Sept. 11, 1962 M. R. LIVINGSTON 3,053,040

METHOD AND APPARATUS FOR PRODUCING A SLUBBED CORE YARN

Filed April 18, 1958

Fig. 1.

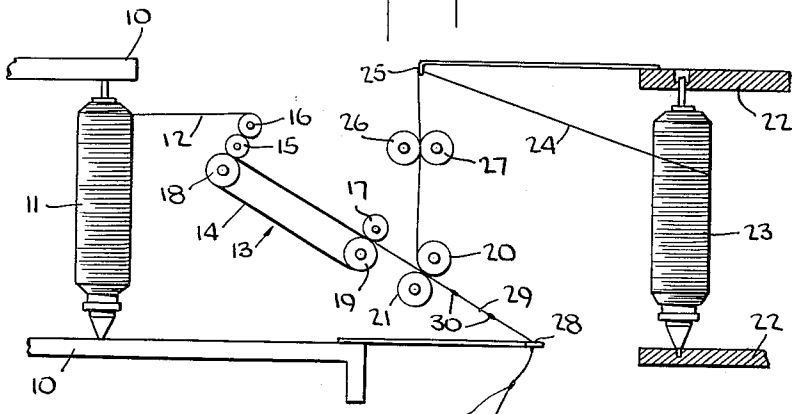



Fig. 2.

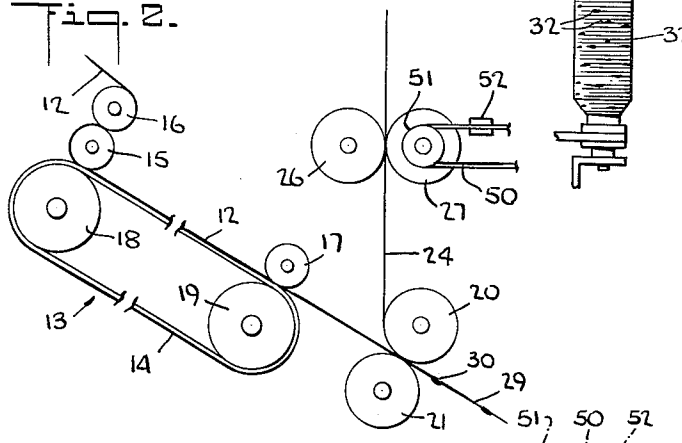
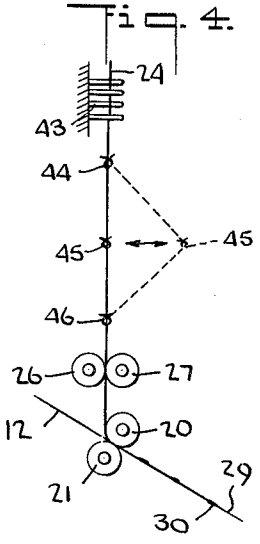



Fig. 4.



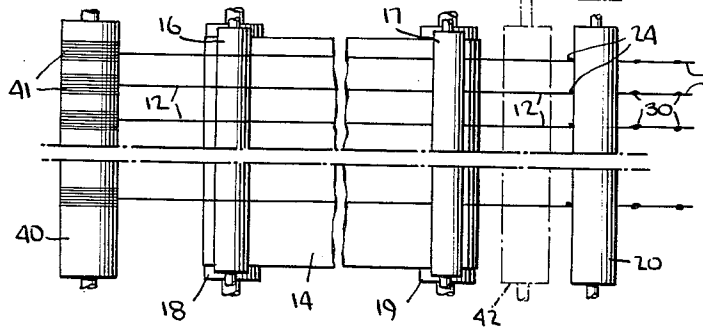




Fig. 3.

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3,053,040

# METHOD AND APPARATUS FOR PRODUCING A SLUBBED CORE YARN

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The present invention relates to novelty spun yarns in which a pre-formed continuous filament yarn or equivalent core is wrapped with discontinuous fibers of staple length with the staple fiber being non-uniformly distributed to produce localized regions in which the staple fiber is piled up, such localized regions being spaced apart along the length of the continuous core. These localized regions of staple fiber pile-up are consolidated with the core by twisting and are referred to as slubs. The slubs may be controlled and made relatively uniform. The invention includes the slub-containing core yarn which is produced as well as methods and apparatus for the production thereof.

In accordance with the invention, a pre-formed continuous filament yarn or spun yarn intended to form the core is passed together with at least one roving between the forward rolls of a drafting device. 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 core is then tensioned until the forward rolls of the drafting device slide or slip with respect to the core to cause the staple fiber to pile up and form a slub which is securely anchored to the core by twisting. The tension on the core is then relieved to permit the filament and the roving to move together and this procedure of producing slippage of the forward rolls with respect to the core is repeated periodically to form a plurality of slubs which are spaced apart along the length of the continuous filament or spun yarn core.

The weighting on the forward rolls is maintained at a low level sufficient to draft the roving and the tension applied to the core is regulated so that roll slippage with respect to the core may proceed without breaking the core. As will be understood, the tension which will be applied to the core is effectively limited by the roll weighting and the coefficient of friction between the forward rolls and the core. The exact value of the tension which should not be exceeded will depend upon the nature and denier of the core and can readily be determined.

The size of the slub which is produced may be varied from small pinhead size (seeds) to long and heavy slubs or long and thin slubs, and is controlled by various factors including the time during which a condition of slippage of the rolls with respect to the core is maintained. The extent of slippage (either partial or complete) is also a factor. Thus, the tension applied to the core and the duration thereof can be varied to control the size of the slubs which are produced. Similarly, the frequency of tension application and relief will vary the spacing of the slubs which are produced. A more complete discussion of slub variation and control will be presented hereinafter.

In conventional drafting and spinning, staple fibers are carded into a loose web and then condensed into a roving or sliver about an inch or less in diameter with the fibers generally extending longitudinally. One or more of these is normally passed beneath rear rolls moving slowly and then to front rolls moving rapidly so that the roving or sliver is drawn or drafted to an extent corresponding to the ratio of the peripheral speed of the front



rolls to the peripheral speed of the rear rolls. Thus, if the front rolls move at a rate tending to advance the roving 15 times faster than the rear rolls, the roving is elongated 15 fold. The elongated roving removed from the front rolls is then twisted and taken up on a bobbin as a singles spun yarn.

When one or more rovings are passed through the drafting device together with a yarn which passed 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.

The invention includes apparatus for producing the slub-containing core yarn, said apparatus including means to supply continuous filament or spun yarn to the forward rolls of a drafting device and means for periodically applying sufficient tension to the continuous filament or spun yarn to cause the forward rolls to slip with respect to the same.

The invention will be more fully understood from the description which follows, taken in conjunction with the accompanying drawing 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;

FIG. 2 is an enlarged diagrammatic side elevation illustrating the drafting device of the invention together with the structural features employed to modify this device to produce slub yarn in accordance with the invention;

FIG. 3 is a diagrammatic plan view illustrating preferred apparatus for carrying out the invention with the means for supplying the core being shown in phantom; and

FIG. 4 is a side elevation of a portion of an apparatus for varying the tension on the core.

Referring more particularly to FIG. 1, the numeral **10** indicates a bobbin stand or creel in which a plurality of bobbins **11** are mounted in conventional manner to supply rovings **12**. Bobbins **11** are rotatable so that when the roving **12** is pulled by the drafting device indicated generally by the numeral **13**, the bobbins **11** will rotate to unwind the rovings **12**.

The drafting device **13** is of conventional construction and includes an apron or endless band **14**, a pair of control rolls **15** and **16**, a weighted back roll **17** (desirably surfaced with rubber or rubber composition), and a pair of rollers **18** and **19** upon which the endless band or apron **14** is mounted. In advance of the apron **14** is a pair of forward rolls **20** and **21** which rotate at a greater velocity than the velocity of the endless band **14** and the back roll **17**. Thus, the roving **12** is elongated or drafted between the back roll **17** and the forward rolls **20** and **21** to attenuate the same and to parallelize along the length of the roving the staple fiber constituting the same. Alternatively, in place of the back roll-forward roll drafting system, the same ultimater effect can be produced on any other conventional drafting system such as a double apron or multi-roll drafting system.

Mounted on a second creel, rack, or bobbin stand **22** are bobbins **23** which carry a continuous core element **24**, the continuous core element being constituted by a continuous filament yarn or by a previously spun yarn. The continuous core element **24** being a yarn is characterized by its high tensile strength which permits it to withstand far greater tension than can possibly be applied to roving **12** without disrupting the same. The core element **24** advances from the bobbin **23** through an aper-

ture in the guide 25 and then to the forward rolls 20 and 21 of the drafting device 13, the rate of supply being controlled by the feed rolls 26 and 27. The feed rolls 26 and 27 are driven by any suitable means which may, for example, be mechanical or electrical, at a rate corresponding to the velocity of the forward rolls 20 and 21. The means for rotating the feed rolls 26 and 27 is diagrammatically indicated by belt 50 and pulley 51 although any suitable mechanism may be employed. Additionally, means diagrammatically indicated by brake 52, are provided to intermittently stop or slow the feed rolls 26 and 27 whereby the core element 24 is tensioned to cause the rolls 20 and 21 to slip relative to the core element.

Any suitable mechanism may be employed to retard the rotation of feed rolls 26 and 27. Thus, if feed rolls 26 and 27 are belt driven, as illustrated, it is simply necessary to apply a braking force to the belt drive or to the feed rolls 26 and 27 or to the belt 50. This latter form of braking is shown for simplicity of illustration. If the feed rolls 26 and 27 are electrically driven, the electric motor drive can be slowed as by reducing the electrical current supplied thereto, or by momentarily switching off the electrical current supply. A braking force may be applied in addition to the reduction or switching off of the electrical current.

Clutch mechanisms may be employed to disconnect the driving means employed from the feed rolls 26 and 27. As will be evident, almost infinite variation in fed roll drive retarding means may be effected and the particular mechanism which is elected constitutes a secondary feature of the present invention. It should be noted, however, that the weighting of the forward rolls 20 and 21 and the tension applied to the core element 24 by the feed rolls 26 and 27 should not be permitted to exceed a combination which will so stress the core element 24 as to break the same. At the same time, the weighting of the forward rolls 20 and 21 should be sufficient to maintain the drafting of the roving 12.

The braking (slowing or stopping) of the feed rolls 26 and 27 may be effected intermittently in a regular or irregular manner. Thus, braking forces may be applied after uniformly spaced periods of time and for uniform durations. On the other hand, suitable means may be employed to apply the braking force intermittently in a non-uniform or haphazard manner. Similarly, the braking force itself may be uniform or non-uniform and may be applied for the same or different durations so as to vary the length and thicknes of the slub which is produced. Again, any suitable mechanism may be employed to time the application of the braking force and its duration. These means are not shown since they form no part of the invention and since suitable timing mechanisms are conventional.

Only a single bobbin 11 and roving 12 are illustrated in FIG. 1. It will be understood that a plurality of rovings 12 may be withdrawn from separate bobbins and combined together in the same manner.

The composite yarn emerging from the forward rolls 20 and 21 is passed through an aperture in the yarn guide 28. The composite yarn is identified by the numeral 29 and it contains a continuous core constituted by the continuous filament or spun yarn 24 surrounded by discrete fibers from the drafted roving 12. At spaced apart points along the length of the composite 29, the discrete fibers from the roving 12 are bunched together and piled up as indicated at 30. The composite 29, after passing through the yarn guide 28 is led to a ring spinning device indicated generically by the numeral 31 in which the composite 29 is twisted to wrap the discrete fibers from the roving 12 around the core element 24 to provide securely attached slub portions 32 in a continuous core yarn surrounded by staple fibers, the composite 29 then being taken up on bobbin 33. Thus, in accordance with the present invention, a conventional spinning frame is modified by the addition of a creel or equivalent means to supply continuous filament or spun yarn (the core element 24), the addition of means intermittently to tension the continuous core such as the feed rolls 26 and 27 together with means to drive the feed rolls at substantially the same peripheral speed as the forward rolls 20 and 21 combined with means intermittently to retard the velocity of the feed rolls 26 and 27. Additionally, suitable guides accurately to position the roving 12 and the core element 24 may be included in the structure which is employed.

If each spindle or take up bobbin 33 is fed from separate bobbins 11 and from separate bobbins 23 with the various rolls 15, 16, 17, 20, 21, 26, and 27 extending the length of the frame, the cost of modifying existing spinning frames would be substantial, though it is feasible to effect such modification.

Preferably, the invention is performed employing apparatus as illustrated in FIG. 3 for the purpose of reducin the cost of modifying existing equipment.

Thus, small beams containing the same number of ends as are supplied on a standard spinning frame are prepared. The usual number of ends is about 240. In this manner, a sheet of yarns or rovings is supplied from a single beam. Referring more particularly to FIG. 3, the rovings 12 are supplied from the beam 40, with each roving 12 being separately wound on the beam 40 as is indicated by the numeral 41. In the same manner, the core elements 24 are wound on the beam 42.

The core elements 24 supplied from the beam 42 may be supplied to the forward rolls 20 and 21 by the feed rolls 26 and 27 which are illustrated in FIG. 1 and the action which has previously been described will take place. It is also possible to drive the beam 42 directly. In this form of the invention, the core elements 24 are supplied at a controlled interrupted speed by controlling the rotation of the beam 42. Since controlled feeding is directly accomplished by means of the positively controlled rotation of the beam 42, the feed rolls 26 and 27 may be eliminated.

It will be appreciated that since all of the yarns ends supplied from the beam 42 (when this beam is driven) or supplied by the feed rolls 26 and 27 are simultaneously acted upon in the same manner, all of the slub-containing yarns which are produced by a given spinning frame will be substantially identical.

In place of varying the rate at which the core element 24 is fed by varying the speed of rolls 26 and 27, these rolls may operate at a constant speed from about 20–50% slower than the peripheral speed of forward roll 20. As shown in FIG. 4 the element 24 first passes through a tensioning device such as a tension gate 43 and then through a series of guides 44, 45, and 46. Guide 45 intermittently is displaced to the position shown in phantom and is rapidly returned to its initial position so as to vary the length of the path which the core element travels and thus to vary its speed. This apparatus is especially suited for producing tiny seed slubs at closely spaced intervals.

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 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 are employed as will be evident to those skilled in the art.

The invention illustrated in the table which follows in which pre-formed yarns are combined as the core with rovings as described to produce slub-containing yarns.

*Table*

| | Core | Rovings | Draft Ratio | Front Roll Weighting, oz. | Percent Reduction in Core Feed Rate | Time of Core Feed Reduction, sec. | Interval Between Braking, sec. | Slub Character |
|---|---|---|---|---|---|---|---|---|
| 1 | 100 d. Nylon | 2 ends 2.0 hank Acetate. | 15:1 | 6 | 100 | 0.1 | 1.0 | Short medium slubs spaced 8–10″ apart. |
| 2 | 100 d. High Tenacity Rayon. | 2.0 hank Cellulose Triacetate. | 10:1 | 6 | 50 | 0.5 | 0.5 | Thick and thin yarn—5″ thick and 5″ thin |
| 3 | 50 d. Rayon | 3.0 hank Acetate | 10:1 | 4 | 30 | 0.1 | variable | Fine seed slubs at varying spacings. |
| 4 | 100 d. Acetate | 1.0 hank Acetate/Rayon. | 12:1 | 2 | 35 | 0.1 | 0.2 | Small seed slubs closely spaced. |
| 5 | 100 d. High Tenacity Rayon. | 2 ends 2.5 hank Cellulose Triacetate. | 18:1 | 6 | Variable | Variable | Variable | Slubs of many sizes, spacings and 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 my invention.

Having described my invention, what I desire to secure by Letters Patent is:

1. A method of producing a slubbed core yarn comprising feeding a yarn to serve as a core, taking up said yarn with twist, feeding at least one roving of staple length fibers and taking it up with said yarn thereby to produce a core yarn, and periodically reducing the rate of feed of said yarn whereby said roving produces a slub about said core.

2. A method as recited in claim 1 in which said roving is fed by a rear yarn-carrying member, taken up with said yarn by a forward yarn-carrying member and drafted continuously between said rear and forward members.

3. A method of producing a slubbed core yarn comprising supplying to a yarn-carrying member at least one roving of staple length fibers, supplying to said member together with said roving a yarn to serve as a core, periodically tensioning said core to cause said member to slip relative to said core whereby the fibers of said roving are caused to pile up about said core during slippage, and twisting the core and roving fibers issuing from said member.

4. A method as recited in claim 3 in which said member is weighted sufficiently to draft said roving but insufficient to break said core.

5. A method as recited in claim 3 in which said core is positively fed to said member at a speed corresponding with the peripheral speed of said member and said feed is intermittently retarded to increase the tension on said core.

6. A method as recited in claim 3 in which said core is positively fed to said member by means operating at a substantially constant speed, and the path of travel of said core is intermittently increased to increase the tension on said core.

7. A method as recited in claim 3 in which said core is constituted by a continuous filament yarn.

8. A method as recited in claim 3 in which said core is constituted by a spun yarn.

9. A method as recited in claim 3 in which said core is fed to said member along with a single roving.

10. A method as recited in claim 3 in which said core is fed to said member along with a plurality of rovings.

11. A method of producing a slubbed core yarn comprising drafting between forward and rear yarn-carrying members at least one roving of staple length fibers, supplying to said forward member together with said roving a yarn to serve as a core, periodically tensioning said core to cause said forward member to slip relative to said core whereby the fibers of said roving are caused to pile up about said core during slippage, and twisting the core and roving fibers issuing from said member.

12. Apparatus for producing a core yarn comprising a yarn-carrying member, means to supply at least one roving of staple length fibers to said member, means to supply a core to said member to issue from said member together with said roving, means periodically to retard the supply of said core to cause said member to slip intermittently relative to said core, and means to twist the core and roving fibers issuing from said member.

13. Apparatus as recited in claim 12 in which said means to supply said core includes a pair of feed rolls, means to drive said feed rolls at a peripheral speed approximately equal to that of said member, and means periodically to retard said feed rolls.

14. Apparatus as recited in claim 12 in which said means to supply said core includes a pair of feed rolls, means to drive said feed rolls at a substantially constant speed, and means intermittently to increase the path of travel of said core to increase the tension on said core.

15. Apparatus as recited in claim 12 in which said means to supply said core comprises a beam having a plurality of said cores wrapped thereabout, means to drive said beam and thereby to feed said cores at a speed approximately equal to the peripheral speed of said member, and means periodically to retard said beam.

16. Apparatus as recited in claim 12 in which said means to supply at least one roving to said member includes a beam having a plurality of rovings wrapped thereabout and means for feeding a plurality of rovings to said member in conjunction with each core.

17. Apparatus for producing a core yarn comprising drafting means comprising forward and rear drafting rolls, means to supply at least one roving to said rear roll, means to supply a core to said forward roll whereby said roving being drafted and said core will be carried by said forward roll together so that a composite yarn comprising said core and said roving will leave said forward roll, means periodically to retard the supply of said core to cause said forward rolls to slip intermittently relative to said core, and means to twist the drafted roving and core issuing from said forward roll.

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