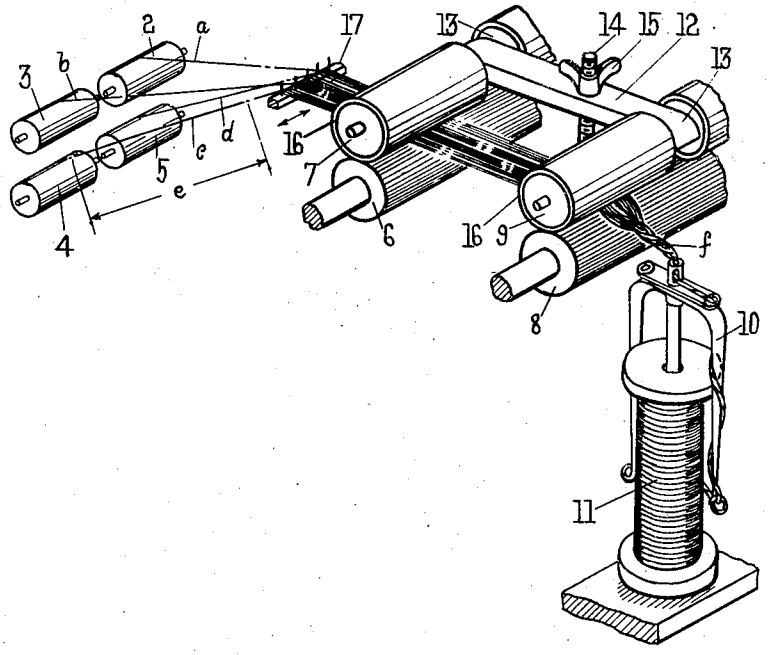
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MANUFACTURE OF SPUN YARNS

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Inventor:
FRANK C. HALE
by
Seltzer and Seltzer
Attorneys

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MANUFACTURE OF SPUN YARNS

Frank Corbyn Hale, Spondon, near Derby, England, assignor to Celanese Corporation of America, a corporation of Delaware

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This invention relates to the manufacture of 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. The particular purpose of the invention is to enable a fairly close measure of control to be obtained over the length of the fibre, so as to obtain a spun yarn as uniform as possible in structure, and consequently of a fairly high degree of strength.

According to the invention, the filaments to be converted into fibre vary in denier at intervals along their length, so that breakage occurs at the thinner and weaker parts when the filaments are subjected to a breaking load. Thus the breakage is effected at substantially predetermined points, the actual length of the fibres corresponding closely to the intervals between the thin portions of the filaments. Preferably the variation in denier occurs at regular and uniform intervals so as to enable the fibres to be of substantially equal length.

In addition to the control given over fibre length by localizing the points of rupture of the filaments to weak parts of the filaments, undue extension of the filaments under the breakage load may be avoided except close to the points of breakage, so that the elasticity of the material as a whole is not lost. The degree to which the whole filament is extended by the breaking operation will, however, depend on the denier ratio between the thin parts and the rest of the filaments. Thus, for example, a ratio of 1.1:1 may give sufficient denier variation for breakage to be confined to the thin portions, but it may be advisable to have a somewhat higher ratio, say 1.5:1, to ensure that the permanent elongation resulting from the application of a breaking force falls on the parts of the filaments near the thin places. Of course, larger denier ratios, of say 2:1 or upwards, may be employed, but in general it is advisable to keep to as low a ratio as possible in order to avoid difficulties arising from the individual fibres varying in thickness.

It is, of course, necessary that a fibrous yarn should have its fibres distributed substantially evenly in its structure so as to impart strength and evenness to the yarn when spun. Consequently, the fibrous mass produced by breaking the filaments of varying denier should have the ends of its fibres in overlapping relationship so that they can be properly spun. This may be effected by arranging that the filaments simultaneously broken have their weak places occurring at spaced intervals, as between filament and filament. It is, however, more convenient to form a multi-filament yarn of varying denier by extending all the filaments equally and simultaneously, so that all the thin places appear side by side in the yarn. (Reference may be had to U. S. Patent No. 1,898,085 and U. S. applications S. Nos. 574,851 filed 13th November, 1931 and 573,422 filed 6th November, 1931, for methods of giving yarns a varying denier, either continuously with the production of the yarns, or subsequently thereto.) Though the points of breakage of the filaments of such yarns would probably not coincide precisely, yet they would be sufficiently close to prevent the fibres having any substantial overlap. These yarns can, however, be utilized by taking a plurality of such yarns from separate supplies and combining them together before, during, or after breakage. If, say 4, 8, 10 or 12 such yarns are so combined, the fibres produced from them are generally evenly distributed throughout the combined bulk, and this can then be reduced to any desired size by passing it through drawing rollers, the fibres of course retaining their even distribution.

The breakage of the bundle of filaments of varying denier is so effected that the continuity of the mass is not broken except for the conversion of the filaments into fibres, so that there is produced a sliver-like bundle which can be transformed into an even yarn. Breakage is conveniently carried out by passing the filaments through two pairs of rollers in series, the rollers of each pair being pressed together so as to grip the filaments firmly and the second pair being driven at a speed sufficiently greater than that of the first pair to break the filaments at their thin portions. A form of apparatus using such

rollers is illustrated in the accompanying drawing and methods of carrying out the invention will now be described with the aid of the drawing.

Four ends *a*, *b*, *c*, *d* of yarn containing continuous filaments, the denier of which varies so as to form thin portions at regular intervals along their length, are unwound from cheeses 2, 3, 4 and 5 and are led through the nips of two pairs of rollers 6, 7 and 8, 9 to the flyer 10 and bobbin 11 of a flyer twisting and winding device.

The rollers 6, 7 and 8, 9 are pressed together by a bridge piece 12 which rides at its extremities in necks 13, 13 formed in the top or press rollers 7, 9. A bolt 14 which may be loaded by a spring (not shown) passes through the bridge piece 12 and is provided with a wing nut 15 by which the pressure on the bridge may be adjusted.

The "ratch" or distance between the nips of the two pairs of rollers approximates, or is slightly in excess of the distance between the thin portions of the yarn (indicated as *e* on the end *c*). The bottom rollers 6, 8 are the driven rollers in each pair and are fluted, while the press rollers 7, 9 are covered with rubber, leather, or like resilient material, indicated at 16, so that the filaments, while being securely gripped, are not injured or broken when passing through the nips of the rollers.

In operation the rollers 8, 9 are driven at a speed sufficiently greater than that of the rollers 6, 7 to break the filaments between the rollers, the breakage occurring at or about the thin portions of the filaments so that the thicker portions are not subjected to undue stress.

In order that the continuity of the ends as a whole is maintained the threads are unwound from the cheeses 2—5 and delivered to the first pair of rollers 6, 7 in such a manner that the thin portions of the threads are in over-lapping relation. Thus, as will be observed from the illustration, the thin portions of the filaments comprising the same yarn may be in substantially similar positions but the thin portions of the yarns themselves do not coincide at any point of the travel of the yarns. In this manner, while the individual yarns are broken completely across their width, the points of breakage are so distributed that the total mass of filaments is never severed completely across the width.

It will be understood that the fineness of the filaments prevents true illustration of their number, and while each thread *a*—*d* is shown as containing only a few filaments there are many more in practice. Actually the filaments are much closer together than can be shown and form a sliver-like mass of material extending between the nips of the rollers so that on breakage, the loose ends are carried forward to the nip of the rollers 8, 9 by the mass of the other filaments. If desired, however, the yarns may be supported on breaking by means such as a travelling endless band or by one or more supporting rollers or carriers.

The breaking action of the two pairs of rollers thus converts the continuous yarns into a fibrous sliver *f* of maintained continuity and which is twisted into a coherent roving and wound on the bobbin 11. A comb guide 17 situated between the cheeses 2—5 and the rollers 6, 7 guides the yarns and maintains them in evenly spaced relation prior to their entering the nip of the rollers. The guide 17 also serves to spread out the filaments of each yarn into a flat band, and reciprocates along the length of the roller 7 in order to prevent undue wear at any one point or series of points on the surfaces of the two pairs of rollers.

The variation in denier in the filaments occurs at intervals corresponding to the type of spun yarn to be produced, such as 1½"–2½" to produce a yarn having characteristics similar to those of cotton yarn, or 2½"–12" or more to produce a yarn having worsted yarn characteristics. The ratch of the rollers is adjusted in accordance with such spacing of the denier variations.

If desired the sliver from the rollers 8, 9, may be passed through a further set of draw rollers before being twisted so as to reduce its size and may even be brought to final size, in which case the twisting may be of sufficient degree to finish the yarn in the one continuous operation of breaking, drafting and twisting.

Alternatively, the roving wound on the bobbin 11 may be subjected to one or more drawing operations similar to those used on yarns of natural fibres, and two or more rovings may be combined in order to increase the evenness of the final yarn. Doubled yarn may be produced by twisting together two or more yarns which have been reduced to the desired degree of fineness and given the requisite twist.

The operation according to the invention may be applied to the breaking of all kinds of continuous or substantially continuous filaments of varying denier into staple fibre. For example, the filaments may consist of cellulose acetate or other organic derivatives of cellulose, such as other cellulose esters, e. g. cellulose formate, propionate and butyrate, and cellulose ethers such as ethyl and benzyl cellulose. Thus yarns of cellulose acetate may be given a varying denier continuously with their production by the dry or evaporative method by any of the means described in U. S. Patent No. 1,898,085 and U. S. applications S. Nos. 574,851 filed 13th November, 1931 and 573,422 filed 6th November, 1931 previously referred to. Again they may be artificial silk of the reconstituted cellulose type, such as viscose, nitro and cuprammonium artificial silk. Of course, the operation may be performed on mixtures of two or more types of continuous filament.

In order to improve the spinning properties of the fibres, which, of course, have the smoothness of the filaments from which they are produced, roughening media may be applied to increase the adhesion between the fibres. In view of the importance of maintaining the even arrangement of the fibres in the sliver-like mass produced by breaking the filaments, it is desirable that any such media should be applied to the filaments before breaking. Such media may be of an insoluble type, e. g. kieselguhr, talc, pumice, carborundum, and emery, and may be applied dry or as pastes or suspensions at any suitable stage prior to breaking, e. g. continuously with the production of artificial filaments. Soluble materials in crystalline or powder form may also be applied dry. Soluble media may also be used, conveniently being applied as solutions of high concentration, as described in U. S. application S. No. 585,381 filed 7th January, 1932, so that drying can be economically effected to leave the desired amount of roughening media on the fibres.

Where the materials are subject to electrification, as for example in the case of cellulose acetate or other organic derivatives of cellulose, hygroscopic materials may be applied to the materials. For example, hygroscopic bodies may be applied as described in U. S. application S. No.

614,853 filed 1st June, 1932, the filaments preferably being dried before breaking.

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

1. Process for the production of yarn of fibrous character, which comprises continuously subjecting to a breaking load a plurality of continuous filaments having thin portions at intervals along their length, said thin portions occurring at spaced intervals and being staggered as between filament and filament so that by the breakage of the filaments occurring at the thin portions the filaments are converted into fibres overlapping each other, and collecting the fibres thus produced as a continuous end.

2. Process for the production of yarn of fibrous character, which comprises continuously subjecting to a breaking load a plurality of yarns of continuous filaments, the filaments in each yarn having thin portions at intervals along their length and the thin portions of the several yarns occurring at spaced intervals and being staggered as between yarn and yarn, so that by the breakage of the filaments occurring at the thin portions, each yarn is converted into fibres overlapping the fibres produced from the other yarns, and collecting the fibres thus produced as a continuous end.

3. Process according to claim 1 wherein the thin portions of the filaments occur at uniform intervals so that the filaments break into fibres of substantially equal length.

4. Process for the production of yarn of fibrous character, comprising continuously subjecting to a breaking load a plurality of continuous filaments of cellulose acetate having thin portions at intervals along their length, said thin portions occuring at spaced intervals and being staggered as between filament and filament so that by the breakage of the filaments occurring at the thin portions the filaments are converted into fibres overlapping each other, and collecting the fibres thus produced as a continuous end.

5. Process for the production of yarn of fibrous character, comprising continuously subjecting to a breaking load a plurality of yarns of continuous filaments of cellulose acetate, the filaments in each yarn having thin portions at intervals along their length and the thin portions of the several yarns occurring at spaced intervals and being staggered as between yarn and yarn, so that by the breakage of the filaments occurring at the thin portions, each yarn is converted into fibres overlapping the fibres produced from the other yarns, and collecting the fibres thus produced as a continuous end.

FRANK CORBYN HALE.