

March 10, 1964

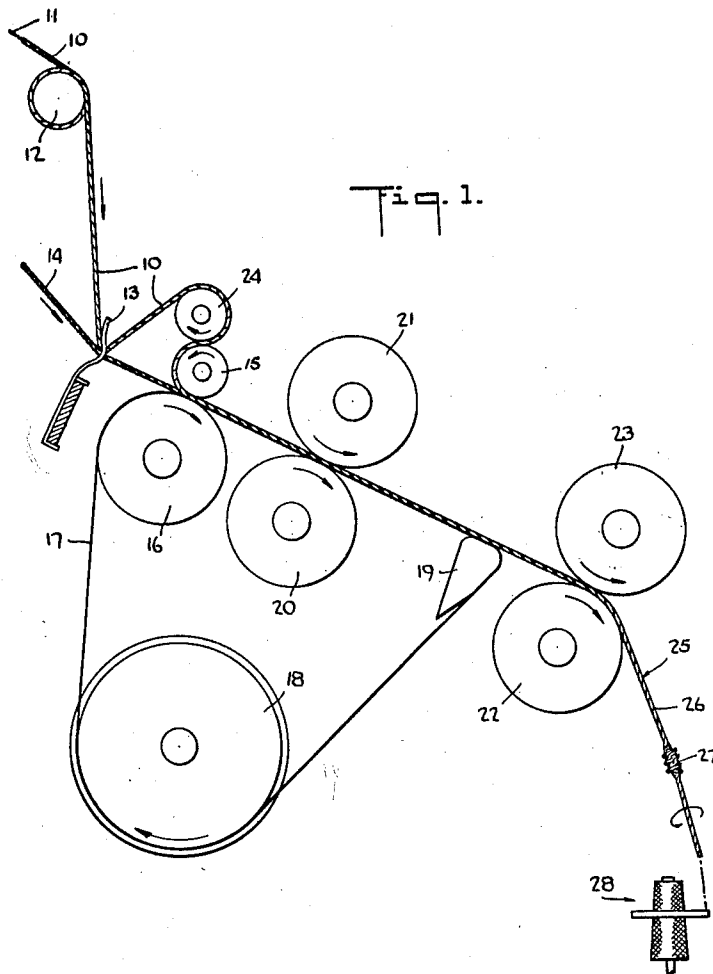
W. E. STAMPS ETAL

3,123,972

SLUB YARN

Original Filed Aug. 26, 1958

3 Sheets-Sheet 1



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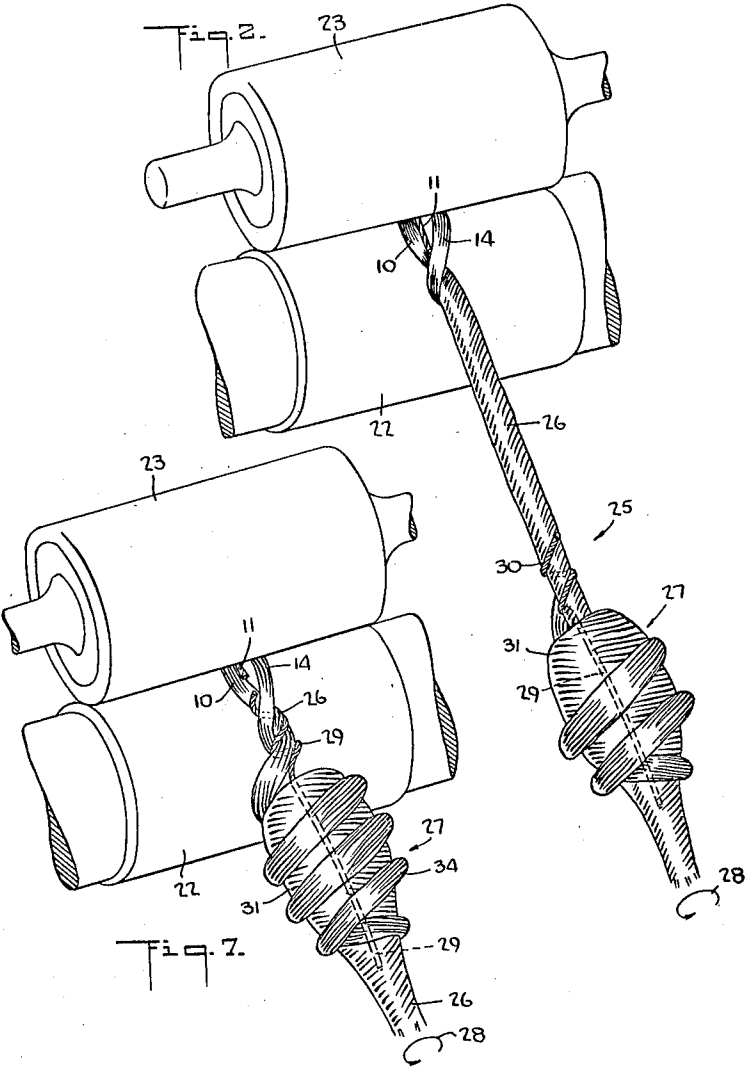
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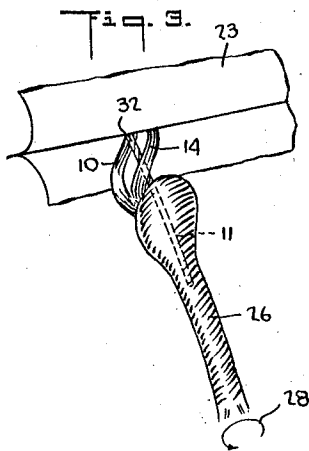
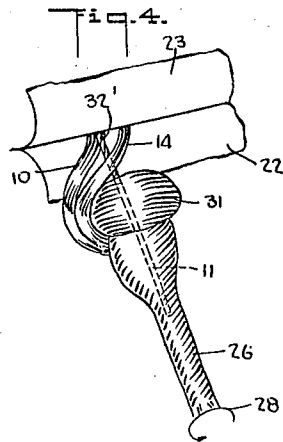
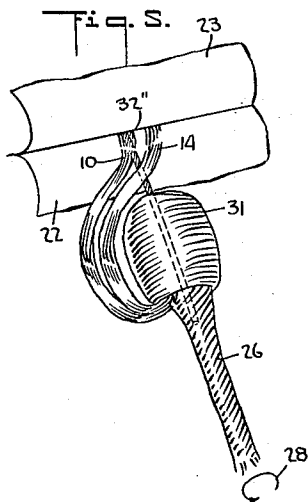
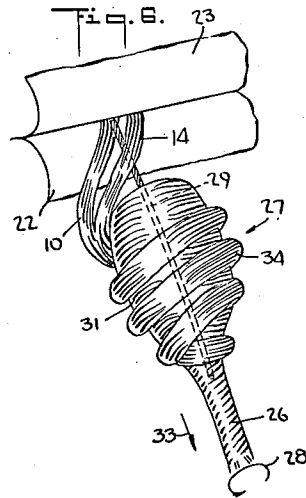
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3,123,972

SLUB YARN

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Original application Aug. 26, 1958, Ser. No. 757,374, now Patent No. 3,044,251, dated July 17, 1962. Divided and this application Dec. 19, 1961, Ser. No. 160,547
8 Claims. (Cl. 57-140)

The present invention relates to novelty spun yarns in which a spun yarn formed of staple fiber is formed with stable "cockled" slubs spaced apart along the length of the yarn.

Heretofore yarns containing "cockled" slubs have been produced unintentionally in spinning mills when attempting to spin fiber blends containing too much over-length staple. Such slubs are caused by a local inclusion of more than the normal number of fibers in a typical cross-section, and are generally unstable, being supported by only a few long fibers, and cause great difficulties in later processing. When such slubs are encountered in normal processing, the stock is nearly always taken out of work and scrapped and the stable supplier is called upon to replace the defective staple.

In accordance with the present invention there is provided a yarn with cockled slubs which are highly resistant to removal and are reinforced by segments of a pre-formed yarn embedded therein. The slubs of the invention are further characterized in some instances by being shorter and thicker than those produced by known mechanical slubbing methods or from so-called self-slub fiber blends. The invention includes the slub-containing spun yarn which is produced as well as methods and apparatus for the production thereof.

In accordance with one aspect of the invention, a pre-formed yarn is passed together with at least one roving between the forward rolls of a drafting device. The pre-formed yarn may comprise a continuous filament yarn made up of one or more continuous filaments which may or may not be twisted or it may comprise a spun yarn composed of staple fibers, but for ease of reference this embodiment will be further described using a continuous filament as the pre-formed yarn. The roving is supplied at a rate less than the feed velocity of the forward rolls so that the roving is drafted. The continuous filament is similarly supplied at a rate less than the feed velocity of the forward rolls so that it is under tension in the drafting zone. The drafted roving and the continuous filament issue together from the forward roll and are twisted by the spinning ring surrounding the take-up bobbin.

The tension on the continuous filament in the drafting device is determined by the linear speed at which it is fed, the linear speed at which the forward roll of the drafting device operates and the weighting of the forward roll. Under a given set of linear speeds this weighting should be insufficient to break the continuous filament in the drafting device to avoid forming a free end which might not be carried beneath the forward roll.

Without wishing to be bound thereby, it is believed that the tension which holds back the continuous filament causes the drafted roving in advance of the forward roll to pile up about the slowly supplied continuous filament to form a slub. At the same time, the twist applied by the ring spinner to the continuous filament in advance of the forward roll causes it to become tightly twisted until it breaks. Upon breakage of the continuous filament, the slub is completed and the roving or rovings supplied by the forward rolls are twisted in conventional manner to form a length of conventional spun yarn until

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the leading end of the continuous filament which is slowly advanced by the forward rolls is again caught in the twist of the spun yarn which is produced whereupon the slub-forming process is repeated until the continuous filament is again broken to complete formation of another slub having a short length of continuous filament yarn embedded therein.

As will be evident, the rate of twist and the rate of continuous filament supply must be adjusted so that the continuous filament is twisted fast enough to continuously increase the number of twists per unit of length whereby the twist will increase to the breaking point. As will be evident, the twist build-up will be more rapid and breakage will occur sooner with slower filament supply and also with more rapid twisting. Similarly, breakage will occur more rapidly in filaments having a lesser capacity for resisting twist.

When the forward rolls are sufficiently weighted to draft the roving, they will normally bear sufficiently upon the continuous filament to prevent the twist from passing through the forward rolls into the drafting zone. The filament is thus twisted more and more tightly against the point where the filament is engaged and prevented from rotating by the forward rolls.

As employed herein the term "roving" has reference to a loose strand of staple fibers having either a low twist or no twist in which case it is sometimes called a sliver.

The length and thickness of the slub which is produced will vary, it being evident that the slub will be longer when more length of filament passes through the forward rolls before breakage occurs. Thus, longer slubs can be formed by increasing the rate of filament supply, or by selecting a filament which requires a greater twist before it will break or by pre-twisting the filament in the opposite direction from the twist being applied in the spinning process. The thickness of the slub is basically determined by the difference between the rate of feed of the roving and the rate of feed of the continuous filament by the forward rolls. If both are supplied to the forward rolls at the rate of the back rolls of the drafting device, then the difference in front roll feed velocity will be substantially indicated by the drafting ratio. Thus, at a drafting ratio of 15:1, the roving will emerge from forward rolls at a rate about 15 times faster than the filament. The greater the difference in feed velocities (or the greater the drafting ratio), the greater will be the thickness of the slubs which are produced. Drafting ratios of from 5:1 to 40:1 are usable in accordance with the invention, drafting ratios of from 10:1 to 25:1 being preferred. At draft ratios less than 5:1, long irregular slubs are formed which makes processing of the yarn difficult. At draft ratios above 40:1 the slubs are very small and unstable.

In this manner, it is feasible to produce by the invention slubs which are thicker and shorter (and therefore more visible) than can be produced in other manner.

When the invention is performed using a plurality of rovings, as is preferred, those portions of the product between the slubs will be similar to conventional spun yarns produced by drafting and twisting several rovings with no continuous filament feed.

When one or more rovings are passed through a drafting device together with a yarn which passes only through the front rolls, this yarn is not drawn and the roving or rovings which are drawn are twisted about the yarn which is not drawn to produce a core yarn in which the yarn which is not drawn forms a core about which the drawn roving or rovings are wrapped.

In the invention, a core yarn is not produced because the continuous filament which corresponds to the core of the art does not extend throughout the spun yarn but is only present in spaced apart segments, and because

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where the continuous filament is present, it has issued forth from the front rolls at a very much slower rate than the rovings so that an increased thickness is obtained by multiple wrappings of roving or rovings and some of the wrappings are opposite in direction with respect to the direction of wrappings in the segments of spun yarn between adjacent slubs.

The invention will be more fully understood from the description which follows taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevation diagrammatically illustrating the procedure of the invention together with the equipment employed for carrying out the process on a schematic basis; and

FIGS. 2-7, inclusive, are partial perspective views illustrating in a step-by-step manner and on an enlarged scale the formation of cockled slubs in accordance with the present invention.

In a preferred form of the present invention a plurality of rovings are supplied and one of these rovings carries the continuous filament with it for the purpose of maintaining the supply of continuous filament in association with the rovings until these reach the forward rolls.

Referring more particularly to FIG. 1, a cored roving 10 containing a continuous filament core 11 is led to a drafting zone, preferably from the upper deck of a spinning frame creel (not shown). The cored roving 10 is shown passing a guide bar 12 into a trumpet guide 13 where it is joined in the form of the invention illustrated by a regular roving 14. The regular roving 14 passes beneath control roll 15 which bears against a driving roll 16 about which the conventional drafting apron 17 is trained, the apron 17 being tensioned and guided by roll 18 and sliding against the member 19 to complete its triangular path adjacent the front or forward rolls. The regular roving then passes beneath the back drafting rolls 20 and 21 and is stretched in passing through the drafting zone to the front drafting rolls or forward rolls 22 and 23.

The cored roving 10 travels a somewhat different path going above the roll 24 and then beneath the control roll 15 in order to apply additional tension to the continuous filament 11. As will be evident, the particular manner in which the continuous filament is tensioned to regulate its supply velocity is not an important feature of the invention. Thus, the weighting of the back rolls 20 and 21 can be increased or the cored roving may be supplied from a roll driven at predetermined speed or the cored roving supplied through feed rolls driven at predetermined speed so that the continuous filament 11 is supplied under tension at a controlled rate less than the peripheral velocity of the forward rolls 22 and 23.

The composite of rovings 10 and 14 and continuous filament 11 which passes through the forward rolls 22 and 23 is generically identified by the numeral 25 and it contains spaced longitudinal segments 26, which are conventional spun yarn in structure, alternated with spaced apart cockled slubs 27, the structure of which as well as the manner of formation of which will be more fully described hereinafter. The composite yarn 25 is continuously twisted, as indicated by the arrow, and taken up in conventional manner by a vertically reciprocating ring spinner and rotating bobbin mechanism indicated generally at 28.

Referring more particularly to FIG. 2, this figure pictures a cockled slub produced in accordance with the invention and also shows the slub producing mechanism immediately prior to slub production. More particularly, there is shown in FIG. 2, the forward rolls 22 and 23 with the rovings 10 and 14 being fed forwardly therefrom together with the forward end of a segment of the continuous filament 11. As will be seen, the rovings 10 and 14 are twisted together by the spinning indicated by arrow 28 to produce a spun yarn segment 26 of the composite slub yarn 25. There has been previously pro-

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duced a cockled slub 27. As will be seen, the slub 27 comprises a more-or-less centrally positioned continuous filament segment 29 which extends through the slub 27. The trailing end of the continuous filament segment 29 is shown twisted in to the forward end of the spun yarn segment 26 as is indicated by the numeral 30. It will be observed that some of the wrappings indicated by the numeral 31 are twisted in an opposite direction with respect to the direction of twist in the spun yarn segment 26. The manner in which the oppositely twisted wrappings 31 are produced will be more fully described hereinafter.

Whereas FIG. 2 illustrates the slub forming mechanism immediately prior to the start thereof, FIG. 3, pictures the start of the slub forming mechanism. As will be seen in FIG. 3, the leading end of the continuous filament 11 has been caught in the twist of the spun yarn segment 26 and, as twisting as indicated by arrow 28 continues, the continuous filament 11 becomes twisted forwardly of its point of engagement with the forward rolls 22 and 23. This twisting is indicated by the numeral 32.

As previously explained, and as will be seen by reference to FIGS. 3, 4, and 5, the rovings 10 and 14 are fed forwardly by the forward rolls 22 and 23 more rapidly than the continuous filament 11. As a result, the wrappings 31 are produced, FIG. 4 showing the start of the production of wrappings 31 and FIG. 5 showing a further stage in the production of the wrappings 31. It will be seen that the wrappings 31 start at the trailing end of the spun yarn which is produced and move forwardly of the yarn (a direction opposite to the direction in which the spun yarn segment 26 is produced). As spinning indicated by arrow 28 continues, the twist in filament 11 becomes tighter as is indicated at 32' and 32''.

FIG. 6 pictures the cockled slub an instant after breakage of the continuous filament 11 as a result of excessive twist. At the instant of breakage, the cockled slub 27 is relieved of the restraining influence of the continuous filament and moves forwardly as indicated by arrow 33 and the excess of rovings 10 and 14 wrap around the inner reverse wrappings 31 to form outer wrappings 34. The trailing end of the continuous filament segment 29 is still free of the rovings 10 and 14 at the stage of slub production indicated in FIG. 6.

The completed cockled slub is illustrated in FIG. 7 where it will be seen that the trailing end of the continuous filament segment 29 has been wrapped into the forward end of the new spun yarn segment 26 and the leading end of the continuous filament 11 just protrudes from between the nip of the forward rolls 22 and 23. As will be evident, the rovings 10 and 14 are spun together by the spinning indicated at 28 to produce a further spun yarn segment 26, the result of this further spinning restoring the conditions shown in FIG. 2. Finally, the spun yarn segment 26 will catch the forward end of the continuous filament 11 as pictured in FIG. 3 and the slub producing process will be repeated.

As will be evident, the cockled slubs of the invention possess extraordinary resistance to removal. In the invention, the cockle is constituted by wrapped rovings which are integral with the rovings constituting the body of the spun yarn and these slubs are reinforced with a segment of continuous filament. In many instances, the spun yarn of the invention will break before the cockled slubs which are formed therein can be pulled out.

While slub size and slub spacing may be controlled to some extent as has been indicated hereinbefore, the procedure of the invention causes slub formation and slub size to be random to a considerable extent. This appears to be because the exact instant and point of filament breakage will vary from one slub to the next and the precise instant of engagement between the spun yarn segment and the leading end of the slowly advancing continuous filament is not precisely predetermined. Since

the continuous filament is under tension with the forward rolls slipping and skidding with respect thereto, the forward movement of the continuous filament is not completely uniform and this appears to contribute to the random formation of slubs which is experienced in accordance with the invention.

Specimens of the slub-containing spun yarn of the invention have been quilled and woven as filling in a running warp and also as the warp, and still further with the slub-containing yarn of the invention constituting both fill and warp. Very few of the slubs were pulled out and most of the slubs withstood fabrication to produce decorated woven fabrics.

When woven into a fabric, the slubs provide a textured appearance which is uni-directional when the novel yarn is employed to constitute either the warp or the weft. It will be understood that the yarns of the invention may be employed, if desired, to constitute both warp and weft. In this event, a roughened appearance is obtained in the final woven product. The appearance characteristics and the hand of the fabrics which may be woven can be considerably varied by variation in the thickness, length, and spacing of the slubs in the yarn which is employed as will be evident to those skilled in the art.

The invention is illustrated in the accompanying table in which a regular roving is combined with a cored roving to produce slub-containing yarns in accordance with the invention.

of spun yarn of staple length fiber and cockled slubs interconnecting said spun segments, said cockled slubs comprising staple fiber wrapped about a segment of a pre-formed yarn.

2. A slub-containing spun yarn as recited in claim 1 in which said segments of spun yarn are constituted by at least one roving which is twisted.

3. A slub-containing spun yarn as recited in claim 1 in which said slubs comprise staple fiber wrappings which at least in part extend in a direction opposite to the direction of twist in said spun yarn segment.

4. A slub-containing spun yarn as recited in claim 3 in which said slubs comprise surface wrappings which in part extend in the same direction as the direction of twist in said spun yarn segment.

5. A slub-containing spun yarn as recited in claim 1 in which the trailing end of said pre-formed yarn segment is twisted into the forward end of the trailing spun yarn segment.

6. A slub-containing spun yarn as recited in claim 1 in which said slubs are of random spacing and size.

7. A slub-containing spun yarn as recited in claim 1 in which said pre-formed yarn is a continuous filament yarn.

8. A slub-containing spun yarn as recited in claim 1 in which said pre-formed yarn is a spun yarn.

Table

Core	Roving With Core	Regular Roving	Draft Ratio	Twist ¹		Front Rolls Weighting, oz.	Yarn Count ¹		Slub Character
				Nominal, t.p.i. Z	Actual, t.p.i. Z		Nominal	Actual	
100 denier cellulose acetate—low twist.	2.0 hank cellulose acetate.	2.0 hank cellulose acetate.	15:1	17	20	12	15/1	10/1	3X yarn diam. and 1/4" long.
100 denier rayon—low twist.	2.0 hank cellulose triacetate.	2.0 hank cellulose triacetate.	20:1	19	24	10	20/1	13/1	4X yarn diam. and 3/4" long.
100 denier rayon—40 t.p.i.—S twist.	do.	do.	15:1	13	21	16	15/1	7/1	4X yarn diam. and 1"-1 1/2" long.
75 denier cellulose acetate—low twist.	2.5 hank rayon.	2.5 hank cellulose acetate.	15:1	15	18	10	19/1	12/1	Small and short.

¹ Twists and counts are average values over considerable lengths.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

This application is a division of application Serial No. 757,374, filed August 26, 1958, and now Patent No. 3,044,251.

Having described our invention what we desire to secure by Letters Patent is:

1. A slub-containing spun yarn comprising segments

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