May 15, 1934. M. M. TAYLOR ET AL 1,959,142

MANUFACTURE OF YARNS

Filed Jan. 21, 1933

FIG_1_

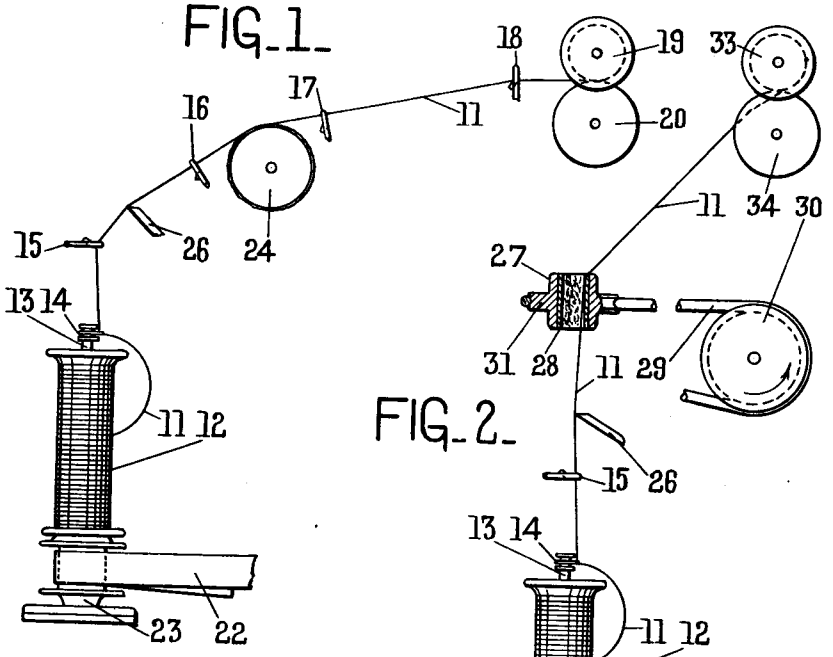


FIG_2_

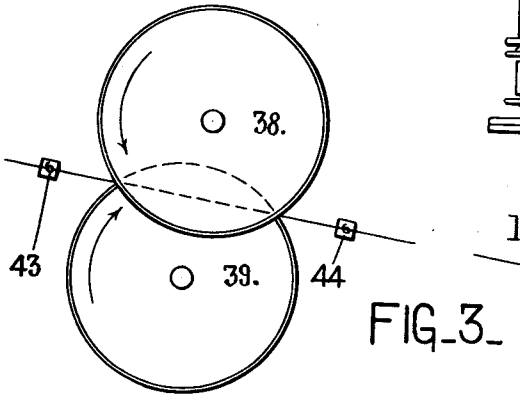


FIG_3_

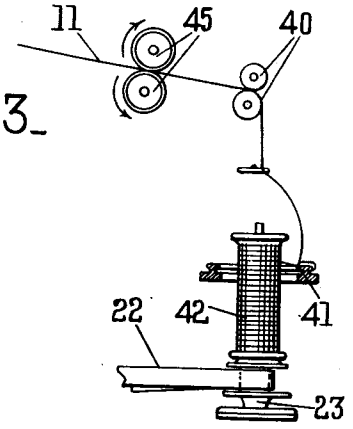
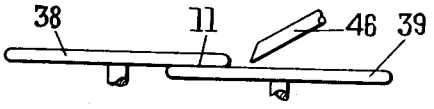


FIG_4_



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MANUFACTURE OF YARNS

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18 Claims. (Cl. 117—23)

This invention relates to the manufacture of textile yarns, and in particular to yarns having a basis of continuous filaments, but having the appearance of spun yarn, that is yarn made from staple fibre.

In the manufacture of spun yarn from artificial fibres, the usual practice is to cut continuous artificial filaments or waste filaments into comparatively short lengths, for example of 1½ to 2 inches or more, and then subject the staple fibres produced to a series of operations appropriate to the length of the fibre, such operations being similar to those accorded to natural fibres such as cotton or wool, including opening, carding, drawing and spinning. These operations represent considerable expense in the production of such yarns, since they involve a relatively slow transformation of the initial fibrous material to a finished yarn.

The object of the present invention is to produce yarn having an appearance similar to that of yarn made from spun fibre while avoiding the necessity for forming continuous filaments into short lengths and spinning the fibres thus produced.

According to the present invention a continuous filament yarn is subjected to the action of cutting or tearing means between which and the yarn there is relative rotary movement so as to break the continuity of the filaments in the bundle at frequent intervals, so that on being twisted the resulting yarn resembles spun fibrous yarn. Frictional or abrasive means are particularly suitable for effecting the breaking of the filaments.

The cutting or tearing operation is so carried out that at any one point only one or relatively few of the filaments in the bundle are broken, or at least some of the filaments remain unbroken, so that the continuity of the bundle as a whole is not interfered with.

The breaking of the individual filaments is carried out in a fairly regular manner so as to impart a uniform appearance along the length of the yarn, and as well as to avoid undue reduction in the strength of the yarn owing to the breakage of the filaments. Conveniently, the operation is carried out during a twisting operation performed on the yarn, and preferably in such a way that a certain amount of twisting-in of the broken ends occurs.

The cutting or tearing of the filaments may be effected during a winding operation with the cutting or tearing means arranged so as to rotate about and engage the yarn as it proceeds from the supply to the winding package. In order to obtain a regular cutting action the yarn is wound preferably at a constant linear rate.

If the treated yarn is required to be twisted, continuously with the cutting or tearing operation, the cutting or tearing of the filaments is carried out while the yarn is proceeding from a package on a rotating twisting spindle to a take-up device or to a further twisting spindle, or the cutting and tearing operation may be effected on the yarn while the yarn is proceeding to a twisting and winding device.

If desired, the filaments throughout the bundle may be cut separately and progressively in lengths corresponding to the length of fibre whose characteristics are to be reproduced, twisting continuously with the cutting operation binding in these lengths and ensuring that continuity of the finished yarn is maintained.

Such an operation affords an easy method of securing the breaking of individual filaments in succession, since the cutting may be performed on the yarn while it is rotating under the influence of the spindle. Consequently, cutting or tearing means arranged to contact with one side of the yarn engages different filaments in turn, and owing to the passage of the yarn over the cutting or tearing means produces a succession of broken filaments at fairly regular and frequent intervals along the length of the yarn.

The actual frequency of breaking will depend to some extent upon the rate of transverse movement between the cutting means and the filaments in relation to the rate of longitudinal movement. Very useful results may be obtained by breaking the filaments of a yarn of say 300 denier while it is being twisted to the extent of say eight or ten turns per inch.

The yarn may, if desired, be subjected to two or more cutting or tearing operations in series or in separate operations to increase the number of filament breakages.

In order to produce a curly, wool-like effect on the protruding ends, the thread may be subjected to a scraping action immediately before being torn or cut. Such scraping subjects each filament to a tension, the sudden release of which on breaking, causes the desired curly effect which produces a full-handling yarn of improved covering power, and having more warmth than yarn not so treated.

The process according to the invention may be applied to any type of continuous filament yarn, for example yarn of cellulose acetate or other organic derivatives of cellulose, e. g. other cellulose esters, such as cellulose formate, propionate and buty-

rate, and cellulose ethers, such as methyl, ethyl and benzyl cellulose, yarn of reconstituted cellulose such as viscose, nitrocellulose and cuprammonium artificial silk and natural silk. It may likewise be applied to yarns consisting of a mixture of filaments of two or more of the above types. Further, a yarn having broken filaments may be doubled with any type of yarn of a similar or dissimilar nature, whether as regards material or type of constituent filaments or fibres. Again, two or more broken filament yarns may be doubled together for the purpose of increasing the denier or counts of the yarn and improving the regularity of the yarn, or for any other purpose such as the production of yarn containing filaments having different dyeing properties. Thus, for example, two or more broken filament yarns of cellulose acetate may be doubled together and one or more of such cellulose acetate yarns may be doubled with yarns, filaments or fibres of natural silk, reconstituted cellulose silk, cotton or wool, or with any two or more of such yarns.

Where the basic yarn consists of artificial filaments, these may be of a lustrous character, or they may be of subdued or reduced lustre. Again, filaments or yarns of subdued or reduced lustre may be mixed or doubled with lustrous filaments or yarns, either before or after effecting filament breakage.

The yarns or mixed yarns according to the invention may be used alone or in admixture with other yarns in the production of woven, knitted or other fabrics. For example, the yarns may be introduced into the weft or warp or both of woven fabrics to produce a fabric having the appearance of one constituted wholly of staple fibre yarns, or having more or less local patterns or effects due to the employment of the broken filament yarns. Similarly, knitted fabrics of all descriptions may contain the yarns either as effect materials or as the sole or principal constituent of the fabrics. The invention includes within its scope fabrics or articles made from or containing such broken filament yarns.

The invention will now be described in greater detail with reference to the accompanying drawing but it is to be understood that this description is given by way of example only and is in no respect limitative.

Figs. 1 and 2 show in elevation, and Fig. 3 in part plan and part elevation different forms of apparatus for cutting or tearing the filaments of the yarn according to the invention; and

Fig. 4 is an elevation view of the part of Fig. 3 shown in plan.

As shown in Fig. 1, a yarn 11 from a rotating package 12 mounted on a twisting spindle 13, conveniently of the type described in detail in U. S. Patent No. 1,784,581, is led upwardly through a loosely fitting guide ring 14 to a guide 15 from which it is taken through further guides 16, 17 and 18 to a winding bobbin 19 rotated at constant peripheral speed by surface contact with a driving drum 20.

The twisting spindle 13 is rotated at constant speed by a tape or band 22 which engages a wharl 23 at the base of the spindle. The spindle 13 is recessed circumferentially at its upper extremity to allow of free passage of the thread 11 between the guide-ring 14 and the spindle 13, and also to allow of free rotary movement of the guide-ring 14.

As the spindle 13 rotates at constant speed and the rate of take-up of the drum-winding device 20 is constant, a regular amount of twist is inserted in the yarn 11 which balloons about the package 12 between the unwinding point on the package and the guide-ring 14, the guide-ring 14 being thus traversed around the recess on the upper extremity of the spindle 13. The yarn 11 rotates about its axis over the length extending from the guide 15 to the winding package 19.

A glass-paper or emery covered rotatable roller 24 is so disposed with respect to the guides 16, 17 as to bear against the yarn 11 proceeding through the guides and to cut and tear the filaments of which the yarn 11 is composed. The roller 24 may be maintained stationary or may be rotated in either direction and at any desired speed depending on the rate of travel of the yarn 11 and on the effect desired in the finished yarn. Thus, by rotating the roller 24 quickly and drawing away the yarn 11 relatively slowly, the filaments are broken at frequent intervals giving a short-staple effect to the finished yarn, or by rotating the roller 24 slowly, less frequent breaking occurs and imparts a long-staple effect to the finished yarn.

In order to cause the filaments to curl over on themselves on breaking, thus producing a finished yarn having enhanced covering power and warmth, a dull knife edge 26 is placed between the guides 15 and 16 so as to divert the yarn from the normal path between the guides, thus imparting a slight extra tension to the filaments. Upon being broken the tension in the individual filaments is released suddenly, causing them to recoil and to assume a curled position. The guide 18 serves to traverse the treated yarn 11 along the surface of the winding package 19 and may be operated by cam or crank means (not shown) to reciprocate at any desired speed.

In Fig. 2 the yarn 11 is shown proceeding from a twisting spindle 13 upwardly through the guides 14 and 15 in a similar manner to that explained with reference to Fig. 1. Instead of being treated by passing over a roller, however, the yarn 11 is led upwardly against the inner surface of a rotating tube 27 having a lining of emery or glass-paper 28. The tube 27 is rotated by means of a belt 29 driven by a pulley 30 and engaging a wharl 31 on the tube 27.

On leaving the breaking tube 27 the path of the yarn is bent sharply so as to ensure that the yarn is always in contact with the roughened interior portion 28 of the tube 27. The tube 27 may be rotated in either direction and at any desired speed depending on the rate of travel of the yarn and on the effect desired in the finished yarn. Thus, by rotating the tube 27 quickly and drawing away the yarn 11 relatively slowly, frequent filament breakages are effected and a short-staple effect is given to the thread. Alternatively, by rotating the tube 27 less quickly a long-staple effect is given to the yarn 11, which, by reason of its rotation is treated regularly along the whole of its length. The yarn 11 may be supplied from a stationary package or from an unwinding package rotating about an axis substantially at right angles to the line of travel of the yarn unwound from it so that the filaments are in an untwisted condition on being broken. According to this method the roughened interior portion 28 of the tube 27 rotates about a substantially twistless bundle of filaments which are thus broken along their length at intervals, the frequency of which may be regulated by varying the rate of travel of the yarn relative to the rate of rotation of the tube 27.

After being treated, the yarn 11 is led to a wind-

ing bobbin 33 resting upon and rotated by a drum 34 adapted to drive the bobbin by surface contact at constant peripheral speed. The drum 34 is provided with an endless traversing slot along its length, which slot engages and guides the yarn, thus obviating the need for separate traversing elements. A traversing drum of this type enables the winding operation to be carried out at a higher speed and with less vibration than when using separate traversing elements. As shown with reference to Fig. 1 a dull knife edge 26 scrapes the yarn 11 just before the breaking means, so as to produce a curled effect on the broken filaments.

The apparatus illustrated in Figs. 1 and 2 twists the yarn during the filament breaking operation. Still further novel effects are obtained by twisting the yarn after the filament breaking operation, one form of apparatus for effecting this process being shown in Fig. 3. In Fig. 3 yarn 11 proceeding in the direction indicated by the arrows, is drawn by a pair of constantly rotating nip rollers 40 between opposed engaging surfaces of a pair of rotating discs 38, 39 of the type described in detail in U. S. application S. No. 413,500 filed 12th December, 1929. U. S. application S. No. 413,500 shows delustring an artificial thread by abrading the filaments comprising the thread with a fine powdered material while the yarn is passing between opposed surfaces of engaging discs. The abrading action, according to U. S. application S. No. 413,500, however, is not so severe as to break the filaments. Instead of, or in addition to the fine powdered material, as used in U. S. application S. No. 413,500, a rough cutting powder is ejected from a hopper or other suitable container (not shown) through a delivery pipe 46 to the surfaces of the discs 38, 39, which on rotation grind the yarn and break its filaments.

As stated above, a fine abrading powder also may be incorporated with the rough cutting powder so as to delustre the filaments while the filaments are being cut by the rougher material. The discs 38, 39 can be rotated in any direction and at any speed, depending on the rate of travel of the yarn and on the amount of filament-breaking required and could be glass or emery paper covered instead of, or in addition to using a loose abrading material. On emerging from the grinding surfaces, the yarn 11 proceeds to the nip rollers 40 from which it is delivered at constant speed to a ring twisting device (indicated generally at 41) which twists the treated yarn and winds it onto a bobbin 42.

The travelling yarn is maintained in position relative to the discs 38, 39 by means of guides 43, 44 so that a constant length of yarn is under treatment at one time. A pair of soft fabric, or fur-covered rollers 45 engage the treated yarn at a point between the guide 43 and the nip rollers 40 and lay the protruding fibres, or beard, flat on the thread prior to the twisting operation when the loose fibres are bound in to the body of the twisted yarn.

The rollers 45 rotate in the opposite direction to the direction of travel of the yarn 11 and at any suitable speed, depending on the amount of beard on the yarn 11. The roughened yarn may be subjected to a gassing, or other beard removing operation after the breaking treatment.

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

1. Process for the production of yarns of filamentous materials, said process comprising severing filaments of a continuous filamentary bundle by exercising a cutting action at frequent intervals along the length of the bundle, thereby transforming at least some of the filaments into fibres and imparting a fibrous character to the bundle.

2. Process for the production of yarns of filamentous materials, said process comprising severing filaments of a continuous filamentary bundle by exercising a cutting action transverse to the bundle at frequent intervals along the length of the bundle, thereby transforming at least some of the filaments into fibres and imparting a fibrous character to the bundle.

3. Process for the production of yarns of filamentous materials, said process comprising severing filaments of a continuous filamentary bundle by exercising a cutting action at different points round the bundle, said cutting taking place at frequent intervals along the length of the bundle, some at least of the filaments thereby being transformed into fibres to impart a fibrous character to the bundle.

4. Process for the production of yarns of filamentous materials, said process comprising severing filaments of a continuous filamentary bundle by exercising at frequent intervals a cutting action on a travelling continuous filamentary bundle so as to sever at least some of the filaments in the bundle into fibres and imparting thereby a fibrous character to the bundle.

5. Process for the production of yarns of filamentous materials, said process comprising rotating a continuous filamentary bundle and during such rotation cutting different filaments of said bundle at different points along and round the bundle, so as to impart a fibrous character to the bundle.

6. Process for the production of yarns of filamentous materials, said process comprising twisting a bundle of continuous filaments by rotating the bundle about its axis and during such rotation cutting different filaments of said bundle at different points along and round the bundle so as to produce a twisted yarn of a fibrous character.

7. Process for the production of yarns of filamentous materials, said process comprising bringing a continuous filamentary bundle into contact with an abrasive adapted to have a cutting action on the filaments and thereby cutting at least some of the filaments into fibres, and imparting a fibrous character to the bundle.

8. Process for the production of yarns of filamentous materials, said process comprising cutting filaments of a continuous filamentary bundle of cellulose acetate or other organic derivative of cellulose at intervals along and round the bundle in such a manner that different filaments are cut at different points in the bundle, so as to impart a fibrous character to the bundle.

9. Apparatus for the production of yarns of filamentous materials, said apparatus comprising cutting means, means for guiding a bundle of continuous filaments into contact with said means so as to cut different filaments at different points along the length of the bundle and impart a fibrous character to the bundle, and means for effecting relative motion between the cutting means and the filaments at their point of mutual contact to ensure severance of filaments in the bundle into fibres.

10. Apparatus for the production of yarns of filamentous materials, said apparatus comprising cutting means, means for guiding a bundle of continuous filaments into contact with said means so as to cut different filaments at different points along the length of the bundle and impart a

fibrous character to the bundle, and means for effecting relative motion between the cutting means and the filaments transverse to the filament bundle at their point of mutual contact to ensure severance of filaments in the bundle into fibres.

11. Apparatus for the production of yarns of filamentous materials, said apparatus comprising in combination means adapted to cut filaments of a continuous filamentary bundle at intervals along the length of the bundle, and means adapted to produce relative rotary motion between said cutting means and said bundle so that different filaments are cut at different points along the length of the bundle.

12. Apparatus for the production of yarns of filamentous materials, said apparatus comprising means adapted to twist a continuous filamentary bundle, and means adapted to cut filaments in said bundle at intervals along the length of said bundle while it is rotating under the influence of the twisting means so that different filaments are cut at different points along the length of the bundle.

13. Apparatus for the production of yarns of filamentous materials, said apparatus comprising abrading means adapted to cut filaments of a continuous filamentary bundle at intervals along the length of the bundle, and means adapted to produce relative rotary motion between said abrading means and said bundle so that different filaments are cut at different points along the length of the bundle.

14. Apparatus for the production of yarns of filamentous materials, said apparatus comprising an abrading roller adapted to contact with, and to cut filaments of a continuous filamentary bundle at intervals along the length of the bundle, and means adapted to produce relative rotary motion between said abrading roller and said bundle so that different filaments are cut at different points along the length of the bundle.

15. Apparatus for the production of yarns of filamentous materials, said apparatus comprising an abrading tube adapted to surround and to rotate about a continuous filamentary bundle with which it contacts so as to cut different filaments at different points along the length of said bundle, and means adapted to wind said bundle.

16. Apparatus for the production of yarns of filamentous materials, said apparatus comprising cutting means, means for guiding a bundle of continuous filaments into contact with said means so as to cut different filaments at different points along the length of the bundle, means for effecting relative motion between the cutting means and the filaments at their point of mutual contact to ensure severance of the filaments, and means adapted to lay any protruding filaments back on the bundle after the cutting operation.

17. Apparatus for the production of yarns of filamentous materials, said apparatus comprising cutting means, means for guiding a bundle of continuous filaments into contact with said means so as to cut different filaments at different points along the length of the bundle, means for effecting relative motion between the cutting means and the filaments at their point of mutual contact to ensure severance of the filaments, and means adapted to twist and wind the fibrous bundle continuously with the cutting operation.

18. Apparatus for the production of filamentous materials, said apparatus comprising in combination means adapted to cut filaments of a continuous filamentary bundle at intervals along the length of the bundle, means adapted to produce relative rotary motion between said cutting means and said bundle so that different filaments are cut at different points along the length of the bundle and means adapted to scrape the bundle before being cut.

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