United States Patent

Andrews et al.

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[54] COMPACT TEXTILE TOW AND METHOD FOF FORMING SAME

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[51] Int. Cl. D01g 1/00

[58] Field of Search ..... 19/.48, .51, .56; 57/144, 140 BY, 57/160, 142, 34, 2, 159, 3, 4, 5; 87/6, 7, 8; 161/172, 175, 176

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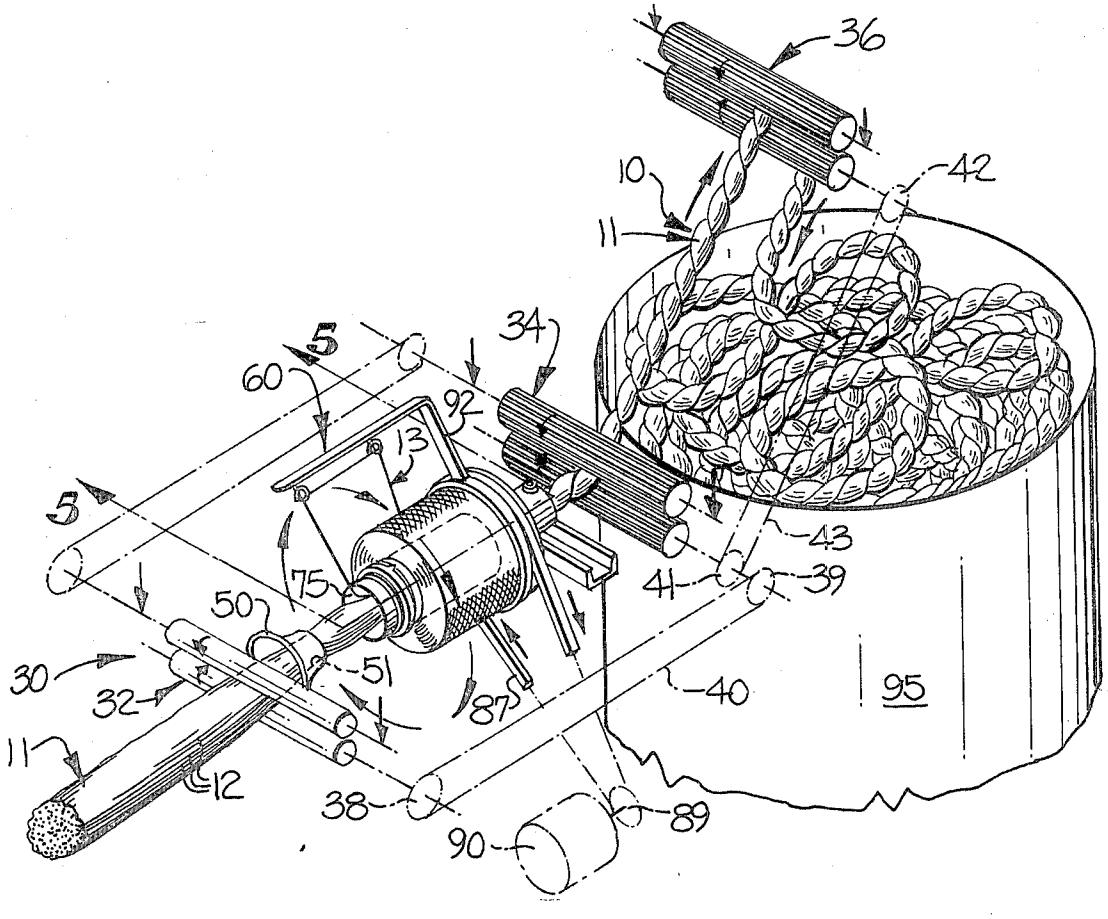
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[57] ABSTRACT

A compact textile tow adaptable for forming staple fibers therefrom comprising an elongate condensed bundle of a plurality of textile filaments having an inherent tendency to expand to a greater cross-sectional area, and a yarn spirally wound around the bundle of filaments and maintaining the same in the condensed condition. The method comprises feeding an elongate bundle of a plurality of textile filaments in a predetermined path of travel while condensing the same to a smaller cross-sectional area and while spirally winding a yarn around the same to maintain the bundle of filaments in condensed condition by opposing the inherent tendency of the bundle of filaments to expand.

17 Claims, 9 Drawing Figures



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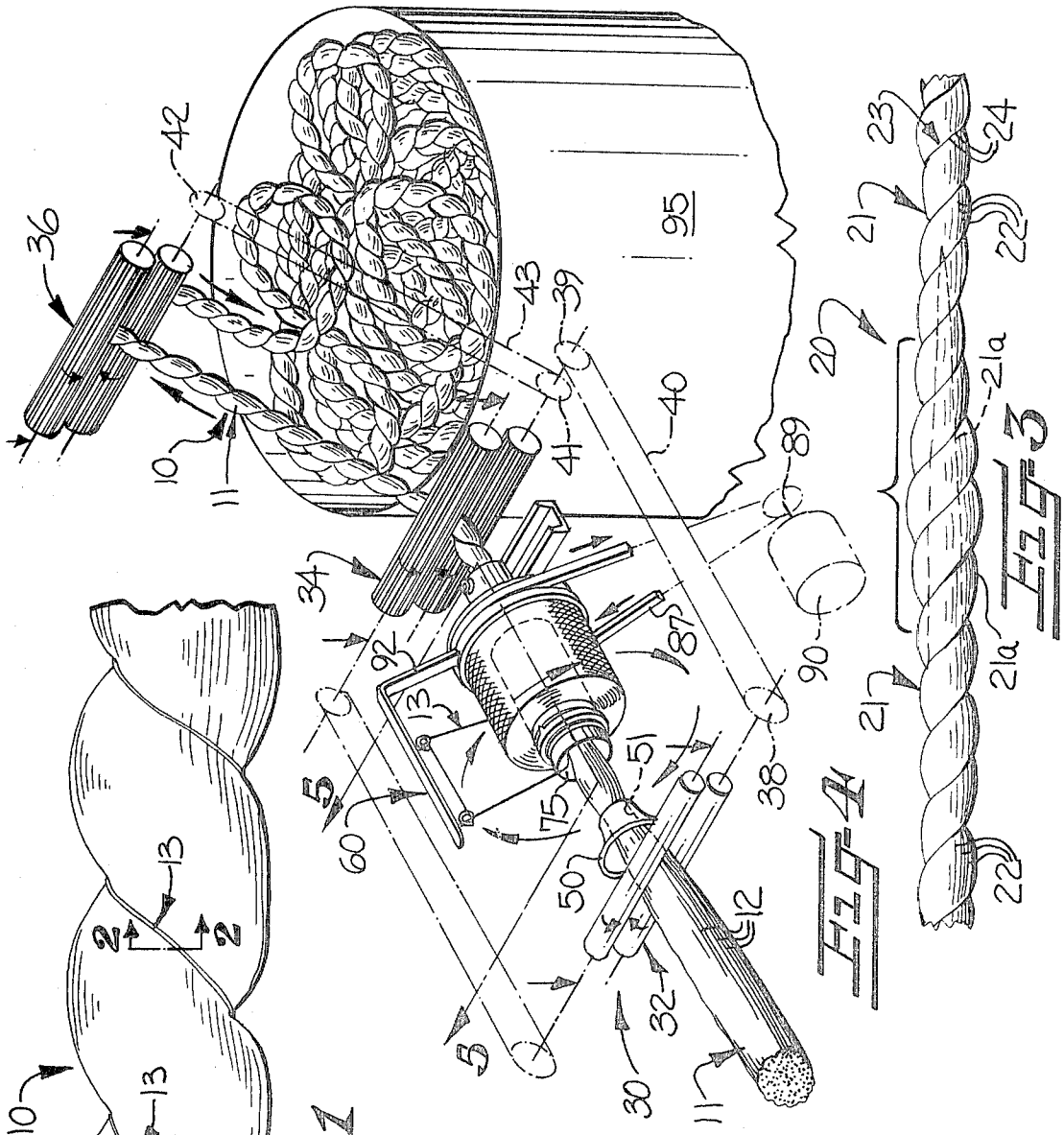


FIG. 4

FIG. 3

FIG. 1

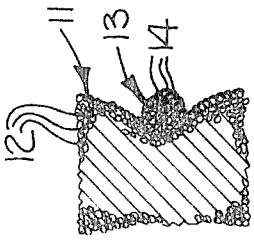


FIG. 2

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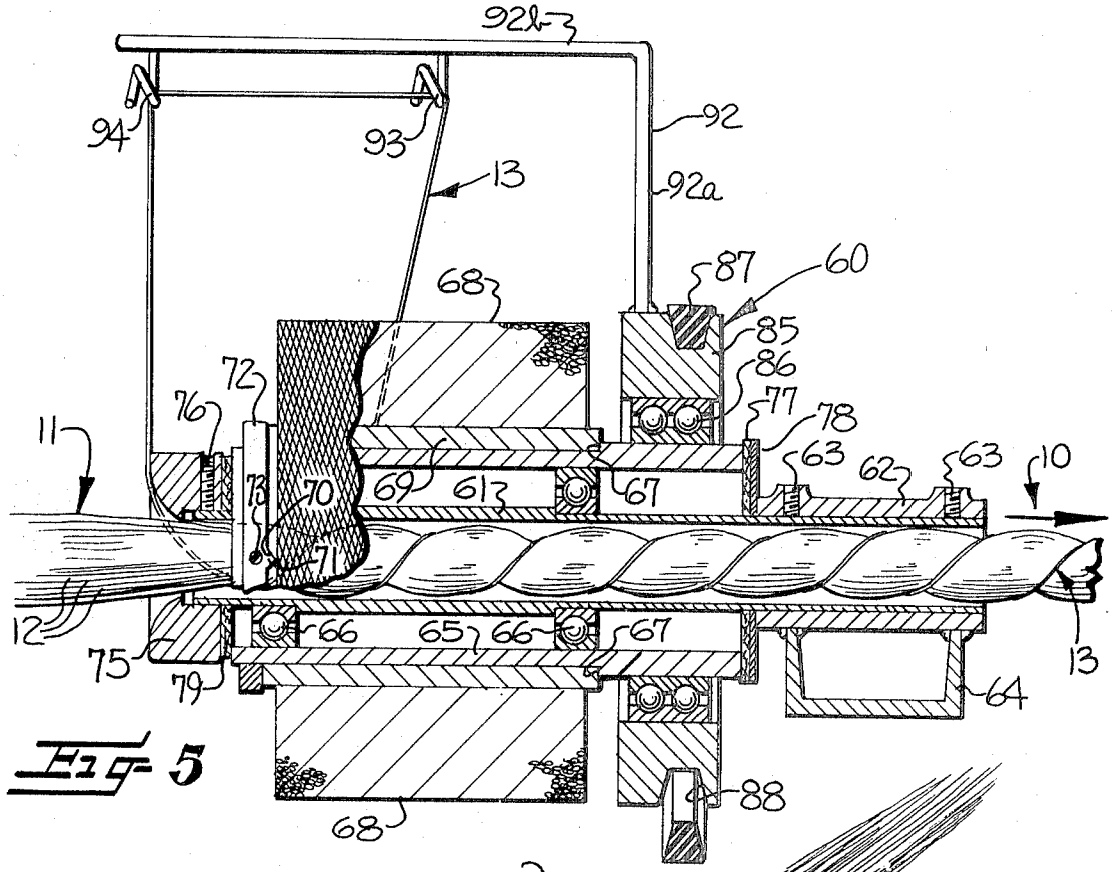


Fig. 5

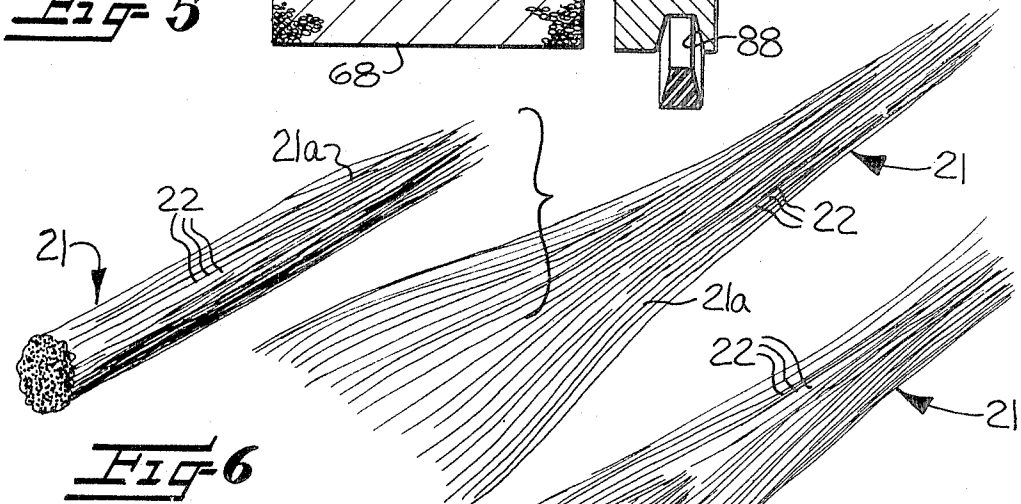


Fig. 6

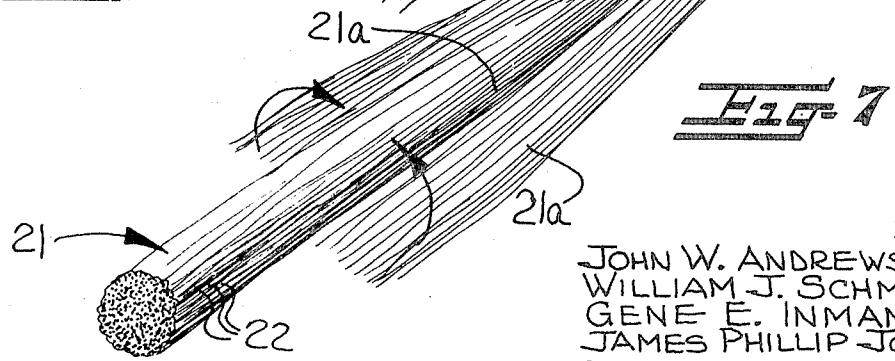


Fig. 7

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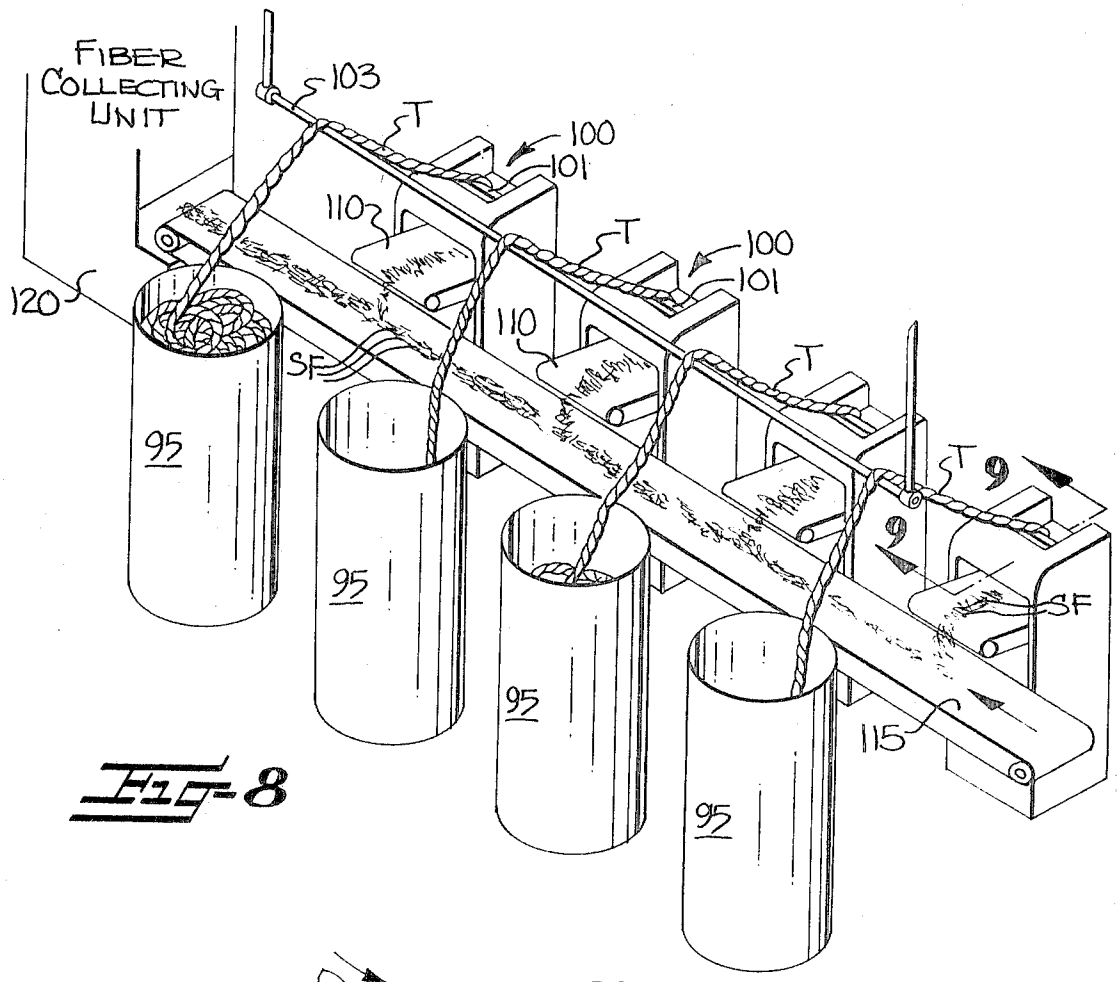


FIG-8

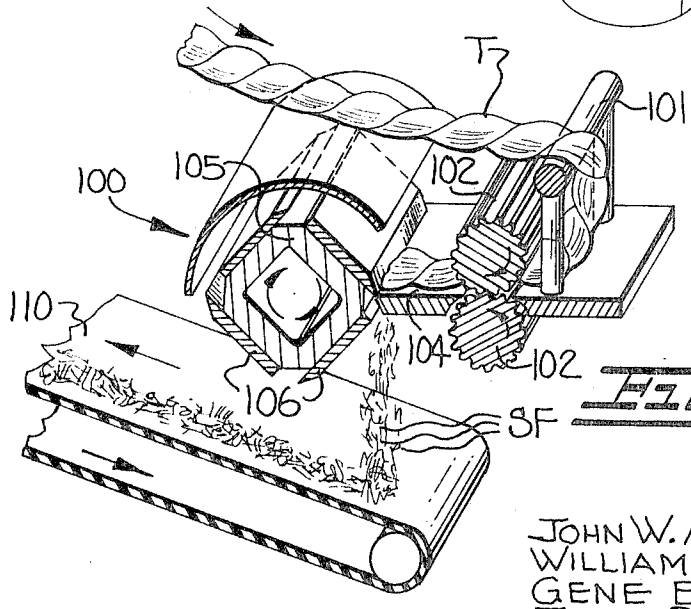


FIG-9

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COMPACT TEXTILE TOW AND METHOD FOF FORMING SAME

This invention relates to textile tow and more particularly to compact textile tow adaptable for forming staple fibers therefrom and method for forming same.

In the manufacture of synthetic staple fibers for processing in conventional textile spinning plants, it is common practice to gather together a plurality of continuous textile filaments as they emerge from spinnerets to form a continuous bundle or tow, hereinafter used interchangeably, of filaments and sever the continuous bundle of filaments at longitudinally spaced intervals to form staple fibers therefrom.

As will be apparent, the severing of the continuous bundle of filaments may take place at various stages after emergence from the spinnerets. It is conventional with many manufacturers of synthetic textile filaments to first purify, stretch, dry and crimp the bundle of textile filaments and transfer the bundle of filaments to textile spinning plants in bundle form for severing into staple fibers. However, depending on the particular synthetic filament, the facilities of the textile spinning plants and the desired properties of the staple fibers, it may be desirable to process the filaments in a different manner that will be apparent to one skilled in the manufacture of synthetic staple fibers.

In any event, during the processing of the continuous bundle of textile filaments prior to severing into staple fibers, many instances arise in which the filament manufacturer deems various elongate lengths or sections of the continuous bundle of filaments to be inferior to his standard of production or incompatible with the standard required by his customers. When such inferior quality is detected, the inferior elongate lengths or sections are severed or otherwise removed from the continuous bundle of textile filaments and discarded as waste.

Since various textile spinning plants can tolerate staple fibers formed from these discarded elongate lengths or sections, an entire industry of salvaging waste textile filaments from filament manufacturers has developed. In salvaging these waste filaments, the discarded lengths or elongate bundles of textile filaments are recovered and passed through a stapilizing machine and severed at longitudinally spaced intervals to form staple fibers.

Heretofore, it has been necessary for an operator to manually feed one end of the elongate bundles of filaments into the stapilizing machine. However, problems exist in controlling the severing of the elongate bundles of filaments to form the desired staple fibers. The problems are manifested in the discrete lengths of the elongate bundles of filaments and the inherent high bulk characteristics thereof. More particularly, it has been virtually impossible for the operator to manually feed the leading end of the elongate bundles of filaments into the stapilizing machine in a straightened condition. Typically, the operators are afraid that they will get their fingers or clothing caught in the staplilizing machine and thus, sling the leading end of the elongate bundles of filaments into the stapilizing machine which causes the bundles of filaments to be severed nonuniformly at the leading end. Similarly, the trailing end of the bundles of filaments have a tendency to be whipped or otherwise moved around and passed through the stapilizing machine in a nonstraightened condition.

In addition, as the bundles of filaments pass through the stapilizing machine, they are compressed in the severing operation in a nonuniform manner to cause the individual filaments to be cut nonuniformly and thus, prevents control of the formation of staple fibers of the desired quality.

Furthermore, the manual practice heretofore described is time consuming and thus, uneconomical in that the rate of stapilizing is limited to the efficiency of the operator and not the stapilizing machine.

It has been found by this invention that the above problems may be alleviated by condensing the elongate bundles of filaments to eliminate the nonuniform compressing by the stapilizing machine during severing and by interconnecting end portions of successive bundles of filaments prior to stapilizing so that continuous rather than discrete lengths may be fed to the stapilizing machine to minimize the free ends that pass through the stapilizing machine.

Accordingly, it is an object of this invention to provide a compact textile tow adaptable for forming staple fibers therefrom and method for forming same wherein an elongate bundle of a plurality of textile filaments are maintained in a condensed condition.

Another and still further object of this invention is to provide a compact textile tow adaptable for forming staple fibers therefrom and method for forming same including a series of elongate bundles of textile filaments having overlapping end portions wherein the end portions are maintained in overlapping relation and the bundles of filaments are maintained in a condensed condition by a yarn spirally wound around the bundles of filaments including the overlapping end portions.

By this invention, the above objects are accomplished by providing a compact textile tow comprising an elongate condensed bundle of textile filaments having an inherent tendency to expand to a greater cross-sectional area, and a yarn spirally wound around the bundle of filaments and maintaining the same in the condensed condition. Preferably, a single yarn is employed of the same chemical class of textile material as the bundle of textile filaments so that when staple fibers are formed from the compact textile tow, the yarn will not contaminate the staple fibers.

The compact textile tow may comprise a series of elongate condensed bundles of textile filaments having overlapping end portions with each of the bundles having a plurality of textile filaments having an inherent tendency to expand to a greater cross-sectional area, and a yarn spirally wound around the bundles of filaments including the overlapping end portions thereof for interconnecting the bundles of filaments and maintaining the same in the condensed condition.

The method for forming the compact textile tow comprises feeding an elongate bundle of a plurality of textile filaments in a predetermined path of travel while condensing the same to a smaller cross-sectional area and while spirally winding a yarn around the same to maintain the bundle of filaments in condensed condition by opposing the inherent tendency of the bundle of filaments to expand. Where it is desirable to interconnect a series of these bundles, the method includes feeding successive bundles of textile filaments in the predetermined path of travel with adjacent end portions thereof overlapping, while spirally winding the yarn around the successive bundles including the overlapping end portions thereof to thus form a series of condensed interconnected bundles of textile filaments. Preferably, the condensing of the bundle or bundles of filaments is accomplished by spirally winding the yarn therearound under tension. Thereafter, the compact textile tow is passed through a stapilizing machine and severed at longitudinally spaced intervals to form staple fibers with the problems heretofore encountered being alleviated.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

FIG. 1 is a perspective view with portions broken away of one form of a compact textile tow in accordance with the present invention;

FIG. 2 is an enlarged sectional view taken substantially along the line 2—2 of FIG. 1;

FIG. 3 is a perspective view with portions broken away of another form of a compact textile tow of this invention;

FIG. 4 is a schematic perspective view of an apparatus for producing compact textile tow of this invention;

FIG. 5 is an enlarged sectional view taken substantially along the line 5—5 of FIG. 4;

FIGS. 6 and 7 illustrate successive stages in disposing adjacent end portions of successive bundles of textile filaments in overlapping relation for passage through the apparatus of FIG. 4;

FIG. 8 illustrates a stapilizing machine for severing a compact textile tow of the present invention to form staple fibers therefrom; and

FIG. 9 is an enlarged sectional view taken substantially along the line 9—9 of FIG. 8.

Referring specifically to FIG. 1, there is illustrated one form of a compact textile tow, generally indicated at 10 of the present invention. The compact textile tow 10 is adaptable for forming staple fibers therefrom and comprises, as shown, an elongate condensed bundle 11 of a plurality of textile filaments 12 and a yarn 13 spirally wound around the bundle 11 and maintaining the bundle 11 in the condensed condition.

The condensed bundle 11 may include any number of textile filaments 12 but preferably includes at least about 1,000 in number with each being of a length corresponding substantially to the length of the bundle 11 and being within the range of from about 1.5 denier to about 20 denier in size. It will be noted that the condensed bundle 11 is substantially untwisted with the individual filaments therein being substantially untwisted. Thus, it can be appreciated that when the elongate condensed bundle 11 of filaments 12 is passed through a stapilizing machine and severed at longitudinally spaced intervals to form staple fibers therefrom, all the textile filaments 12 will be severed at corresponding longitudinally spaced intervals to form staple fibers having a uniform length corresponding to the intervals at which the elongate condensed bundle 11 is severed.

The windings of yarn 13, as shown, are spaced apart a sufficient distance to leave the major portion of the elongate condensed bundle 11 of filaments 12 exposed. The greater the spacing between the windings of yarn 13, the less yarn 13 that becomes intermixed with the staple fibers formed from the condensed bundle 11 of filaments 12 and the more compatible are the lengths of yarn 13 so intermixed with the staple fibers being formed. It will be appreciated that where a plurality of textile filaments 12 are gathered together, the filaments 12 inherently have a tendency to remain spaced from each other, and thus, the yarn 13 maintains the condensed bundle 11 in the condensed condition by opposing the inherent tendency of the condensed bundle 11 of filaments 12 to expand to a greater cross-sectional area. This feature is best illustrated in FIG. 1 wherein it will be noted that immediately beneath the windings of yarn 13, the condensed bundle 11 is maintained in a higher condensed condition than between windings. Thus, the spacing of the windings of yarn 13 is limited at least in part by the amount of condensing desired. It will also be appreciated that the tension in the yarn 13 may be varied to vary the amount of condensing desired.

Furthermore, the yarn 13, FIG. 2, is preferably formed of a plurality of substantially continuous, untwisted, textile filaments 14 having a cross-sectional area substantially less than that of the condensed bundle 11 of textile filaments 12. Thus, it can be seen that such a yarn 13 minimizes the amount of yarn 13 that becomes intermixed with staple fibers formed from the compact textile tow 10 and attributes to maintaining the lengths of yarn 13 in the staple fibers compatible with the staple fiber lengths. In addition, the textile filaments 12 and 14 are, preferably, of the same chemical class of textile material, whether nylon, rayon, polyester, etc., so that the yarn 13 does not contaminate the staple fibers formed from the compact textile tow 10.

With reference to FIG. 3, there is illustrated another form of a compact textile tow, generally indicated at 20, of the present invention and includes a series of elongate condensed bundles 21 of textile filaments 22 having overlapping end portions 21*a*, and a yarn 23 spirally wound around the bundles 21 of filaments 22 for interconnecting the bundles 21 of filaments 22 and maintaining the same in the condensed condition. Each of the elongate condensed bundles 21 of filaments 22 are preferably identical to each other and to the elongate bundle 11 of filaments 12 illustrated in FIG. 1 and previously described, and accordingly will not be discussed in detail. Similarly, yarn 23 includes a plurality of filaments 24 and is identical to yarn 13, illustrated in FIG. 1, and previously described, and accordingly will not be discussed in detail. It suffices to say that the windings of yarn 23 are spaced apart to leave the major portion of the bundles 21 of filaments exposed with the windings being spaced apart a distance substantially less than the length of the overlapping end portions so that a plurality of windings of yarn 23 will be disposed around the overlapping end portions 21*a* to both condense the overlapping end portions 21*a* and maintain the overlapping end portions interconnected.

For forming the compact textile tow of this invention, reference is made to FIG. 4 wherein an apparatus, generally indicated at 30, is schematically illustrated and will be described in detail for forming the compact textile tow 10 as illustrated in FIG. 1. Apparatus 30 includes three spaced-apart pairs of cooperating nip feed rolls 32, 34 and 36 which are supported in parallel and aligned relation as illustrated by any suitable support means, not shown. The lower feed rolls of each of the pairs are positively driven in the same direction by any suitable means so that an elongate bundle 11 of a plurality of textile filaments 12 may be fed along a predetermined longitudinal path of travel from feed rolls 32 through feed rolls 34 and 36. Feed rolls 34 and 36 are, preferably, driven at the same rate and, preferably, at a rate slightly greater than feed rolls 32 so that the bundle 11 of filaments 12 passing from feed rolls 32 through feed rolls 34 will be maintained under tension. While any suitable drive connections may be made for maintaining this differential feed rate, one suitable arrangement of drive connections is illustrated in FIG. 4. More particularly, the lower of feed rolls 32 has a sprocket 38 operatively connected thereto and the lower of feed rolls 34 has a sprocket 39 operatively connected thereto which has a diameter slightly less than sprocket 38. A drive chain 40 drivingly connects sprockets 38 and 39 which may be driven in any suitable manner, not shown, so that the lower of feed rolls 36 is driven at a slightly higher rate than the lower of feed rolls 32. A similar driving arrangement is provided for the upper of feed rolls 32 and 34 as illustrated. The lower of feed rolls 34 additionally has a sprocket 41 operatively connected thereto and the lower of feed rolls 36 has a sprocket 42 operatively connected thereto, sprockets 41 and 42 being identical. A drive chain 43 drivingly connects sprockets 41 and 42 to drive the lower of feed rolls 36 at the same rate as the lower of feed rolls 34. It will be noted that drive chain 43 will be driven by the lower of feed rolls 34 which is driven by drive chain 40. The pairs of cooperating nip feed rolls 34 and 36 are fluted whereas feed rolls 32 are smooth so that the bundle 11 of textile filaments being advanced therethrough may slip between feed rolls 32 should the tension established therein by feed rolls 34 become excessive.

In accordance with the present invention, an elongate bundle 11 of a plurality of textile filaments 12, such as that discarded by a synthetic filament manufacturer and having by way of example about 70,000 filaments 12 therein which are substantially continuous throughout the length of the elongate bundle 11 with each being about 6 denier in size, is feed along a substantially predetermined longitudinal path of travel through the pairs of cooperating nip feed rolls 32, 34 and 36 without imparting any spiral twist thereto. As previously indicated, axial tension will be maintained on the bundle 11 of filaments 12 due to the differential feed rates of the pairs of cooperating nip feed rolls 32 and 34.

A trumpet 50 is disposed adjacent the pair of feed rolls 32 and has a tapered axial restricted passageway 51 therethrough having a circular cross-sectional area. The bundle 11 of filaments 12 pass through trumpet 50 and is condensed thereby to a smaller cross-sectional area with the axial tension applied by the differential feed rate of rolls 32 and 34 maintaining the bundle 11 condensed as it continues to advance along the predetermined path of travel.

The elongate bundle 11 then passes through a yarn wrapping apparatus, generally indicated at 60, wherein yarn 13 is spirally wound around the bundle 11 of filaments 12 under tension to further condense it and maintain the same in a condensed condition by opposing the inherent tendency of the bundle of filaments to expand even after the axial tension thereon is removed.

The yarn-wrapping apparatus 60 comprises, as best illustrated in FIG. 5, a stationary elongate hollow tube 61 which is axially aligned with trumpet 50 for receiving the elongate bundle 11 of filaments 12 therethrough. The end of the tube 61 remote from trumpet 50 includes a support collar 62 concentrically mounted thereon by set screws 63 and which is supported by any conventional means such as support member 64. Tube 61 has an elongate sleeve 65 concentrically mounted thereon adjacent support collar 62 by spaced-apart bearings 66 for rotation relative to stationary tube 61. Sleeve 65 has a shoulder 67 circumferentially disposed on the outer surface thereof toward the end adjacent support collar 62.

A yarn package 68 having a hollow core 69 is concentrically mounted on sleeve 65 with one end of core 69 abutting shoulder 67. The other end of core 69 includes a recess 70 in which is received a boss or raised portion 71 of a collar 72 that is detachably mounted concentrically of sleeve 65 by set screw 73 to mount collar 72 and yarn package 68 for rotation with sleeve 65. An entrance or trumpet collar 75 having an outer diameter at least greater than the inner diameter of sleeve 65 but less than the outer diameter of sleeve 65 is concentrically mounted on the end of tube 61 adjacent trumpet 50 for adjustment axially of tube 51 by setscrew 76. Between the end of sleeve 65 remote from trumpet 50 and support collar 62 there are concentrically mounted on tube 61 cooperating resilient friction disc 77 and washer 78. Similarly, between the other end of sleeve 65 and trumpet collar 75 there is concentrically mounted on tube 61 a resilient friction disc 79. With these resilient friction disc 77 and 79, rotation of sleeve 65 and the yarn package 68 carried thereby may be restrained by manually adjusting the axial position of trumpet collar 75 on tube 61.

Another collar 85 is mounted by bearing 86 concentrically of sleeve 65 rearwardly of yarn package 68 adjacent the end thereof remote from trumpet 50 for free rotation thereon and includes a drive belt 87 disposed in circumferentially disposed groove 88 and being additionally disposed around pulley 89, FIG. 4, of motor 90 for driving belt 87 which in turn rotates collar 85. Collar 85 has a reversed, generally L-shaped yarn support 92 carried thereby with the short leg 92*a* thereof extending radially outward from collar 85 and the long leg 92*b* thereof extending over yarn package 68 parallel therewith. Yarn guide members 93 and 94 are carried by the long leg 92*b* of yarn support 92 for guiding yarn 13 from yarn package 68.

It will be apparent that by rotating collar 85 in the direction in which yarn 13 was wound on yarn package 68 or in other words, opposite to the direction of unwinding of yarn 13 from yarn package 68, yarn 13 is drawn from yarn package 68 under tension, passed through yarn guide members 93 and 94 and downwardly and inwardly of tube 61 and spirally wound, under tension, around the bundle 11 of filaments 12 passing through tube 61 to further condense the same with the yarn 13 spirally wound therearound maintaining the bundle 11 of filaments 12 condensed. Furthermore, it will be apparent that the amount of condensing by yarn 13 may be controlled by controlling the tension thereon through adjustment of the axial position of trumpet collar 75 on tube 61. In addition, it will be noted that yarn package 68 may be removed when empty and replaced by a full package by demounting collar 72.

The spacing between windings of yarn 13 wound with the yarn-wrapping apparatus 60 is controlled by the rate of rotation of collar 85 in relation to the rate of feed of the bundle 11 of filaments 12 through the apparatus 30. Preferably, as previously indicated the yarn 13 is spirally wound with the windings spaced apart to leave the major portion of the bundle 11 of filaments 12 exposed for reasons heretofore explained.

As heretofore described, the product that emerges from the yarn-wrapping apparatus 60 is the compact textile tow 10, illustrated in FIG. 1. From the yarn-wrapping apparatus 60, the compact textile tow 10, passes between cooperating nip feed rolls 34 and upwardly between cooperating nip feed rolls 36 into a collection container 95.

Where it is desirable to form a compact textile tow 20, as illustrated in FIG. 3, adjacent end portions 21*a* of successive bundles 21 of textile filaments 22 are disposed in overlapping relation in any satisfactory manner. One satisfactory method is illustrated in FIGS. 6 and 7 and comprises spreading the trailing end 21*a* of a first bundle 21 out into a substantially planar configuration and then disposed the leading end 21*a* of the adjacent bundle 21 in overlying relation thereto and then folding the sides of the trailing end portion 21*a* around to enclose the leading end portion 21*a*.

The successive bundles 21 of filaments 22 having overlapping end portions 21*a* are fed along the predetermined longitudinal path of travel through apparatus 30 in the same manner as described in making compact textile tow 10 to form compact textile tow 20, as illustrated in FIG. 3. It will be apparent that the overlapping end portions 21*a* of successive bundles 21 of filaments 22 will advance through the trumpet 50 and yarn-wrapping apparatus 60 without separating to form a series of condensed bundles of textile filaments having a yarn spirally wound therearound including the overlapping end portions for interconnecting the bundles of textile filaments and maintaining the same in a condensed condition by opposing the inherent tendency of the bundles of filaments to expand.

Whether the compact textile tow of this invention is in form 10, as illustrated in FIG. 1, or in form 20, as illustrated in FIG. 3, it is adaptable for passing through a stapilizing machine for severing at longitudinally spaced intervals to form staple fibers therefrom without the problems heretofore encountered.

With reference to FIG. 8, a plurality of stapilizing machines, generally indicated at 100, are illustrated and arranged in side by side relation. Each of the stapilizing machines 100, FIG. 9, include a guide bar 101 and a pair of cooperating fluted feed rolls 102 which may be driven by any suitable means, not shown, for drawing compact textile tow in either form 10 or 20, here generally designated at T, from container 95 over bar 103, under guide bar 101 and through feed rolls 102. From the feed rolls 102, the compact textile tow T is fed over a bed plate 104 into a stapilizing cutter 105 where the blades 106 thereof cooperate with one end of bed plate 104 for shearing or otherwise severing the compact textile tow T at longitudinally spaced intervals to form staple fibers SF therefrom. The staple fibers SF are received on a continuous conveyor 110 and are advanced thereby to an accumulating conveyor 115 which is common to each of the stapilizing machines 100. The accumulating conveyor 115 then advances the staple fibers SF to a fiber collecting unit 120 where the staple fibers SF may be bailed and thereafter shipped to a textile spinning plant for further processing.

It will be understood from the foregoing description that the compact textile tow of this invention alleviates the problems heretofore encountered by an operator manually feeding bundles of textile filaments into a stapilizing machine and the difficulties in controlling the uniformity of the staple fibers formed therefrom.

In the drawings and specification, there have been set forth preferred embodiments of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:

1. A compact textile tow comprising

a series of elongated condensed bundles of textile filaments having adjacent bundles with overlapping end portions, said overlapping end portions of adjacent bundles being arranged with one end portion substantially surrounded by the other end portion, each of said bundles having a plurality of textile filaments having an inherent tendency to expand to a greater cross-sectional area, and

a yarn spirally wound around said bundles of filaments including said overlapping end portions thereof for interconnecting the bundles of filaments and maintaining the same in said condensed condition.

2. The compact textile tow, as set forth in claim 1, wherein the windings of said yarn are spaced apart to leave the major portion of said bundles of filaments exposed.

3. The compact textile tow, as set forth in claim 2, wherein the windings of said yarn are spaced apart a distance substantially less than the length of the overlapping end portions of said bundles of filaments.

4. The compact textile tow, as set forth in claim 2, wherein the overlapping end portions of the bundles of filaments each have a plurality of windings of yarn therearound.

5. The compact textile tow as set forth in claim 1, wherein the textile filaments forming each bundle have a length corresponding substantially to the length of their respective bundle.

6. The compact textile tow as set forth in claim 1, wherein the textile filaments forming each bundle are at least about a thousand in number, with each filament being within the range from about 1.5 denier to about 20 denier in size.

7. The compact textile tow, as set forth in claim 1, wherein said bundles of textile filament are substantially untwisted.

8. The compact textile tow, as set forth in claim 1, wherein said textile filaments and yarn are formed of the same chemical class of textile material.

9. The compact textile tow, as set forth in claim 1, wherein said yarn is formed of a plurality of substantially continuous untwisted textile filaments having a cross-sectional area substantially less than that of said bundle of textile filaments.

10. A method of forming a compact textile tow adaptable for forming staple fibers therefrom comprising,

successively feeding elongate bundles of textile filaments in a predetermined path of travel while condensing the same to a smaller cross-sectional area and while arranging adjacent end portions of the bundles in overlapping relation with one end portion substantially surrounded by the other end portion and

while spirally winding a yarn around the successive bundles including the overlapping end portions thereof to form a series of condensed interconnected bundles of textile filaments.

11. Method according to claim 10, wherein the adjacent overlapping end portions of the bundles are arranged with the trailing end portion of each bundle substantially surrounding the leading end portion of each bundle.

12. A method according to claim 10 wherein the condensing of the bundles of filaments is accomplished by spirally winding said yarn therearound under tension.

13. A method according to claim 10 wherein the condensing of the bundles of textile filaments comprises passing the same through a restricted passageway prior to spirally winding the yarn therearound.

14. A method according to claim 10 wherein the condensing of the bundles of filaments is accomplished by passing the same through a restricted passageway and then spirally winding the yarn therearound under tension.

15. A method according to claim 10 wherein the yarn is spirally wound with the windings spaced apart to leave the major portion of the bundles of filaments exposed.

16. A method according to claim 10 wherein the step of spirally winding the yarn around the bundles of textile filaments includes passing the bundle of filaments through a rotating hollow yarn package while drawing yarn from the package and wrapping it around the bundles of filaments.

17. A method of forming staple fibers from an elongate bundle of textile filaments comprising

feeding the bundle of textile filaments in a predetermined path of travel while condensing the same to a smaller cross-sectional area and spirally winding a yarn around the same to maintain the bundle of filaments in condensed condition by opposing the inherent tendency of the bundle of filaments to expand, and thereafter

severing the spirally wrapped condensed bundle of textile filaments at longitudinally spaced intervals to form staple fibers therefrom.

* * * * *