Oct. 13, 1970 J. R. WHITEHURST 3,533,138

APPARATUS AND METHOD FOR PRODUCING HIGH DENSITY TEXTILE SLIVER

Filed Sept. 6, 1968

3 Sheets-Sheet 1

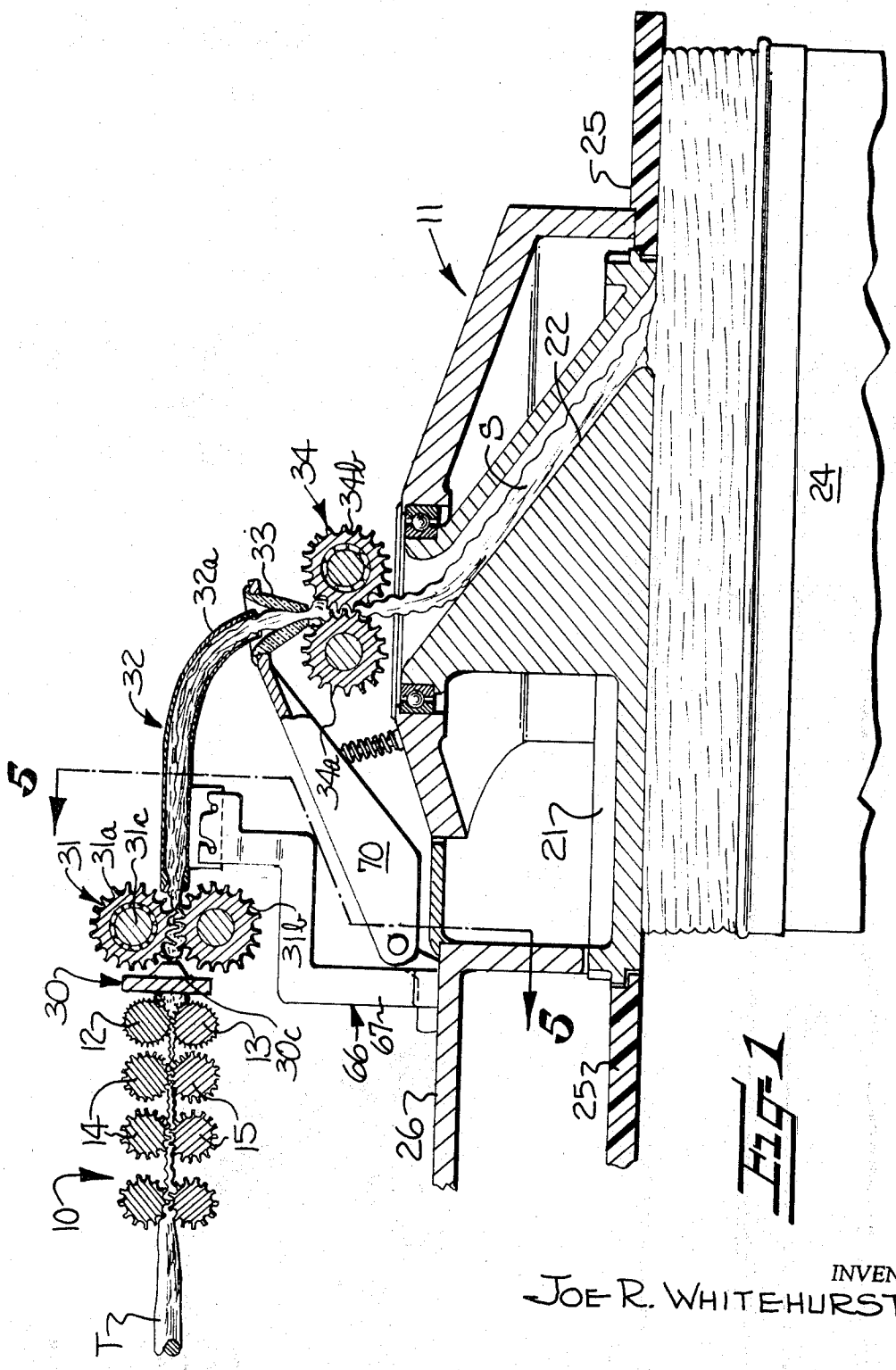


FIG. 1

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3 Sheets-Sheet 2

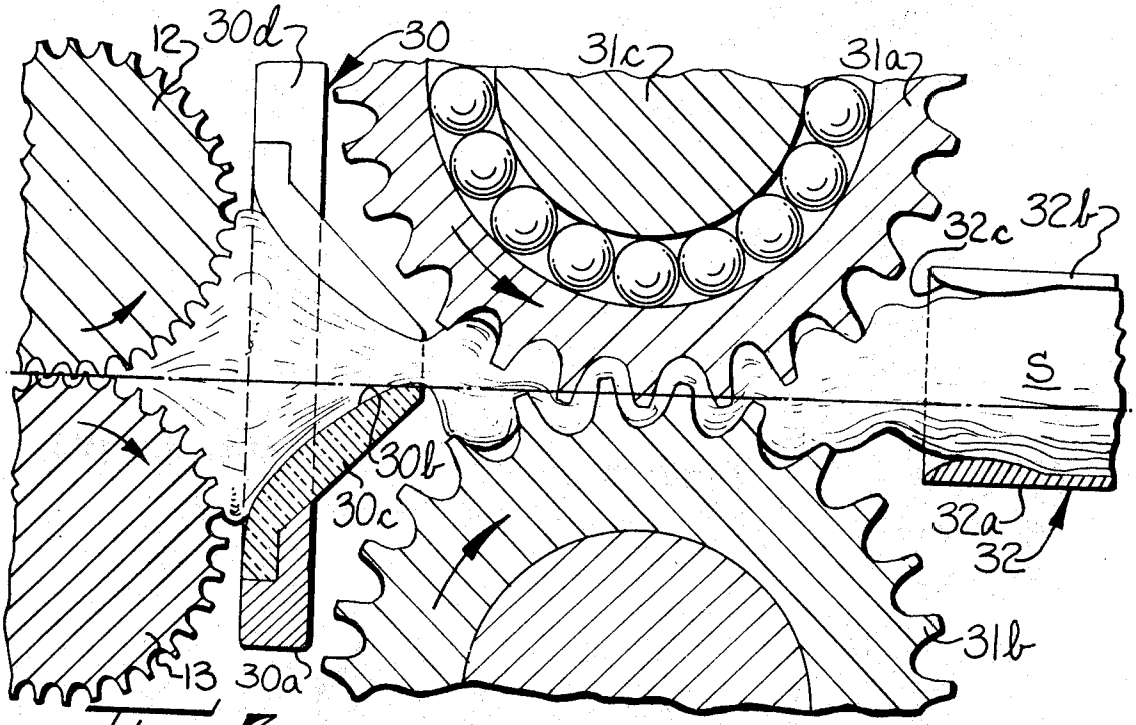


Fig-3

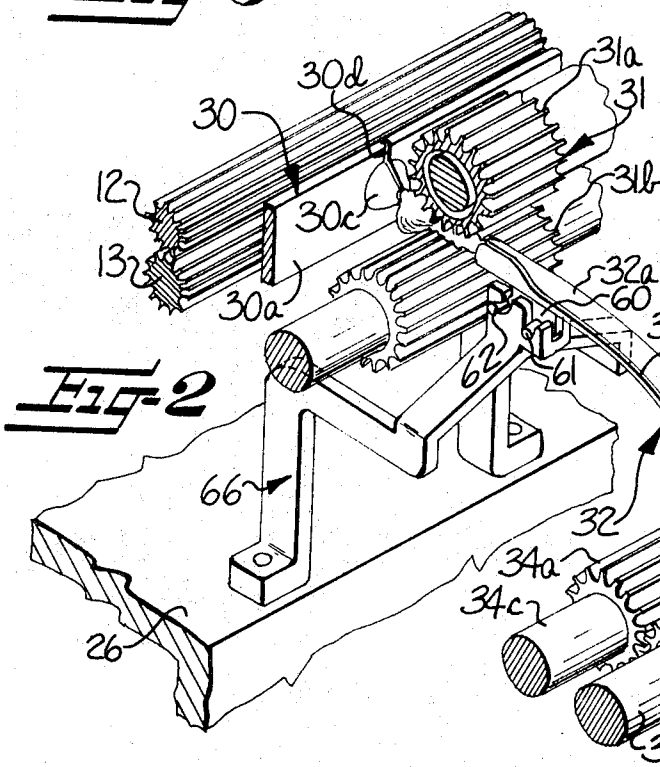


Fig-2

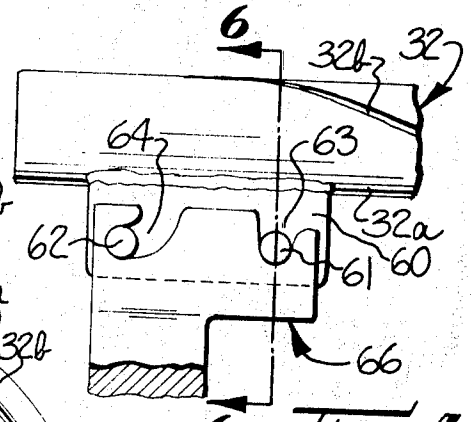
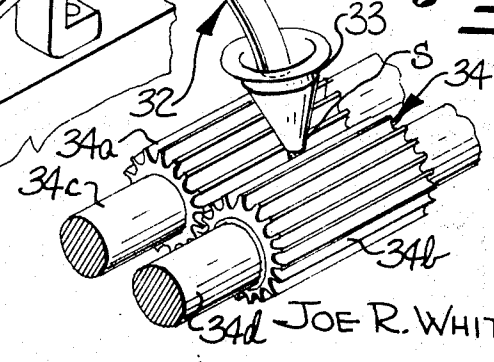


Fig-4



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3 Sheets-Sheet 3

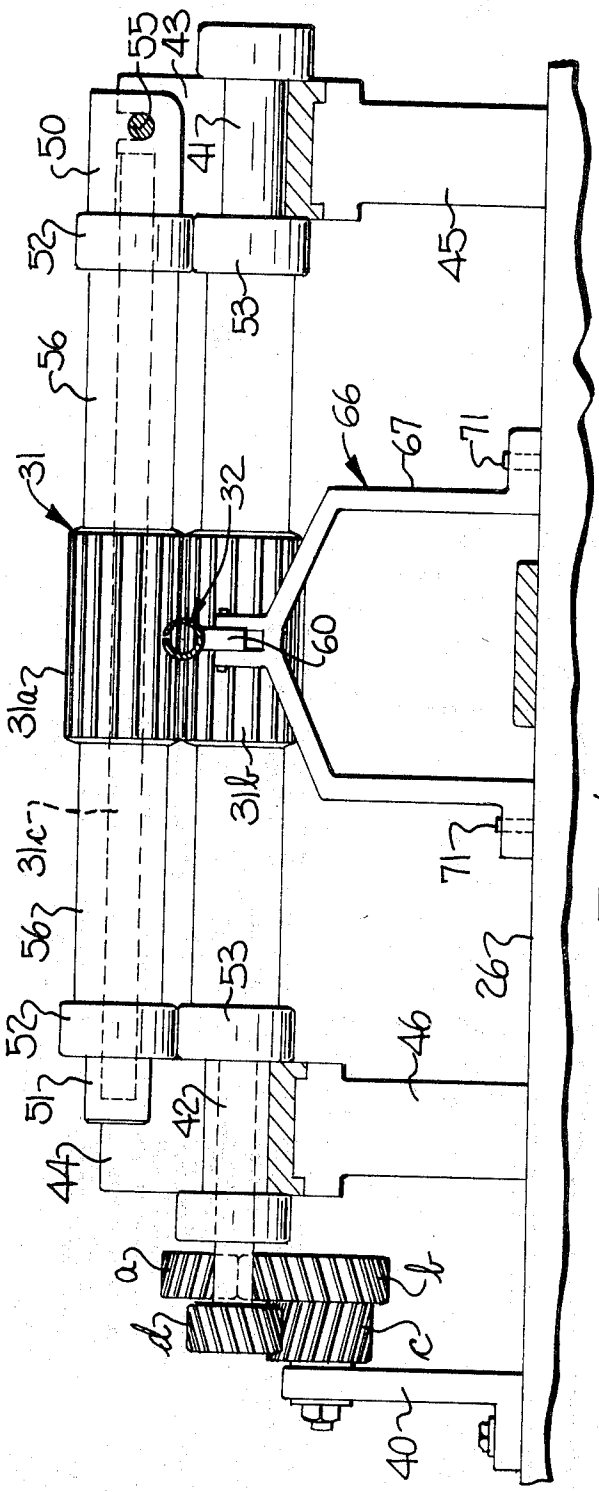


Fig. 5

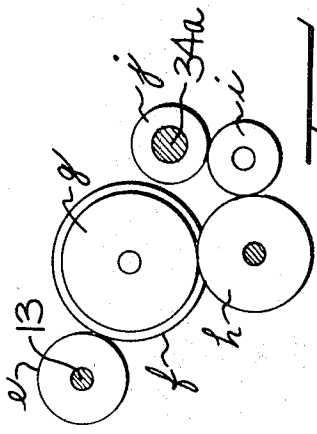


Fig. 8

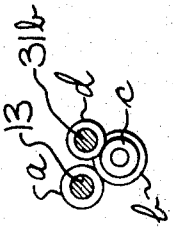


Fig. 7

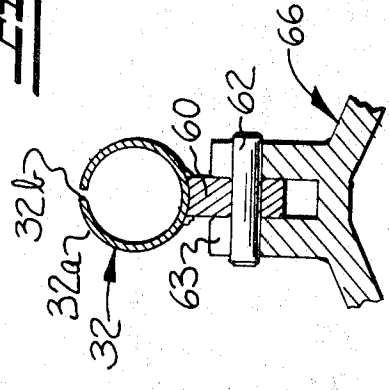


Fig. 6

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3,533,138

APPARATUS AND METHOD FOR PRODUCING HIGH DENSITY TEXTILE SLIVER

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Continuation-in-part of application Ser. No. 548,691, May 9, 1966. This application Sept. 6, 1968, Ser. No. 767,571

Int. Cl. D01h 5/72

U.S. Cl. 19—150 3 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus and method for controlling textile fibers during their travel from the delivery rolls of a drafting unit to a coil forming member to increase the density and tensile strength of sliver being formed from the fibers and thereby to enable coiling a greater than normal length of sliver in a given size coiler can by immediately condensing a web issuing from the drafting rolls into a sliver, then precompressing the sliver immediately after its formation to increase its density and the cohesion of the fibers therein relative to each other while reducing the cross-sectional area of the sliver, guidingly confining the thus compressed sliver in its path of travel to a coiler trumpet to aid in maintaining the increased density of the sliver and the cohesion of the fibers therein relative to each other while substantially preventing production of fly by substantially shielding the sliver from ambient air, and then further compressing the sliver while pulling the sliver, from the point at which it is being precompressed, through the trumpet and delivering the sliver to the coil forming member.

This application is a continuation-in-part of my copending application Ser. No. 548,691, filed May 9, 1966, now Pat. No. 3,401,429 and entitled Apparatus for Controlling Sliver Between Drafting Rolls and a Coiler Head.

The apparatus disclosed and claimed in my said copending application significantly reduces the normally occurring substantial increase in the C.V. reading of sliver nonuniformity (coefficient of variation of weight per unit length) during travel of the sliver from the delivery rolls of a drafting unit to a coiler by guidingly confining the textile sliver in its path of travel in a guide tube of predetermined internal dimensions so as to maintain substantial cohesion and integrity of the fibers relative to each other.

It is an object of this invention to provide an improved apparatus and method for so controlling a textile sliver in its travel from a drafting unit to a coil forming member as to not only avoid any substantially increase in the C.V. reading (nonuniformity) of the sliver, but also to increase the density and consequently reduce the volume per given weight thereof to enable coiling a greater than normal length of sliver in a given size coiler can and to improve the condition of the sliver for subsequent handlings and processes.

According to the instant invention, a fibrous textile web is condensed into a sliver immediately as it emerges from the delivery rolls of a drafting unit, and immediately thereafter, the sliver is precompressed, preferably by means of a first pair of fluted calender rolls, so as to increase its density and increase the cohesion of the fibers therein relative to each other while reducing the cross-sectional area of the sliver. Thereafter, the sliver is guidingly confined in its path of travel from a point closely adjacent the first fluted calender rolls to a coiler trumpet to aid in maintaining the increased density of the sliver

and the cohesion of the fibers therein relative to each other while minimizing production of fly by the sliver. In order to ensure that the increased density, the increased cohesion of the fibers, and the reduced cross-sectional area configuration of the sliver are maintained after the sliver emerges from the first calender rolls and as the sliver is being received by a coil forming member, the sliver is again compressed immediately as it emerges from the second condensing means embodied in the coiler trumpet, preferably by means of a second pair of fluted calender rolls, and the sliver so drawn through the trumpet is then delivered to the rotating coil forming member immediately adjacent the calender rolls.

It is preferred, but not entirely necessary, that both pairs of calender rolls are of the fluted type so that, not only is the sliver compressed at each pair of calender rolls, but the mating flutes of the calender rolls impart increased density to closely spaced areas of the sliver by crimping the sliver transversely thereof during its travel, thereby further increasing the cohesion of the fibers in the sliver relative to each other and greatly increasing the tensile strength of the sliver.

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

FIG. 1 is a longitudinal vertical sectional view through a portion of a drawing frame, including the drafting rolls and coiler head thereof, and showing a preferred embodiment of the sliver controlling apparatus for carrying out the method of the present invention in association therewith;

FIG. 2 is a perspective view of the improved sliver controlling apparatus of FIG. 1;

FIG. 3 is an enlarged fragmentary vertical sectional view through the delivery rolls of the drafting unit, the sliver condensing means, the first pair of calender rolls, and the ingress end of the sliver guide tube for particularly illustrating the relationship therebetween, with the sliver passing from the condensing means to the sliver guide tube;

FIG. 4 is a fragmentary view of a preferred means for supporting the sliver guide tube;

FIG. 5 is an enlarged elevation, partially in section, taken along line 5—5 in FIG. 1 and showing a preferred means for supporting the precompressing or first pair of calender rolls and showing portions of the drive means therefor;

FIG. 6 is a fragmentary vertical sectional view taken substantially along line 6—6 in FIG. 4; and

FIGS. 7 and 8 are schematic illustrations of suitable gear arrangements for transmitting rotation from the drafting rolls to the first and second pairs of calender rolls.

Referring more specifically to the drawings, a representative embodiment of novel apparatus for carrying out the method of this invention is shown in association with a drawing frame and is located between a drafting unit 10 and a coiler head 11 (FIG. 1). Drafting unit 10 includes a series of sets of top and bottom drafting rolls including front or delivery rolls 12, 13, rearwardly of which additional sets of upper and lower drafting rolls 14, 15 are provided for drafting textile fibers or textile material T therethrough. Textile material T emerges from delivery rolls 12, 13 in the form of a broad, thin, flat web which is condensed into a sliver S as it passes from delivery rolls 12, 13 through the apparatus of the present invention to a rotary coil forming member or tube gear 21. As shown, tube gear 21 is provided with a downwardly and outwardly inclined passage 22 therein which is open at its upper end for receiving sliver S and which is open at its lower end for laying sliver in coils in a

coiler can **24**, as is usual. Tube gear **21** is positioned in an opening through a spectacle **25** carried by a main transverse frame member or beam **26** spaced beneath drafting unit **10**.

The term "C.V." is used throughout the textile industry and in the instant application to mean the coefficient of variation in the volume of successive portions of a textile sliver, and the term "C.V. reading" means the percentage of variation in cross-sectional volume of the sliver as calculated in a well-known manner by passing test lengths of sliver through a "Stock Variation Analyzer" or comparator. One type of testing device commonly used for this purpose is known as a "Uster Tester."

As is usual, the textile material T travels a distance of several inches from delivery rolls **12, 13** to tube gear **21**, during which the textile material is normally maintained under a slight tension draft and is condensed from a web to a sliver. At high speeds; especially at speeds of more than 700 feet per minute, when the textile material is not controlled in the manner disclosed in my said copending application or in the manner according to the instant invention, the nonuniformity or C.V. reading already in the textile material emerging from delivery rolls **12, 13** is increased substantially as heretofore stated, because the required tension draft produces an abnormal or false draft at previously existing areas of relatively low density in the textile material. It is apparent that such relatively low-density areas are of lesser tensile strength than adjacent areas of high or normal density, and, therefore, the density of such low density areas, and areas contiguous thereto, is further reduced, thereby increasing the C.V. reading of the textile material.

Also, as a consequence of the high speed travel of the material through the air, as it is usually guided to a coiler trumpet, the resistance of the air has the effect of retarding the movement of surface fibers from the moving fibrous mass and thus separates or dislodges many surface fibers; especially relatively short fibers, from the fibrous mass. Such separated fibers further increase the C.V. reading of the sliver and are carried into the ambient air as fly and accumulate as lint on various adjacent parts of the drawing frame and on the textile material in process. Such accumulated lint reduces efficiency in operation of the drawing frame and is difficult to remove. Further, the quantity of the sliver is reduced by lint settling upon the sliver.

According to the apparatus and method of the instant invention, the attenuated web of textile material emerging from delivery rolls **12, 13** is so controlled thereafter in its travel to coiler head **11** as to produce sliver having characteristics of high density, high tensile strength and reduced cross-sectional area while substantially preventing the escapement of fibers from the main body of the textile material such as to minimize the accumulation of lint on adjacent parts of the drawing frame and to improve the uniformity of the textile material as compared to the uniformity of textile material which may be attained when utilizing other prior art types of sliver controlling means between the drafting unit and the coiler head of a drawing frame.

By reducing the cross-sectional area of the sliver according to this invention, it is possible to increase by about 15–18% the maximum length of sliver of given weight per yard which may be coiled into a given size coiler can as compared to the maximum length of sliver which could be coiled into such a coiler can heretofore. In other words, the number of layers of sliver and the number coils of sliver per layer may be increased substantially in filling a given size can.

Essentially, the apparatus of this invention comprises a first condensing means or web condenser **30**, first sliver compressing means **31**, sliver guiding and confining means **32**, a second condensing means or coiler trumpet **33**, and second sliver compressing means **34**, all of which are serially arranged between delivery rolls **12, 13** and tube gear **21**. The first condensing means or web condenser **30** initially condenses the fibrous web emerging from delivery rolls **12, 13** into a sliver and is preferably in the form of an elongate plate **30***a* having a flat, substantially straight, rear surface against which the web emerging from delivery rolls **12, 13** is propelled. The dimension of plate **30***a* parallel to rolls **12, 13** should be at least equal to the width of the web of textile fibers emerging from delivery rolls **12, 13**. It is preferred that plate **30***a* is spaced within about 1/16"–1/8" from delivery rolls **12, 13**.

As best shown in FIG. 3, the central portion of condensing plate **30***a* is provided with a tapered or trumpet-shaped opening or passage **30***b* therethrough. Generally, the sizes of slivers produced in the textile industry from most textile fibers are in the range of about 50–70 grains per yard, although there are instances in which slivers as large as 200 grains per yard are produced. Thus, it is peferred that trumpet-shaped passage **30***b* is defined by a web-condensing trumpet **30***c* (FIG. 3) which may be pressed lightly into or otherwise removably secured to condensing plate **30***a* so that a trumpet having a different size of discharge orifice may be used in place of trumpet **30***c* when a sliver of different weight per yard is to be produced.

It should be noted that trumpet **30***c* extends through plate **30***a*, with the smaller or front end portion of trumpet **30***c* extending forwardly into close proximity to the nip of a pair of upper and lower precompressing calender rolls **31***a*, **31***b* which are components of the first sliver compressing means **31**. The distance from the front end of trumpet **30***c* to the nip of calender rolls **31***a*, **31***b* should be less than the average staple length of the fibers in the textile material T so as to avoid imparting false draft to the material in this zone. It is preferred that calender rolls **31***a*, **31***b* are of the fluted intermeshing type, although it is to be understood that calender rolls provided with smooth peripheral surfaces may be used, if desired. When the sliver is compressed by smooth calender rolls, it will undesirably expand to a greater extent upon emerging from the calender rolls than is the case when fluted calender rolls are used. Also, fluted calender rolls are preferred because the intermeshing flutes thereof will impart transverse crimp to the sliver being compressed therebetween and thereby further increase the tensile strength of and further reduce the volume per yard and cross-sectional area of the textile material. Calender rolls **31***a*, **31***b* are preferably of greater diameter than delivery rolls **12, 13** so they may be provided with relatively larger flutes thereon.

Upper calender rolls **31***a* may be freely rotatable on a shaft **31***c*, and the driven bottom calender roll **31***b* transmits rotation to upper calender roll **31***a* by virtue of the sliver S being compressed therebetween. The surface speed of first calender rolls **31***a*, **31***b* should be such relative to the surface speed of delivery rolls **12, 13** as to impart a very small tension draft to the textile material and to pull the textile material, which is being condensed from a web into a sliver by the first condensing means **30**, through trumpet **30***c*. A draft of about 1.001 to 1.005 is preferred between delivery rolls **12, 13** and calender rolls **31***a*, **31***b*, although the draft in this zone may be increased, if desired.

Drafting unit **10** may be driven in any desired or well-known manner and rotation may be imparted to the first pair of calender rolls **31***a*, **31***b* by a suitable train of gears *a–d* (FIG. 7) connecting bottom delivery roll **13** with bottom calender roll **31***b*. As shown in FIGS. 5 and 7, gears *a*, *d* are fixed to corresponding ends of rolls **13**, **13***b*, and mesh with respective intervening change gears *b*, *c* fixed in axial relation to each other and journaled on a standard **40** carried by beam **26**. The tension draft in the zone between delivery rolls **12, 13** and calender rolls **31***a*, **31***b* may be varied by replacing certain of the gears *a–d* with gears of other sizes, as desired.

As shown in FIG. 5, reduced opposed ends of bottom calender roll 31*b* may be journaled in suitable bearings 41, 42 mounted in respective slide blocks 43, 44 and suitably adjustably secured to conventional roll stands 45, 46 carried by beam 26. Slide blocks 43, 44 may be of the usual type used for drafting rolls and having U-shaped slots therethrough for receiving the bearings 41, 42 therein.

The upper calender roll 31*a* preferably is mounted so that it may be readily lifted away from lower or bottom calender roll 31*b* to facilitate the threading of textile material through trumpet 30*c* of first condensing means 30 and between calender rolls 31*a*, 31*b*. Also, means are provided for limiting the extent of intermeshing relationship between calender rolls 31*a*, 31*b* to prevent the teeth of the flutes of upper calender roll 31*a* from engaging the grooves between the teeth of the flutes of the lower or bottom calender roll 31*b*, and vice versa. The depth of intermeshing of the flutes of calender rolls 31*a*, 31*b* also controls to some extent the speed at which the sliver S is advanced by calender rolls 31*a*, 31*b*.

Accordingly, it will be observed in FIG. 5 that reduced opposed ends of shaft 31*c* of upper calender roll 31*a* are journaled in respective bearings 50, 51, each of which has an enlarged portion or spacing member 52 thereon which normally rests against a corresponding enlarged portion 53, there being one of the enlarged portions 53 provided on each of the bearings 41, 42. The diameter of enlarged portions 52, 53, associated with upper and lower calender rolls 31*a*, 31*b*, is such as to limit the intermeshing relationship of calender rolls 31*a*, 31*b* to a predetermined extent. Bearing 50 is pivotally mounted, as at 55, in the upper portion of slide block 43, but bearing 51 is freely positioned in slide block 44. Thus, upper calender roll 31*a* may be readily titled upwardly away from bottom calender roll 31*b* about the pivot point 55 to thereby permit ready access to trumpet 30*c* of first condensing means 30, when desired.

As best shown in FIG. 2, the upper portion of condensing plate 30*a* and its trumpet 30*c* are provided with a narrow slot 30*d* extending from the top edge of condensing plate 30*a* to the discharge orifice of trumpet 30*c* to facilitate threading textile material T into the trumpet-shaped passage 30*b*. Depending upon the weight per yard of the stock being processed, the slot 30*d* may be about 1/32" to 1/16" wide at the trumpet orifice and is preferably slightly wider at the upper edge of condensing plate 30*a*. Opposite ends of condensing plate 30*a* may be suitably removably supported on slide blocks 43, 44.

Suitable weighting means may be associated with upper calender roll 31*a* so that it will apply the desired amount of compression to the sliver passing between rolls 31*a*, 31*b*. In this instance, the weighting means takes the form of a pair of sleeves 56 mounted on shaft 31*c* and extending between opposite ends of calender roll 31*a* and the proximal surfaces of the enlarged portions 52 of bearings 50, 51.

The sliver guiding and confining means 32 comprises an elongate sliver guide tube 32*a*, open at both ends, and whose rear or ingress end is positioned forwardly of and in closely spaced relation to the nip of first calender rolls 31*a*, 31*b*. The diameter or cross-sectional area of tube 32*a* is substantially less than that of the larger or open upper end of coiler trumpet 33, so that the egress or exit end portion of tube 32*a* may extend downwardly within and be encircled by the internally tapered upper portion of coiler trumpet 33. The internal diameter or cross-sectional area of tube 32*a* is substantially greater, however, than that of the discharge orifice of each trumpet 30*c*, 33.

It is preferred that the proximal end portions of trumpet 30*c* and sliver guide tube 32*a* are positioned between the arcs defined by the peripheral surfaces of first calender rolls 31*a*, 31*b*, or at least the distance from the nip of rolls 31*a*, 31*b* to the proximal ends of trumpet 30*c* and tube 32*a* should be less than the average staple length of the fibers in the sliver. Thus, the sliver enters the tube before it has fully expanded to the extent to which it can inherently after having been precompressed by rolls 31*a*, 31*b*. Also, the ambient air will not then be as effective in expanding the sliver as it would be if the tube 32*a* were spaced from the nip of rolls 31*a*, 31*b* a distance equal to or greater than the average staple length.

The axes of web-condensing trumpet 30*c* and the rear end of sliver guide tube 32*a* preferably are spaced a short distance above the common plane of the nips of delivery rolls 12, 13 and first calender rolls 31*a*, 31*b* as represented by the broken lines in the central portion of FIG. 3. This distance may be about 1/32" to 1/16" and, because of its larger size, the axis of tube 32*a* may be located further above said common plane than the axis of trumpet 30*c*. Such arrangement is desirable because, for various reasons such as heat generated by the drafting rolls, the ambient air is in constant motion and tends to rise from beneath the drafting rolls and the calender rolls 31*a*, 31*b*. Consequently, the web emerging from delivery rolls 12, 13 and the sliver emerging from calender rolls 31*a*, 31*b* tend to move upwardly. Thus, the trumpet 30*c* is positioned above the plane of the nips of rolls 12, 13; 31*a*, 31*b* so as to be aligned with the normal path of the web emerging from delivery rolls 12, 13. Thereafter, the sliver being formed through passage 30*b* is pulled downwardly by calender rolls 31*a*, 31*b* and, since the axis of the ingress end of tube 32*a* is above the plane of the nips of rolls 12, 13; 31*a*, 31*b*, the sliver is directed from the nip of rolls 31*a*, 31*b* generally toward the bottom portion of the wall of tube 32*a* so the sliver will not tend to move over the upper edge of the mouth of tube 32*a*.

As the compressed sliver emerges from between first calender rolls 31*a*, 31*b*, it is in a somewhat flattened condition and the sliver expands to some extent. Therefore, the ingress end of tube 32*a* is preferably provided with an internal shoulder or ridge 32*c* (FIG. 3) around its inner periphery which may project inwardly about 1/64" to 1/32" so as to define a restriction at the ingress end of tube 32*a* which aids in gathering the sliver into the tube 32*a* and will permit some expansion of the sliver after it enters the tube. In so doing, the ridge conditions the sliver to reduce friction between the sliver and the length of the confining passage defined by tube 32*a* during further travel of the sliver through tube 32*a*.

The second compressing means 34 is embodied in a pair of fluted calender rolls 34*a*, 34*b* positioned between and closely adjacent coiler trumpet 33 and the open upper end of passage 22 in tube gear 21. In the second embodiment of the apparatus disclosed in my said copending application Ser. No. 548,691, calender rolls are also positioned between a condensing trumpet adjacent the delivery rolls of a drafting unit and the ingress end of a sliver guide tube. However, since the apparatus of said copending application is devoid of calender rolls between the exit end of its sliver guide tube and the tube gear, the sliver travels about twice as far between the calender rolls adjacent the ingress end of the sliver guide tube and the point forwardly thereof at which a pulling force is being applied to the sliver than is the case in the present invention. Not only is the distance from the aforementioned calender rolls of said copending application to the point at which the pulling force is being applied to the sliver much greater than is the case in the present invention, but the sliver is not subjected to a second condensing and compressing action adjacent the inlet of the tube gear passage. The inherent nature of attenuated textile sliver is such that, within certain limits, the greater the distance between the point at which a sliver is being delivered by rolls and the succeeding point at which the sliver is being taken up, the greater is the tendency for the sliver to expand. Thus, it follows that a sliver will expand a considerably greater amount in its course from the web-condensing trumpet to the bottom of the coiler tube gear of said copending application than it will utilizing the second

compressing or calender rolls **34***a*, **34***b* according to the instant invention.

By providing calender rolls between the coiler trumpet **33** and the tube gear **21** as disclosed herein, a sliver of given weight per yard is of relatively smaller cross-sectional area and, therefore, sliver guide tube **32***a* may be of smaller internal diameter or internal cross-sectional area throughout a major portion of its length than that of the sliver guide tube disclosed in said copending application to accommodate a given size sliver. For example, to accommodate sliver in the range of about 50 to 70 grains per yard, the internal diameter of the major portion of sliver guide tube **32***a* of the present invention should be about ¼" to 5/16" (0.49 to 0.077 square inch internal cross-sectional area) in order to properly guidingly confine the sliver in its path of travel, at relatively high speeds of 700 feet per minute or greater, to the second calender rolls **34***a*, **34***b* while maintaining the cohesion and integrity of the fibers relative to each other so that the increase in the C.V. reading (nonuniformity) of the sliver is no more than about 0.5. However, in the processing of very heavy slivers, such as 150 grains per yard, the internal cross-sectional area of sliver guide tube **32***a* may be about 0.300 square inch, which is within the range of the internal cross-sectional area of the sliver guide tube set forth in my said copending application, namely, about 0.150 to 0.300 square inch (7/16" to ⅝" internal diameter).

In any event, the internal cross-sectional area of tube **32***a* should be sufficient to ensure that the tube will not interfere with the travel of the sliver therethrough, and the maximum internal cross-sectional area of tube **32***a* relative to the cross-sectional area of the sliver S should be such that the tube will shield the sliver in its travel from first calender rolls **31***a*, **31***b* to trumpet **33** from the friction of ambient air against the sliver. In the absence of tube **32***a*, as a consequence of high speed travel of the sliver through the air, the resistance of the air would have the effect of retarding the movement of surface fibers from the moving fibrous mass and thus would separate or dislodge many surface fibers; especially relatively short fibers, from the fibrous mass. Such separated fibers further increase the C.V. reading of the sliver and are carried into the ambient air as fly and settle and accumulate as lint on various adjacent parts of the drawing frame and on the textile material in process. Such accumulated lint reduces efficiency in operation of the drawing frame and is difficult to remove. Further, the quality of the sliver is reduced by lint settling upon the sliver.

It is preferred that the exit end of sliver guide tube **32***a* is positioned within the upper portion of coiler trumpet **33**, as heretofore described, in order to ensure that a minimum of air turbulence may be created between the end of tube **32***a* and the area of trumpet **33** at which maximum condensing of sliver S is effected by the relatively small or restricted lower orifice of trumpet **33**. Otherwise, the sliver S may expand or open up as it emerges from the egress end of tube **32***a* and thus may be ruptured at this area, or the expanding or opening of the fibers in the sliver S may choke the coiler trumpet **33** so that the second calender rolls **34***a*, **34***b* may then rupture and part the sliver adjacent the point at which it emerges from the lower end of trumpet **33**. Also, by positioning the egress end portion of sliver guide tube **32***a* within the enlarged upper portion of the passage through trumpet **33**, the prevention of expansion of the fibers thus assured prevents the escapement of lint or fly from sliver S. Tube **32***a* is preferably of circular internal cross section, but may be of somewhat oblong or eliptical cross section without departing from the invention.

To facilitate manually threading the textile material through sliver guide tube **32***a*, it is provided with a very narrow threading slot **32***b* throughout the length thereof which extends radially through the wall of tube **32***a*. As shown in FIG. 2, it is preferred that threading slot **32***b* is formed in the upper portion of the tube **32***a* at the ingress end of tube **32***a* and extends for a relatively short distance along the length of the tube and then curves downwardly, with the major length of slot **32***b* being formed in one side of tube **32***a* as opposed to being formed in the upper wall portion thereof. This arrangement of the slot **32***b* facilitates the threading of the sliver into the ingress end portion of the tube and, since tube **32***a* curves downwardly to the lower level of trumpet **33**, by providing the major length of slot **32***b* in the sidewall portion of sliver guide tube **32***a*, the sliver will not be thrown against that portion of the wall of the sliver guide tube having the threading slot therein. This reduces scuffing of the sliver and also avoids the problem of small fibers being removed from the sliver by the wall of the sliver threading slot **32***b*.

Slot **32***b* is substantially less width than the width of the sliver S passing through sliver guide tube **32***a*. Depending upon the size of the sliver, as stated earlier herein, sliver guide tube **32***a* may have an internal diameter of about 5/16" to ¾", and slot **32***b* in tube **32***a* may be about 1/32" to 3/32" wide throughout the major portion of its length.

The second calender rolls **34***a*, **34***b* of sliver compressing means **34** may be of conventional type commonly used in association with the coiler heads of drawing frames. Although calender rolls **34***a*, **34***b* are preferably of the fluted type for the same reasons given with respect to first calender rolls **31***a*, **31***b*, the second calender rolls may have smooth peripheral surfaces, if desired. Roll **34***a* may be fixed on its shaft **34***c* and calender roll **34***b* may be journaled on its shaft **34***d*. Further, spacing means, not shown, may be provided for maintaining rolls **34***a*, **34***b* in the desired intermeshing relationship similar to the spacing members or enlarged portions **52**, **53** of the bearings **50**, **51**, **41**, **42** of FIG. 5, for example.

The shafts **34***c*, **34***d* of the second pair of calender rolls **34***a*, **34***b* may be mounted in a conventional manner and, therefore, a further description of the supporting means for the second pair of calender rolls **34***a*, **34***b* is deemed unnecessary. Calender roll shaft **34***c* may be driven in a conventional manner, as by a train of gears *e–j* (FIG. 8) connecting the delivery roll **13** to shaft **34***c*. The effective surface speed of the second pair of calender rolls **34***a*, **34***b* should be such as to apply a tension draft to the sliver sufficient to pull the same from the nip of the first pair of calender rolls **31***a*, **31***b*, through sliver guide tube **32***a*, and through coiler trumpet **33**, and to deliver the thus compressed, high density sliver into the passage **22** of rotary coil forming member **21** to be coiled into can **24**. A relatively low tension draft, as compared to that normally required, may be imparted to the sliver in its travel between the first and second pairs of calender rolls **31***a*, **31***b*, and **34***a*, **34***b* so as to substantially eliminate the possibility of imparting any false draft to the sliver in this zone. For example, in the absence of applicant's invention, it is customary to apply a draft of from about 1.08 to 1.12 to the sliver. According to the present method, however, because of the increased tensile strength and high density of the sliver, the amount of tension draft between calender rolls **31***a*, **31***b* and calender rolls **34***a*, **34***b* may be as low as 1.010 or under.

By the arrangement of the condensing means **30**, **33**, the compressing means **31**, **34**, and the sliver guiding and confining means **32** according to this invention, the exit ends of the trumpets **30***c*, **33** may be substantially smaller than has been the case heretofore, thus further reducing the cross-sectional area of a sliver per given weight per unit length. For example, in processing a 60 grain per yard sliver, the smaller or discharge end of the passage **30***b* in web condensing trumpet **30***c* may be about .140 to .150 inch and, whereas the diameter of the small end or orifice of a coiler trumpet normally is about .135 inch, it has been found that the orifice of the coiler trumpet **33** associated with the present invention now may be reduced to about .110 to .125 inch diameter, thus further condensing and reducing the cross-sectional area of the sliver.

The distance from the egress end of coiler trumpet **33** to the nip of second calender rolls **34***a*, **34***b* also is less than the average staple length of the fibers in sliver S to avoid imparting a false draft to the sliver in this zone.

In order to support sliver guide tube **32***a* so that its ingress end may be positioned closely adjacent the nip of first calender rolls **31***a*, **31***b* and between the arches of the first calender rolls, and so that the exit or egress end of tube **32***a* may be positioned within the internally tapered upper portion of trumpet **33** without engaging the wall thereof, tube **32***a* has a downwardly projecting rib or plate portion **60** depending therefrom adjacent its ingress end and through which a pair of longitudinally spaced pins **61**, **62** extend laterally. Opposite ends of pins **61**, **62** extend loosely into respectively notches or grooves **63**, **64** (FIG. 4) in the bifurcated upper portion of a bracket **66** provided with two downwardly extending legs **67** which are adapted to straddle the conventional coiler trumpet support arm **70** shown in FIG. 1. The lower ends of legs **67** rest upon beam **26** and are held in the desired position by upstanding pins **71** on the beam **26** which loosely penetrate suitable openings provided in the rear lower portions of the legs **67**. Thus, bracket **66** may be readily removed from beam **26** simply by raising the same upwardly free of pins **71**.

Referring again to FIG. 4, it will be observed that the rear notch **64** in the bifurcated upper portion of bracket **66** is formed somewhat in the manner of a bayonet slot so that, in order to remove the sliver guide tube **32***a* from bracket **66**, when desired, it is simply necessary for the operative to raise the forward end of tube **32***a* upwardly so that it clears the upper end of trumpet **33** and so that the front pin **61** clears the front portion of the upper edge of bracket **66**. Thereupon, tube **32***a* is moved forwardly, as pin **62** is slid along bayonet slot **64** in bracket **66**, and then lifted upwardly to remove sliver guide tube **32***a* from the bifurcated upper portion of bracket **66**.

In operation, it is thus seen that the web of textile material T emerging from delivery rolls **12**, **13** is propelled against the rear surface of condensing plate **30***a*, which is positioned closely adjacent the front surfaces of delivery rolls **12**, **13**. Plate **30***a* then guides and gathers the web into the passage **30***b* of trumpet **30***c* where the textile material is condensed into a small sliver. As the first pair of calender rolls **31***a*, **31***b* pulls the sliver through trumpet **30***c*, they immediately compress the sliver.

The second pair of calender rolls **34***a*, **34***b* then aids in retaining the compressed state of the sliver to a substantial degree, even though the sliver expands a relatively small amount as it leaves the nip of the first pair of calender rolls **31***a*, **31***b*. If the calender rolls **31***a*, **31***b* are fluted, as preferred, the sliver is also crimped transversely thereof at the same time that it is compressed, thereby further increasing the density and tensile strength of the sliver and further ensuring a reduced volume per given weight of the sliver or, in other words, a retentive relatively reduced cross-sectional area in sliver as it is pulled from the first calender rolls **31***a*, **31***b* to the second calender rolls **34***a*, **34***b*.

The second condensing means then further condenses the sliver as it is thereafter compressed and crimped a second time by the calender rolls **34***a*, **34***b* and then delivered into the passage **22** of coil-forming member **21** to be coiled into the can **24**.

It is thus seen that I have provided an improved method and apparatus for forming a fibrous web being delivered from a drafting unit into a sliver having characteristics of high density, high tensile strength, reduced volume per given weight per unit length and reduced cross-sectional area per given weight per unit length, while maintaining the cohesion and integrity of the fibers in the sliver relative to each other so that there is very little increase in the C.V. reading (nonuniformity) of the sliver in its course to a coil forming member. Also, it is seen that, since the sliver being formed is of reduced cross-sectional area for a given weight per unit length as compared to slivers produced by prior methods and apparatuses, a substantially greater length of sliver of given weight per unit length may be coiled into a sliver can of given size than has been the case heretofore, since a greater number of layers of sliver of given weight per yard and a greater number of coils of sliver per layer may now be positioned in a sliver can of given size than has been practical heretofore to my knowledge.

In the drawings and specification, there has been set forth a preferred embodiment 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, the scope of the invention being defined in the claims.

I claim:

1. Apparatus for controlling fibrous textile material in its course from delivery rolls of a drafting unit to a rotary coil forming member; said apparatus comprising

a condensing plate closely adjacent the delivery rolls and having a trumpet-shaped passage therethrough for condensing a fibrous web emerging from the delivery rolls into a sliver,

a first pair of rotatable fluted intermeshing calender rolls for calendering, crimping and pulling the sliver through said trumpet-shaped passage,

said trumpet-shaped passage of said condensing plate terminating between the arcs of the first pair of calender rolls closely adjacent the nip thereof,

a second pair of rotatable fluted intermeshing calender rolls adjacent said coil forming member and arranged to calender, crimp and pull said sliver from said first calender rolls and to deliver the sliver to said coil forming member,

a sliver condensing coiler trumpet disposed closely adjacent the nip of said second pair of calender rolls,

an elongate sliver guide tube for guidingly confining the sliver in its path of travel from said first calender rolls into said coiler trumpet and having an ingress end positioned closely adjacent the nip of and between the arcs of said first pair of calender rolls,

the internal cross-sectional area of said sliver guide tube being within the range of about .049 to .077 square inch for readily accommodating sliver in the range of about 50 to 70 grains per yard and wherein the ingress end of said sliver guide tube is provided with an internal shoulder around its inner periphery defining a restriction to aid in imparting cohesiveness to the sliver passing through said guide tube,

the nips of said delivery rolls and said first calender rolls being disposed in a common substantially horizontal plane with respect to each other and wherein the axes of the discharge orifice of said trumpet-shaped passage and the ingress end of said sliver guide tube are each disposed a predetermined distance above said horizontal plane, and

drive means operatively connecting the drafting unit to one of the calender rolls of each pair.

2. Apparatus for controlling fibrous textile material in its course from delivery rolls of a drafting unit to a rotary coil forming member and wherein the drafting unit includes a beam extending beneath said delivery rolls; said apparatus comprising

a condensing plate closely adjacent the delivery rolls and having a trumpet-shaped passage therethrough for condensing a fibrous web emerging from the delivery rolls into a sliver.

a first pair of rotatable fluted intermeshing calender rolls for calendering, crimping and pulling the sliver through said trumpet-shaped passage,

a second pair of rotatable fluted intermeshing calender rolls adjacent said coil forming member and arranged to calender, crimp and pull said sliver from said first calender rolls and to deliver the sliver to said coil forming member,

a sliver condensing coiler trumpet disposed closely adjacent the nip of said second pair of calender rolls,

an elongate sliver guide tube for guildingly confining the sliver in its path of travel from said first calender rolls into said coiler trumpet,

drive means operatively connecting the drafting unit to one of the calender rolls of each pair, and

means mounting said sliver guide tube on said beam and comprising

a downwardly projecting rib fixed to said tube adjacent its ingress end and having a pair of substantially horizontally spaced laterally projecting pins thereon, and

a bracket mounted on said beam and projecting upwardly therefrom forwardly of said first calender rolls and having a bifurcated portion on its upper end adapted to receive said downwardly projecting rib therein, said bifurcated upper portion having a pair of longitudinally spaced notches in its upper surface with the rearmost notch being substantially L-shaped such that the corresponding pin on said rib may be moved downwardly thereinto and then rearwardly, and the other of said notches being located so as to receive the other of said pins when said one pin occupies the latter rearward position.

3. A method of producing a high density sliver during continuous travel of textile fibers from a drafting unit to a rotatable coiler member; said method comprising the successive steps of

condensing a web of textile fibers emerging from the drafting unit into a sliver closed adjacent the drafting unit,

calendering the sliver to compress the same at a point less than the average staple length of the fibers in the sliver from the point where the web is condensed to form the sliver to avoid imparting false draft to the sliver passing therebetween while imparting crimp thereto and while applying a minute tension draft

of about 1.001 to 1.005 to the sliver sufficient to pull the fibers through the condensing step,

guidingly confining the crimped sliver in an elongate passage from a point less than the average staple length of the fibers in the sliver from the point of calendering of the sliver to substantially prevent escapement of lint from the sliver passing therebetween to a point adjacent the coiler member so as to substantially prevent escapement of lint therefrom,

condensing the crimped sliver as it emerges from the elongate passage,

again calendering the sliver while imparting additional crimp thereto and while applying a relatively low tension draft of about 1.010 to the sliver such as to pull the sliver from the first point of calendering through the elongate passage without imparting false draft to the sliver and delivering the sliver to the coiler member, and

wherein the condensing of the web into a sliver and the condensing of the crimped sliver emerging from the elongate passage include respective passage thereof through increasingly restricted passageways.

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DORSEY NEWTON, Primary Examiner

U.S. Cl. X.R.

19—157

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,533,138 Dated October 13, 1970

Inventor(s) J. R. Whitehurst

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, Line 45, "quantity" should be --quality--; same column Line 68, after "number" and before "coils" insert --of--. Column 4, Line 19, "peferred" should be --preferred--. Column 7, Line 14, "0.49" should be --0.049--. Column 8, Line 15, after "32b" insert --of--. Column 9, Line 15 "respectively" should be --respective--. CLAIM 2, Column 11, Line 3, "guildingly" should be --guidingly--. CLAIM 3, Column 11, Line 32, "closed" should be --closely--.

SIGNED AND SEALED
DEC 29 1970

(SEAL)
Attest:

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