected in the usual stretch spinning process, the motion of the liquid assisting in carrying on the broken filaments, or in the subsequent precipitating bath. Similarly in the production of artificial materials by the viscose process the speed of rotation of the draw-roller may be such that the materials in the coagulating bath itself are subjected to a stretch which effects a breakage of the individual filaments without causing rupture of the bundle as a whole, or the bundle of filaments after emerging from the coagulating bath may pass round two or more lap rollers or between two or more pairs of nip rollers, the relative speeds of rotation of which are adjusted so as to bring about the desired rupture of individual filaments. Treatment of the filament bundle to effect breakage subsequent to its emergence from the coagulating bath may be carried out either in a further bath or in the absence of such bath. When it is desired to effect the breakage of the filaments in the coagulating bath itself, it is preferable to employ some means of preventing or restricting the stretch applied by the stretching roller from extending back to the jet, for example by passing the bundle of filaments round or over guides or rollers or by employing a coagulating bath flowing in a counter-current to the direction of travel of the filament bundle. When the materials are produced by dry spinning processes, as for example in the case of artificial silk obtained by the nitrocellulose process, the breakage is preferably effected subsequent to the actual production of the filaments, either continuously with their production, e. g. by passing them round two rollers, the second of which rotates at such peripheral speed as to break individual filaments, or in an operation separate from that of their production. The breaking operation may be effected on the formed filaments, either before or after, or even during de-nitration.

The imitation spun yarns of the present invention may also be obtained from materials containing organic derivatives of cellulose, e. g. by saponification of the yarns produced according to the process of the parent specification, or by saponifying normal cellulose ester filaments and the like and subjecting them to an operation to cause breakage of individual filaments, either during or subsequent to saponification.

While particular examples of methods of effecting breakage of individual filaments have been described above, it will be appreciated that the present invention contemplates broadly the manufacture of imitation spun yarns containing regenerated cellulose by causing breakage of individual filaments at any stage in the production of the materials, whether prior to, during or subsequent to regeneration of the cellulose.

As stated above, the operation to effect breakage of the individual filaments may, if desired, be carried out as a process separate from the production of the artificial materials. Thus a yarn

in hank form may be softened and subjected to a stretching operation or breakage may be effected during the travel of the materials from one point to another, for example from bobbin to bobbin. Softening of the materials may be effected either prior to or during the stretching operation, for example by passing a yarn through a bath containing a suitable softening agent or by immersing it in package, hank or other suitable form in the softening agent.

Again, a number of yarns in warp formation may be subjected to a stretching or other operation while in a softened state in order to effect breakage of individual filaments, and, if desired, a number of such yarns may then be associated together to form a single yarn of larger denier.

The operation to effect breakage of the individual filaments may be carried out upon the filament bundle either in an untwisted or twisted state. Preferably, however, the bundle has a low twist. A final twist may be effected after breakage of the individual filaments and while the yarn is in a softened condition whether or not it has previously been twisted. In this manner, a more crinkled yarn may be obtained. If desired, however, the softening agent may be removed from the yarn, for example by washing, before the final twist, if any, is effected.

After breakage of the individual filaments the yarn may be wound or twisted and wound in any suitable manner, e. g. by means of a cap spinning apparatus or a centrifugal spinning box.

The degree of softening of the yarn when it is subjected to the operation to effect breakage of the individual filaments will, of course, depend upon the amount of stretch and the reduction of denier which it is desired to obtain in the finished materials, but in general it is preferable that the yarn should be in such condition that a relatively high degree of stretch e. g. 300–400% or more, is possible before the requisite number of breakages is obtained. In this manner a yarn may be obtained which may be associated with other yarns to yield a thread of suitable denier having a large number of broken ends per unit length, and further by effecting a relatively high degree of stretch the tensile strength of the materials may be increased.

Any suitable softening agents for the materials to be treated may be employed, for example sulphuric acid or other mineral acids, caustic alkali and other alkaline reagents, thiocyanates, zinc chloride and other compounds having a softening or swelling action upon the materials. The concentrations of reagents employed will, of course, depend upon the degree of stretch it is desired to obtain, and upon the temperature and duration of application of the softening agents and other factors, but it will be appreciated that in general, with the same starting materials and when other conditions are the same, a somewhat lower concentration will be employed to obtain an imitation spun yarn according to the present invention than would be used to obtain a normal yarn having the same degree of stretch. As is shown above, however, it is preferable that the yarn should be softened to such an extent that a high degree of stretch is obtainable before breakage according to the present invention results, and the use of baths having a high softening power, e. g. 50–70% sulphuric acid and equivalent concentrations of other agents, is therefore particularly valuable.

Breakage of the filaments results in a number of filament ends projecting from the yarn. If considerable hariness of this character is not desired, twisting may serve to bind the ends as far as possible in the yarn. If desired, the yarn may be treated, as for example by passage between or over brushes or between rollers, so as to lay the ends substantially in the direction of the length of the yarn to facilitate twisting-in of the ends. The yarn may be subjected to a gassing operation to remove superfluous projecting filaments.

Alternatively, the yarn may be passed over a roughened surface or edge in order to fray out the filaments and yield a product of increased hairiness, e. g. during the washing or drying of the stretched yarn. Such an operation may itself bring about breakage of individual filaments, and may be carried out in conjunction with the stretching process, or, though less preferably, instead of such process.

The yarns obtained according to the present invention may be subjected to any desired after treatment to improve or modify their properties, e. g. they may be treated to incorporate finely divided materials therein for delustring, mordanting, weighting or other purposes, or may be subjected to shrinking operations to improve their extension or other properties.

As described in the parent specification, to which reference is made broadly, the yarns containing broken filaments may be doubled with other yarns of a similar or dissimilar nature, either with regard to the type of constituent filaments or fibres, or as regards the substances constituting the filaments or fibres. Thus two or more broken filament yarns may be doubled together to increase the denier and/or improve their regularity or for any other purpose. Further, the yarns employed for the production of the imitation spun yarn or for doubling with such yarn may be of high, medium or low lustre, and the association of different types of yarns may take place before or after breakage of the constituent filaments.

The yarns or mixed yarns of the invention may be employed in the production of woven, knitted or other fabrics and may constitute either the whole or a portion of such fabrics, for example a fabric may be woven containing a warp of normal yarn and a weft of the imitation spun yarn obtained according to the present invention, or again the warp or weft may be constituted of a normal or imitation spun yarn of cellulose acetate or other organic derivative of cellulose, and the weft or warp of a normal or imitation spun yarn containing regenerated cellulose, and in this manner materials showing differential dyeing effects may be obtained.

The following examples are given in order to illustrate the invention, but they are not to be considered as limiting it in any way:—

Example 1

A cellulose acetate yarn of 750 denier is passed through a bath containing a 48% aqueous solution of dioxane between rollers driven to impart a stretch of about 4:1, the period of contact with the bath being about 2 minutes. A slip of the yarn is allowed on the take-up roller so that the yarn is not completely broken, but individual filaments are ruptured. After washing, drying and collecting the yarn with a twist of 8 turns per inch it is saponified to give a regenerated cellulose yarn by passing it first through a wetting-out bath containing water and then through a bath containing 4% aqueous solution of caustic

soda containing 25% sodium chloride at about 75–85° C., the period of contact with the bath being 30–50 seconds. It is then washed, dried and rewound.

Example 2

A viscose yarn of 500 denier having a twist of about .5 turn per inch is passed through a bath containing 55% aqueous sulphuric acid at 20°–25° C. between rollers driven to impart a stretch of about 2:1. The period of contact with the bath is about 2 minutes. In this manner a yarn containing individual broken filaments is obtained, which is washed, dried and given a twist of about 5 turns per inch.

Example 3

A cuprammonium cellulose solution is spun through a precipitating bath in the normal manner, and the thread so obtained is stretched about 75% between the spinning funnel and hardening bath by means of rollers travelling at about 30 metres per minute and 52 metres per minute. In this manner a yarn containing individual broken filaments is obtained. The yarn is then passed through a hardening bath in which, if desired, it may be allowed to shrink in order to increase the extensibility of the material, after which it is washed, dried and given a twist of about 5 turns per inch.

What I claim and desire to secure by Letters Patent is:—

1. Process for the manufacture of imitation spun yarn, which comprises softening the whole of a bundle of artificial filaments and subjecting the softened bundle of filaments while in transit to an operation, such that individual filaments are broken while the bundle still contains long lengths of unbroken filaments.

2. Process for the manufacture of imitation spun yarn, which comprises softening the whole of a bundle of artificial filaments and stretching the softened bundle of filaments while in transit, to such an extent that individual filaments are broken while the bundle still contains long lengths of unbroken filaments.

3. Process for the manufacture of imitation spun yarn having a basis of regenerated cellulose, which comprises softening a bundle of artificial filaments along their whole length and subjecting the softened bundle of filaments while in transit to an operation such that at intervals along the length of the bundle individual filaments are broken while the continuity of the bundle as a whole is retained.

4. Process for the manufacture of imitation spun yarn having a basis of regenerated cellulose, which comprises softening a bundle of artificial filaments along their whole length and stretching the softened bundle while in transit to such an extent that at intervals along the length of the bundle individual filaments are broken while the continuity of the bundle as a whole is retained.

5. Process for the manufacture of imitation spun yarn having a basis of regenerated cellulose, which comprises softening a bundle of artificial filaments having a basis of an organic ester of cellulose along their whole length, stretching the softened bundle to such an extent that at intervals along the length of the bundle individual filaments are broken while the continuity of the bundle as a whole is retained, and subjecting the product to a saponifying operation to regenerate the cellulose.

6. Process for the manufacture of imitation spun yarn having a basis of regenerated cellulose, which comprises stretching a bundle of filaments having a basis of cellulose acetate or other organic ester of cellulose while softening them along their whole length until individual filaments are broken, and subjecting the product to a saponifying operation to regenerate the cellulose.

7. Process for the manufacture of imitation spun yarn, which comprises softening a bundle of artificial filaments having a basis of regenerated cellulose along their whole length, stretching the softened bundle of filaments while in transit to such an extent that at intervals along the length of the bundle individual filaments are broken while the continuity of the bundle as a whole is retained, and twisting the bundle.

8. Process for the manufacture of imitation spun yarn, which comprises softening a bundle of artificial filaments having a basis of regenerated cellulose along their whole length and stretching the softened bundle of filaments while in transit to such an extent that individual filaments are broken while the bundle still contains long lengths of unbroken filaments.

9. Process according to claim 8, wherein the bundle of artificial filaments is softened to such an extent that it is necessary to stretch the bundle to at least 300% of its original length to obtain the desired number of individual broken filaments.

10. Process for the manufacture of imitation spun yarn, which comprises softening a bundle of artificial filaments having a basis of cellulose acetate along their whole length, stretching the softened bundle of filaments to such an extent that individual filaments are broken while the bundle still contains long lengths of unbroken filaments, and subjecting the product to a saponifying operation to regenerate the cellulose.

11. Process for the manufacture of imitation spun yarn having a basis of regenerated cellulose, which comprises stretching a bundle of filaments having a basis of cellulose acetate while softening them along their whole length until individual filaments are broken, passing the bundle of filaments after breakage over a rough surface to fray out broken filaments, and subjecting the product to a saponifying operation to regenerate the cellulose.

12. Process for the manufacture of imitation spun yarn, which comprises softening a bundle of artificial filaments having a basis of regenerated cellulose along their whole length, stretching the softened bundle of filaments while in transit to such an extent that individual filaments are broken while the bundle still contains long lengths of unbroken filaments, and twisting the bundle while in a softened condition.

13. Process for the manufacture of imitation spun yarn, which comprises softening a bundle of artificial filaments having a basis of regenerated cellulose along their whole length and stretching the softened bundle of filaments while in transit to such an extent that at intervals along the length of the bundle individual filaments are broken, while over any short length of the bundle the majority of the filaments remain unbroken.

14. Process for the manufacture of imitation spun yarn, which comprises softening a bundle of artificial filaments having a basis of cellulose acetate along their whole length, stretching the softened bundle of filaments to such an extent that at intervals along the length of the bundle indi-

vidual filaments are broken, while over any short length of the bundle the majority of the filaments remain unbroken, and subjecting the product to a saponifying operation to regenerate the cellulose.

15. Process for the manufacture of imitation spun yarn, which comprises stretching during the travel of the materials from one point to another to at least 300% of its original length a bundle of filaments having a basis of an organic ester of cellulose while softening them along their whole length so that at intervals along the length of the bundle individual filaments are broken, while at each point the majority of the filaments remain unbroken, and subjecting the product to a saponifying operation to regenerate the cellulose.

16. Process for the manufacture of imitation spun yarn, which comprises softening a bundle of artificial filaments having a basis of regenerated cellulose along their whole length, stretching the softened bundle of filaments while in transit to such an extent that at intervals along the length of the bundle individual filaments are broken, while over any short length of the bundle the majority of the filaments remain unbroken, and twisting the bundle while in a softened condition.

17. An imitation spun yarn which contains broken artificial filaments and long lengths of unbroken artificial filaments.

18. An imitation spun yarn which contains broken artificial filaments and long lengths of unbroken artificial filaments, said artificial filaments having a basis of regenerated cellulose.

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