March 5, 1963 F. C. FIELD, JR 3,079,746

FASCIATED YARN, PROCESS AND APPARATUS FOR PRODUCING THE SAME

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FIG. 2

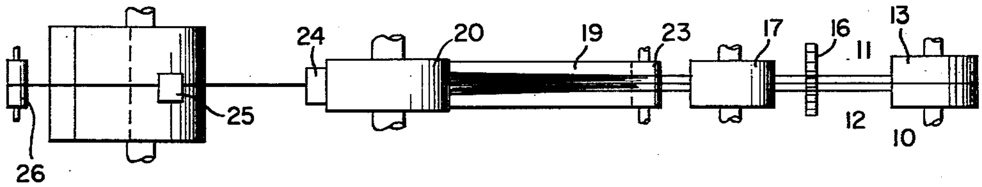

FIG. 1

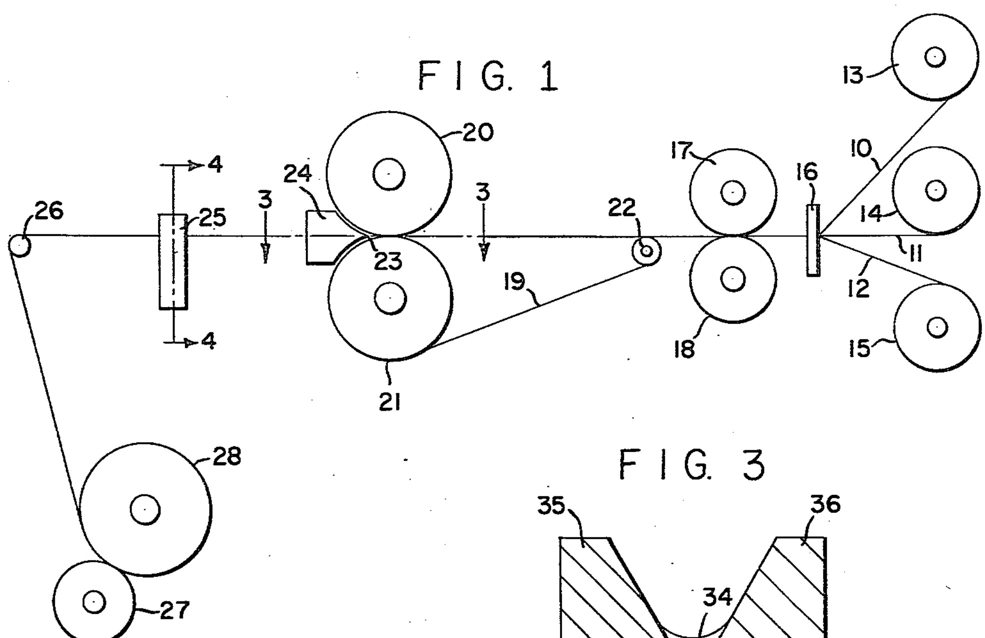

FIG. 3

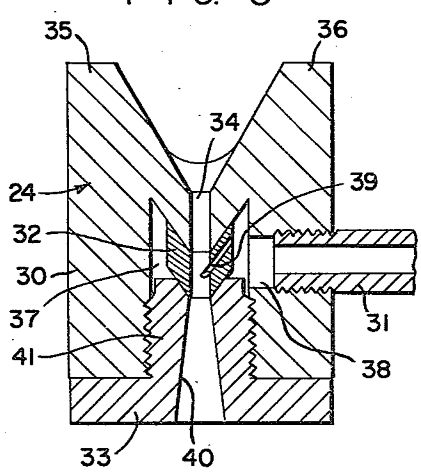

FIG. 4

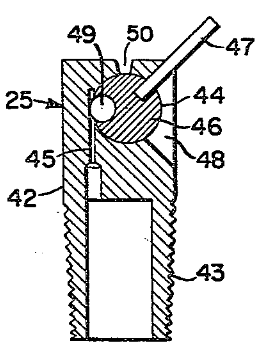

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FIG. 7

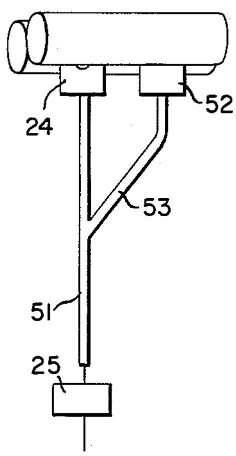

FIG. 5

FIG. 6

FIG. 8

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FASCIATED YARN, PROCESS AND APPARATUS FOR PRODUCING THE SAME

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19 Claims. (Cl. 57—51)

This invention relates to novel yarn spun from discontinuous filaments, and to a process and apparatus for producing it. More particularly, the invention relates to draft spinning of multifilament strands, such as sliver, roving, low twist yarn or tow composed at least in part of staple fiber or other discontinuous organic textile fibers, wherein a rotating fluid torque jet is used to permanently consolidate the filaments into a yarn having a core of fibers bound together as a compact bundle by surface wrappings of a minor proportion of the fibers, and to the novel yarns which result. These products will be referred to hereinafter as fasciated yarn. Discontinuous fibers may be used which are naturally occurring or prepared from continuous filaments by cutting or stretch-breaking.

It is an object of this invention to prepare fasciated yarn in various novel and useful forms. Another object is to provide efficient processes for preparing fasciated yarn from multifilament strands. Another object is to provide such a process for use in combination with conventional staple fiber drafting procedures to replace true twisting for consolidating the yarn. Another object is to provide a direct spinning process for preparing fasciated yarn in which discontinuous filaments are provided by stretch-breaking continuous filaments. A further object is to provide such processes suitable for operation at unusually high speeds to produce a wide range of yarn counts, including fine-count yarns, without the use of true twist or adhesives. A still further object is to provide apparatus for practicing the novel processes. Other objects will become apparent from the specification, the drawings and the claims.

The novel fasciated yarn products of this invention are characterized by having a predominance of true twist in the surface wrappings, the core of discontinuous fibers being substantially free from true twist, and by surface fibers twisted tightly about the bundle of core fibers in irregular helices of 10° to 80° angle to form a substantially continuous binding of helically twisted fibers along the core bundle. Twist can usually be observed in the core bundle but this is an alternating S and Z twist having a net twist value of substantially zero in terms of true twist. This false twist and/or filament intermingling may help to consolidate the yarn, but the fibers are bound together primarily by the surface wrappings. The surface wrappings may completely cover the core bundle but are preferably composed of a minor proportion of the yarn fibers with the individual fibers randomly twisted about the core bundle. Since the surface fibers form a substantially continuous binding along the yarn, only a small proportion is needed to provide adequate yarn strength. A lea product of 500 is readily obtained with fibers averaging at least 2.5 inches in length, and can also be obtained with fibers as short as 1 inch in length when using the special apparatus disclosed subsequently. Much stronger yarns are obtained with fibers averaging 4 to 10 inches in length, which are readily formed in the direct spinning process by stretch-breaking continuous filaments.

These novel fasciated yarns are produced, in accordance with this invention, by a process in which a strand of fibers is drafted, as in conventional direct spinning, and the fibers are then consolidated into a yarn by fluid twisting with a torque jet in a manner which introduces a predominance of true twist in surface fibers by twist transference. The fluid treatment is a form of false twisting, since the amount of yarn rotation introduced in one direction prior to the torque jet is equalled by the amount of yarn rotation in the other direction after the jet. However, the process is conducted to introduce twist non-uniformly across the fiber bundle so that the subsequent untwisting of the yarn as a whole provides a net twist in surface fibers of the yarn. The previous slow methods of consolidating the fibers into yarn by true twist are avoided, making high production speeds practical in commercial operation.

In accordance with the present process, a drafted bundle of staple or other discontinuous fibers is prepared in conventional manner on a direct spinning frame, except that the bundle is not condensed. Instead the supply is drafted and expanded into a ribbon-shaped bundle of parallel fibers passing through the final drafting rolls. The fibers may be supplied to the process as a strand of one or more ends of roving, tow or low twist yarn of discontinuous organic textile fibers, or as a strand of continuous filaments which are stretch broken into fibers during drafting. The supply and draft ratio should provide a bundle after drafting of at least 30 denier in size. A cotton count of 180 corresponds to about 30 denier. The ribbon-shaped bundle of drafted fibers should be at least 0.3 inch wide. This result is most readily achieved by feeding a plurality of ends of roving, tow or yarn in parallel to the drafting operation.

As the fibers leave the final drafting rolls they are picked up by an aspirating jet of compressible fluid and forwarded to a twisting jet which backs up twist through the aspirating jet. The twisting jet applies a torque to the fiber bundle by means of a vortex formed with a jet of compressible fluid of at least ½ sonic velocity. Since the bundle is ribbon-shaped as it leaves the front rolls, the twist is applied non-uniformly across the bundle. An inner core of fibers starts to twist first and outer fibers are then caught up by the twisting core bundle to receive a lesser amount of twist. The fibers are initially consolidated into a yarn having a highly twisted core and less highly twisted surface fibers. The desired effect is achieved when the ribbon-shaped bundle is at least 0.3 inch wide as it leaves the drafting rolls, and may be much wider. The aspirating jet should be arranged to guide the outer fibers so that they will become entrained with or caught up by the twisting core fibers and receive twist. It may be desirable, particularly with short fibers, for the aspirating jet passageway to extend from the drafting rolls toward the twisting jet for a distance greater than the length of the fibers in order to consolidate the fibers efficiently into a yarn.

The twisted yarn arriving at the twisting jet is then untwisted by the jet as the yarn travels beyond the jet to take-up rolls. In conventional false-twisting processes the twist is uniform throughout the yarn and all of the twist initially introduced by the false twister is removed from the yarn during passage from the false twister to take-up rolls. Because the twist is not uniformly introduced in the present process, however, the less highly twisted surface fibers become untwisted first and then twist in a reverse direction as untwisting of the core bundle continues. This phenomenum will be referred to as twist transference. Since the surface fibers have been randomly caught up in the yarn at different times to receive varying amounts of twist, twist transference will result in fibers twisted helically about the core bundle at varying helix angles. In general, depending upon the relative speeds of yarn travel and twisting, helix angles from 10° to 80° result. Portions of surface fibers may be doubled back on the yarn as the yarn passes through the twisting jet and result in a few helical wrappings in a direction opposite to the others, e.g., with some fiber wraps in an S direction and others in a Z direction.

In the drawings, which illustrate specific embodiments of the invention,

FIGURE 1 is a side elevation of one form of apparatus for use in the process of the invention,

FIGURE 2 is a corresponding top view of the apparatus shown in FIGURE 1,

FIGURE 3 is an enlarged cross-section of the aspirating pick-up jet shown in the above figures, the section being taken on line 3—3 of FIGURE 1,

FIGURE 4 is an enlarged cross-section of the twisting torque jet of the above apparatus, the section being taken on line 4—4 of FIGURE 1,

FIGURE 5 shows a fasciated yarn product on an enlarged scale,

FIGURE 6 shows another form of fasciated yarn product,

FIGURE 7 shows a modified form of aspirating pick-up which is used when fiber bundles from separated locations on front drafting rolls are consolidated into a single fasciated yarn, and

FIGURE 8 shows such a yarn product on an enlarged scale.

Suitable raw materials for the yarns of this invention include all synthetic and natural organic textile fibers and combinations thereof. Natural fibers that may be used include cotton, wool, silk, ramie, flax, jute, hemp and the like. Suitable synthetic fibers include polyamides such as poly(epsilon caproamide) and poly(hexamethylene adipamide), poly(undecanoamide) and poly(heptanoamide); cellulose esters, e.g., cellulose acetate; polyesters; particularly polyesters of terephthalic acid or isophthalic acid and a lower glycol, e.g., poly(ethylene terephthalate); poly(hexahydro-p-xylylene terephthalate); polyalkylenes, e.g., polyethylene, linear polypropylene, etc.; polyvinyls and polyacrylics, e.g., polyacrylonitrile, as well as copolymers of acrylonitrile and other copolymerizable monomers. Copolymers of ethylene terephthalate containing less than 15% combined monomers other than ethylene terephthalate and copolymerizable with ethylene terephthalate are also useful in practicing this invention.

These fibers can be supplied in a number of forms for processing into the fasciated yarns of this invention. Suitable forms of strands include one or more ends of roving, sliver, tow, or low twist staple yarns. The term "tow" includes deniers of 50 or less to 500,000 or more. The only criterion to be met is that the tow must be suitable for handling in the drafting or stretch-breaking zone of the process so that it can be drafted to the proper degree to form the desired count or size of fasciated yarn product. The process is thus suitable for preparing a wide range of end products for various uses served by conventional spun staple yarns. Obviously, it is possible to process strands of discontinuous fibers without drafting but normally such a modification will not allow high enough productivity per position to be economically attractive.

A direct spinning, stretch-break, drafting system is preferably used to prepare discontinuous fibers for consolidation into fasciated yarn. Continuous tows and the resulting partially continuous sliver can be controlled and drafted at exceptionally high process speeds. By using a direct spinning system for stretch-breaking continuous filaments, there is no zone of complete fiber discontinuity before consolidation; hence fiber control problems resulting from windage and static are appreciably reduced, thus making production speeds in the range of 100 to 1500 yards per minute practicable. Stretch-breaking during drafting will more readily provide fibers averaging 4 inches in length and is essential for fibers of 10 inches and above. Long fibers provide high strength products. A particularly useful raw material for this process is a tow prepared specifically for stretch-breaking. Such a tow can contain a programmed or random series of weak points both with respect to the filaments and the yarn bundle, so that particularly uniform stretch-breaking occurs. This gives a superior product from the viewpoint of uniformity, strength, and improved optical and tactile properties.

Referring to FIGURES 1 and 2, ends of tow **10**, **11** and **12** are supplied from packages **13**, **14** and **15**, respectively. The tow ends are led through guide member **16** to back rolls **17** and **18** of the drafting section of a conventional direct spinning frame, pass through the nip of the rolls onto a supporting apron **19**, and are conveyed to front drafting rolls **20** and **21**. A single bottom apron is shown which encircles and is driven by the bottom front roll **21**. An idler roll **22** supports the apron in front of the back drafting rolls **17**, **18**. As shown in FIGURE 2, the guide member **16** is arranged to direct the tows so that they lie side-by-side on the apron and are flattened into a single ribbon-shaped bundle **23** of parallel fibers during passage through the nip of front drafting rolls **20**, **21**. Any of the conventional means for guiding fibers from the back rolls to the front rolls may be used, instead of the single bottom apron shown, provided that the fibers are fed between the front rolls as a ribbon at least 0.3 inch wide. The spacing and relative speeds of the front and back rolls may also be in accordance with conventional practice for stretch breaking and drafting a continuous filament feed, or for drafting a staple fiber feed. The usual spacing of about 12 inches and speeds to provide drafting ratios in excess of 10 times are suitable but may be varied widely.

The fibers are picked up at the nip of front rolls **20**, **21** by an aspirating jet **24** and forwarded to a twisting jet **25** to effect consolidation into the fasciated yarn product. The yarn then passes over a guide roller **26**, also serving as a twist stop, and is wound up on package **27**, which is surface driven by roll **28**. The primary function of aspirating jet **24** is to remove the fibers from the front drafting rolls so as to prevent roll wraps and guide the fibers into the bundle being twist-consolidated into yarn. As shown in more detail in FIGURE 3, the jet includes a body portion **30**, a fluid inlet tube **31**, a fluid guide ring **32**, and an exhaust member **33**. The body **30** has an inlet passageway **34** on each side of which are fins **35** and **36** shaped to the contour of rolls **20**, **21** so as to fit snugly between the rolls and extend nearly into the nip. The inlet passageway extends into a chamber **37**. Fluid tube **31** is screwed into an opening **38** through the side of the body into this chamber. Ring **32** is provided with a plurality of holes **39** which direct fluid tangentially and angularly into the central opening. The exhaust member **33** has a venturi passageway **40** through a threaded projection **41** which is screwed into chamber **37** of the body to hold the ring in place. The inlet passageway **34**, the ring, and the venturi passageway then provide a continuous passageway through which the fibers are forwarded to the twisting jet.

The twisting jet is shown in FIGURE 4. The body block **42** has a projecting nipple **43** which screws into the source of fluid. A cylindrical opening **44** is drilled through the block at right-angles to the axis of the nipple. A small fluid passageway **45** directs fluid tangentially into opening **44** from the nipple. A cylindrical member **46** fits snugly into opening **44**; it is arranged to be rotated within the opening by handle **47** projecting through a slot **48** in the body block. A circular yarn passageway **49** is drilled through member **46** parallel to the cylindrical surface so as to leave an opening along one side of the passageway. Member **46** is turned by means of handle **47** to align this opening with a string-up slot **50** through block **42** for insertion of yarn at start up. The member is then rotated back to the operating position shown. Fluid entering tangentially into yarn passageway **49** through fluid passageway **45** creates a vortex which exerts a twisting torque on the yarn.

The following example illustrates a preferred embodiment of the invention when operating the process with the apparatus described above:

Example 1

Three ends of 1300 denier, 900 filament, zero twist tow of polyethylene terephthalate continuous filaments are fed into apparatus as shown in FIGURES 1 and 2 at 14 yards per minute. Filaments having a high variable elonagtion at break, varying from 70% to 130%, are preferred to facilitate stretch-breaking. The tows are fed through the nip of the back rolls in slightly spaced-apart relation so that the strand has a width of not less than ¼ inch between filamments at the extreme sides. The filaments are broken and fanned sufficiently in the stretch-break-drafting zone to form a ribbon of parallel discontinuous fibers not less than 5/16 inch wide which is fed through the nip of the front rolls. These rolls are driven at 533 yards per minute surface speed to provide a draft ratio of 38, i.e., 38 times the surface speed of the back rolls. The distance between front and back rolls is 12 inches.

The fibers of the ribbon-shaped bundle are picked up from the front rolls by an aspirating jet, illustrated in FIGURE 3, supplied with room temperature air at 50 pounds per square inch gage air pressure. The twisting jet illustrated in FIGURE 4 is mounted 2 inches from the aspirating jet and is also supplied with room temperature air at 50 p.s.i.g. The jets are mounted in the same plane as the drafting plane, centered on the drafting zone, and with their twisting torques acting in the same direction. With this arrangement, the aspirating jet initiates twisting to consolidate the fibers into a yarn and forwards outer fibers of the ribbon in a manner which causes them to form surface wraps about a more highly twisted core bundle. The second twisting jet applies a stronger torque to twist the core bundle to a maximum twist angle and then remove core twist in a manner which provides twist transference to the surface wraps as the yarn passes beyond the jet. The yarn is wound up at a speed of 500 yards per minute, so that there is an overfeed of 5.5% with respect to the wind-up.

The yarn product is illustrated in FIGURE 5. The fasciated structure of unidirectional helical wrappings about a core bundle substantially free of true twist is clearly evident. The surface fibers are randomly twisted tightly about the core fibers in irregular helices of varying helix angles to form a substantially continuous binding of helically twisted fibers along the core bundle. The yarn is 50 cotton count, has a minimum lea product of 2500 and an index of irregularity of not more than 1.3. Relative humidity is maintained at about 50%.

The lea product is equal to the cotton count times the strength in pounds of a 120 yard skein of yarn wound with 1.5 yards per turn. The index of irregularity is measured as described in the "Manual for the Uster Evenness Tester" (Uster Corp., Charlotte, North Carolina) and a value of 1.3 indicates a high degree of uniformity in comparison with commercial spun yarns.

Example 2

Example 1 is repeated, but using undrawn tows of 3500 denier and 1170 filaments per tow, of polyethylene terephthalate, and with the draft ratio increased to 73 to give a production speed at windup of 1100 yards per minute. The air pressure to the twisting jet **25** is increased to 100 p.s.i.g. The fasciated yarn product is similar to that of Example 1 but has a cotton count of 39, a lea product of 2400, and an index of irregularity of 1.8.

Example 3

Example 1 is repeated, but using 2 ends of the 1300 denier, 900 filament tow, a draft ratio of 40, and a windup speed of 250 yards per minute. The fasciated yarn product is similar to that of Example 1, but has a cotton count of 80, a lea product of 3700, and an index of irregularity of 1.4.

Example 4

Example 1 is repeated, but using 10 ends of the 1300 denier, 900 filament tow, drafted into a ribbon-shaped bundle at least ¾ inch wide at a draft ratio of 27, the windup speed being 250 yards per minute. The jet air pressure is 40 p.s.i.g. The fasciated yarn product is similar to that of Example 1, but has a cotton count of 10, a lea product of 3400, and an index of irregularity of 1.6.

Example 5

A novelty fasciated yarn is produced, with apparatus as in Example 1, from a single end fed of 80,000 denier, 40,000 filament tow of polyacrylonitrile. The tow is drafted into a ribbon-shaped bundle at least 2 inches wide at a draft ratio of 21 and a speed at the front drafting rolls of 102 yards per minute. The air pressure to the jets is 50 p.s.i.g. and the yarn is wound up at 100 yards per minute. The fasciated yarn product is illustrated in FIGURE 6. In addition to the unidirectional wrappings as shown in FIGURE 5, there are also tight spots wherein the yarn bundle is compacted by concurrent **S** and **Z** helical twists in the surface fibers. The yarn has a cotton count of 1.4 and a lea product of 1322.

Example 6

Two ends of 700 denier, 460 filament, zero twist tow of polyacrylonitrile are drafted over a hot plate at 105° to 110° C. into a ribbon-shaped bundle 5/16 inch wide at a draft ratio of 11 and a front roll speed of 105 yards per minute. The apparatus is as in Example 1, but twisting jet **25** is supplied with hot air at 100° C. and 100 p.s.i.g. The yarn is wound up at 100 yards per minute. An extremely uniform fasciated yarn is obtained which is exceptionally free from the fuzz characteristic of conventional acrylic spun yarns. It has a cotton count of 44, a lea product of 3600, and an index of irregularity of 1.8.

Example 7

Example 6 is repeated with a feed of 4 ends of the tow and with the twisting jet supplied with steam at 166° C. and 100 p.s.i.g. A similar product is obtained which has a cotton count of 22, a lea product of 4000, and an index of irregularity of 1.8.

Example 8

Eight ends of 1200 denier, 200 filament, zero twist, polytetrafluoroethylene tow are fed to apparatus as in Example 1 and drafted into a ribbon-shaped bundle ¾ inch wide, using a draft ratio of 8 and front roll speed of 125 yards per minute. The jets are supplied with room temperature air at 50 p.s.i.g. and a 4-cotton count yarn product is wound up at 120 yards per minute. The fasciated yarn has an unusually high proportion of surface wrappings as well as loops and other convolutions.

Example 9

Two ends of 1300 denier, 900 filament, polyethylene terephthalate tow, and one end of 2200 denier, 1500 filament, viscose rayon tow are fed to apparatus as in Example 1 and drafted into a ribbon-shaped bundle 7/16 inch wide, using a draft ratio of 39 and a front roll speed of 267 yards per minute. The jets are supplied with room temperature air at 50 p.s.i.g. and a 42-cotton count fasciated yarn product is wound up at 250 yards per minute. The appearance, strength and uniformity are similar to the product of Example 1.

Example 10

Two ends of 2 hank roving, combed cotton are fed separately to spinning apparatus which differs from that of FIGURES 1 and 2 in having an additional aspirating jet for picking up fibers from the front drafting rolls. The two jets forward the fibers into a common manifold **51** for consolidation into a single yarn, as shown in FIG-

URE 7. The additional jet **52**, which is a non-twisting aspirating jet or sucker gun, is used for blowing separated fibers through tubular pasageway **53** into a midpoint of manifold **51**. The manifold is arranged to extend the yarn passageway **40** of aspirating jet **24** nearly to the twisting jet **25**. Fibers entering the manifold from passageway **53** are maintained in contact with the partially consolidated bundle of fibers from jet **24** until loose fibers become attached sufficiently to form surface wrappings during the twist transference which takes place after the yarn passes twisting jet **25**. This arrangement is particularly useful when spinning relatively short naturally occurring fibers, or for forming surface wraps of an entirely different type of fibrous material about the main yarn bundle.

The two ends of cotton roving are separately drafted, at a draft ratio of 13 and a front roll speed of 45 yards per minute, and are picked up separately by the aspirating jets. These jets and the twisting jet **25** are supplied with room temperature air at 50 p.s.i.g. The fibers are consolidated into a yarn with fibers from one end of roving predominating in the core bundle and fibers from the other end predominating in the surface wrapping. The fasciated yarn product has a cotton count of 13 and is wound up at 40 yard per minute. It is illustrated in FIGURE 8. About 50% of the yarn fibers are unidirectionally wrapped about the surface to completely cover and compact the core bundle.

Example 11

Example 10 is repeated with 2 ends of 1 hank roving wool blend (¼ wool, ¾ cotton) and a draft ratio of 11.5, the other conditions being the same. A 5-cotton count fasciated yarn is obtained of the type illustrated in FIGURE 8.

Example 12

Example 10 is repeated with 2 ends of ¾ hank roving silk and a draft ratio of 24, the other conditions being the same. A 9-cotton count fasciated yarn is obtained of the type illustrated in FIGURE 8.

Example 13

The apparatus shown in FIGURES 1 and 2 is also suitable for consolidating strands of distinct types of fibers into a yarn wherein one type of fiber predominates in the core and another type of fiber predominates in surface wrappings. Three ends of 1300 denier, 870 filament, polyethylene terephthalate tow are drafted into a ribbon-shaped bundle of parallel fibers as in Example 1, but using a draft ratio of 29 and a front drafting roll speed of 112 yards per minute. One end of 70 denier, 34 filament, ½ Z twist 66-nylon yarn is added at the front rolls and the combination is consolidated by twist transference as in Example 1, the yarn blend being wound up at 95 yards per minute. A fasciated yarn is obtained wherein helical surface wrappings are of polyethylene terephthalate fibers wrapped primarily unidirectionally about a core of the nylon combined with polyethylene terephthalate fibers. The yarn has a cotton count of 22, a lea product of 2376, and an index of irregularity of 1.3.

Instead of the single end of 70 denier nylon yarn, a strand of glass or metallic filaments can be introduced to provide a product which includes glass filaments or wire in the core. This modification is useful for providing products of greater strength or dimensional stability or resistance to ultraviolet light, and for insulating metal conductors.

Example 14

Example 13 is repeated, but replacing the nylon with one end of 420 denier spandex yarn, prepared as disclosed in Example I of U.S. Patent No. 2,999,839, issued September 12, 1961, to Arvidson, Jr., and Blake, and elongated 5.4 times. The jets are supplied with room temperature air at 60 p.s.i.g. An elastic fasciated yarn is obtained having a spandex fiber core and surface wrappings similar to those of Example 13.

Example 15

Example 13 is repeated, but replacing the nylon with one end of 150 denier, 40 filament, 2½ Z twist cellulose acetate yarn introduced at the back rolls and drafted with the polyethylene terephthalate fibers at a draft ratio of 39 with a front drafting roll speed of 267 yards per minute. The acetate end alternately snap breaks and drafts to give intermittant slubs. The product, consolidated by twist transference, is wound up at 250 yards per minute. A fasciated yarn is obtained which has slubs held in place by surface wrappings. When the yarn is woven into fabric the effect is similar to that of Duppioni silk.

The novelty and utility of the products are apparent from the examples and accompanying drawings. Over and above the creation of new yarn forms from discontinuous fibers, the primary advantages of the process are three:

(1) High speed of operation,
(2) Uniformity of product, and
(3) Fine-count yarns are readily produced.

The high-speed implications of this process are of great importance. Previous spinning processes must be operated at slow speed primarily because of the speed limitation imposed by the spindle for inserting true twist into a discontinuous yarn bundle. The conventional true twist yarns currently being produced achieve consolidation by twist levels of 10 to 20 turns per inch and higher. Since the consolidation in the process of the present invention occurs via false-twisting techniques which, in the case of torque jets, can easily exceed a million twists per minute, it is clear that the process easily provides 10 to 100 or more times the productivity of the prior art.

Since many different embodiments of the invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited by the specific illustrations except to the extent defined in the following claims.

I claim:

1. A fasciated yarn comprising discontinuous organic textile core fibers bound together as a compact bundle by surface wrappings of discontinuous organic textile fibers, characterized by a predominance of true twist in the wrappings and substantial absence of true twist in the core bundle, and by surface fibers twisted tightly about the bundle of core fibers in irregular helices of varying helix angles within the range from 10° to 80° to form a substantially continuous binding of helically twisted fibers along the core bundle, the individual surface fibers being randomly twisted about the core bundle.

2. A fasciated yarn as defined in claim 1 wherein the fibers average at least one inch in length and the yarn has a strength of at least 500 lea product.

3. A fasciated yarn as defined in claim 1 wherein the core includes continuous filaments.

4. The twist-transference, fluid twisting process for producing a fasciated yarn which comprises continuously feeding a substantially zero twist strand of organic textile fibers to drafting rolls of a conventional direct spinning process, drafting the strand to form an at least 30-denier bundle of discontinuous fibers and expanding the bundle into a ribbon-shaped bundle of parallel fibers at least 0.3 inch wide at the final drafting rolls, sucking the fiber ribbon directly from the rolls through an aspirating jet of compressible fluid and false twisting the ribbon into a yarn by feeding the bundle through a vortex formed by a jet of compressible fluid of at least ½ sonic velocity to back up twist through the aspirating jet and cause outermost fibers of the ribbon to be caught up by the twisting bundle after a partially twisted core of the other fibers has been formed so that the yarn arriving at the twisting jet has a highly twisted core and less highly twisted surface fibers, removing false twist from the yarn during passage of the yarn

beyond the twisting jet to untwist the core and reverse the direction of twist in less highly twisted surface fibers, and collecting the yarn.

5. A process as defined in claim 4 wherein the strand fed to the drafting rolls is a roving of staple fibers.

6. A process as defined in claim 4 wherein the strand fed to the drafting rolls is composed of continuous filaments which are stretch-broken during drafting into fibers averaging at least 4 inches in length.

7. A process as defined in claim 4 wherein the aspirating jet, in addition to sucking the fibers from the final drafting rolls, also initiates false twisting in the fiber ribbon.

8. A process as defined in claim 4 wherein the false twisting jet twists the yarn at a rate of at least 200,000 turns per minute and the yarn is fed through at a speed of 100 to 1500 yards per minute.

9. A process as defined in claim 4 wherein the aspirating jet is located as close as possible to the final drafting rolls and the false twisting jet is spaced up to 3 inches away.

10. A process as defined in claim 4 wherein the strand fed to the drafting rolls is composed of continuous filaments fed directly from a drawing operation which are stretch-broken into fibers averaging at least 4 inches in length, thereby providing a coupled draw, draft and twist process.

11. A process as defined in claim 10 wherein the filaments are spun, drawn, stretch-broken, drafted and twisted in a continuous coupled operation.

12. A process as defined in claim 4 wherein the strand fed to the drafting rolls comprises at least two ends of at least 500 deniers each which are drafted and spun into a single fasciated yarn.

13. A process as defined in claim 4 wherein the strand is composed of filaments which are heated and stretch-broken into fibers averaging at least 4 inches in length.

14. The twist-transference, fluid twisting process for producing a fasciated yarn which comprises continuously feeding two bundles of textile fibers separately to drafting rolls of a conventional direct spinning process and drafting to form two separate ribbon-shaped bundles of parallel fibers, each bundle being at least 30 denier and forwarding one bundle from the rolls by means of an aspirating jet of compressed fluid directly through a straight yarn passageway to a vortex formed by a jet of compressible fluid of at least ½ sonic velocity to back up twist in the bundle while forwarding the other bundle from the rolls as loose fibers by means of a second aspirating jet which blows the fibers onto the partially twisted first bundle in the yarn passageway to produce a false twisted yarn having a highly twisted core and less highly twisted surface fibers prior to the twisting jet, removing false twist from the yarn during passage of the yarn beyond the twisting jet to untwist the core and reverse the direction of twist in surface fibers, and collecting the yarn.

15. In a spinning apparatus, drafting means comprising back rolls and a final pair of front rolls for continuously drafting a strand of fibers into a ribbon-shaped bundle of parallel fibers, aspirating jet means for picking up the fiber bundle from the drafting means, the aspirating jet means being shaped to conform to the surfaces of said front rolls to suck the fibers from the front rolls as the ribbon-shaped bundle passes from between the front rolls, twisting jet means for false twisting the fiber bundle in one direction between the two jets and for removing twist as the bundle travels beyond the twisting jet, and means for collecting the fiber bundle in the form of yarn.

16. Apparatus as defined in claim 15 wherein said twisting jet means comprises a passageway for the fiber bundle of circular cross-section and means for directing a jet of compressible fluid tangentially into the passageway at ½ sonic velocity, at least, to provide a vortex having a rotary motion of at least 200,000 turns per minute.

17. In a spinning apparatus, drafting means for continuously drafting a strand of fibers into a ribbon-shaped bundle of parallel fibers, aspirating jet means for picking up the fiber bundle from the drafting means comprising a passageway for the fiber bundle of circular cross-section and means for directing a jet of compressible fluid tangentially and angularly into the passageway to provide an aspirating vortex for sucking the fibers into the passageway and twisting the fibers into a bundle, twisting jet means for false twisting the fiber bundle in one direction between the two jets and for removing twist as the bundle travels beyond the twisting jet, and means for collecting the fiber bundle in the form of yarn.

18. Apparatus as defined in claim 15 wherein said aspirating jet means comprises a passageway for the fibers which extends from the drafting rolls toward the twisting means for a distance greater than the length of fibers being spun to direct the fibers into the twisting bundle.

19. Apparatus as defined in claim 18 wherein said passageway comprises a straight manifold and a side passageway leading from a second aspirating jet means for picking up fibers to a midpoint of the manifold.

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