July 16, 1968 F. KALWAITES 3,392,425

APPARATUS FOR DRAFTING SLIVER

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Fig. 1.

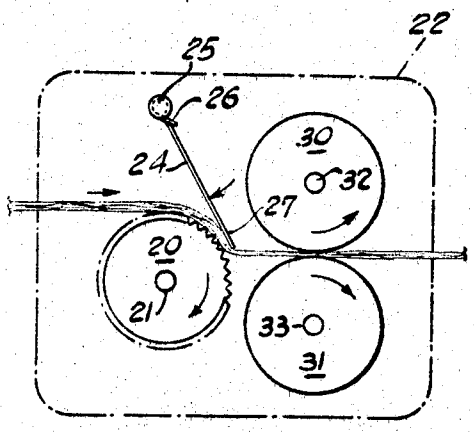


Fig. 2.

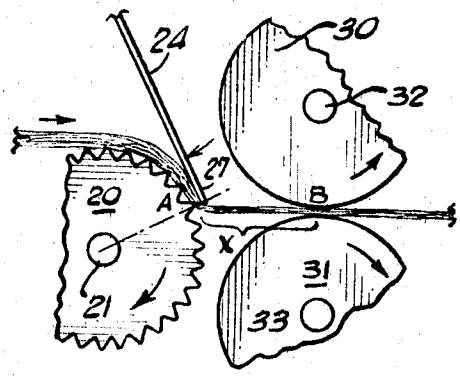


Fig. 3.

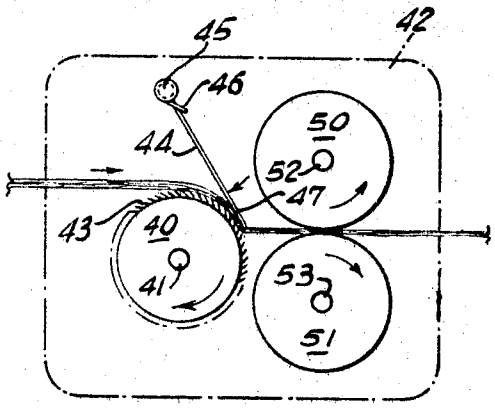
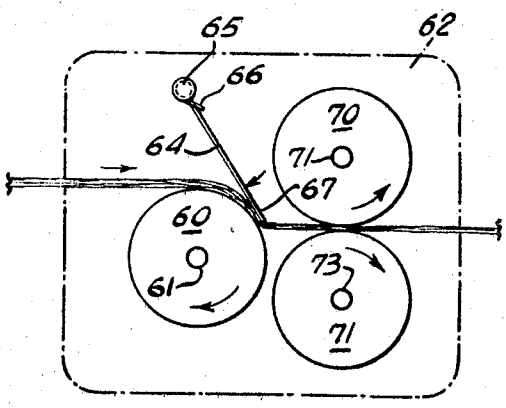


Fig. 4.



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APPARATUS FOR DRAFTING SLIVER

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Continuation-in-part of application Ser. No. 420,924, Dec. 24, 1964. This application May 8, 1967, Ser. No. 648,512
3 Claims. (Cl. 19—290)

ABSTRACT OF THE DISCLOSURE

Apparatus for drafting sliver or roving and maintaining the fibers under control while being drafted comprising a roll and a nip blade in tangential pressing contact with the roll. The blade being flexible along its edge to tend to conform to the cross-sectional configuration of the sliver or roving being drafted whereby a uniform, controlled draft is produced.

The present application is a continuation-in-part of my co-pending application Ser. No. 420,924 filed Dec. 24, 1964, now abandoned.

The present invention relates to apparatus for drafting slivers and/or rovings, and more particularly to apparatus for improving the control and the efficiency of drafting cotton sliver or cotton roving.

A common system for drafting sliver and rovings is called "roll drafting." In this process the drafting of the roving is accomplished by means of three pairs of drawing rolls, each succeeding pair of rolls having a greater linear surface speed than the preceding pair of rolls. The bottom roll of each pair is usually fluted and positively driven while the top roll of each pair is usually covered with leather or similar materials to improve the gripping power of the roll. The drafting is controlled by the speed of the rolls, the spacing between rolls and the pressure applied by the top rolls. The technique of drafting has many limitations, especially when used with cotton fiber. The setting between rolls must be greater than the staple length of the fiber to prevent breaking of the fiber and as cotton varies considerably in length, at any given roll setting some fiber, the long ones, will be broken while the very short fibers are given very little drafting. Actually only a small percentage of cotton fibers are positively controlled with roll drafting. Improvements have been made on this basic system by various means such as changing the surface of the rolls, changing roll diameters, allowing some rolls to slip over the longer fibers, etc.

A major advance over this basic system is what is called "long drafting." Generally this type of drafting incorporates an apron and roll or a pair of aprons in combination with a pair of rolls to accomplish drafting. The use of such aprons allows greater control over the distance between drafting nips as the apron configurations may be changed and placed much closer to the nip formed by a pair of rolls. The aprons also allow fibers to sip and provide better control over the fibers being drafted. However, there are some disadvantages to these mechanisms in that they are more complicated and expensive, the aprons usually wear unevenly, produce uneven yarns and require replacement.

In most of the apron drafting systems, the portion of the apron contacting the fibers is in a slack rather than a tensional state. This slack state reduces the amount of control that may be placed on the fibers by the apron. Furthermore, the slack aprons do not produce a positive nip on the fibers except at the area contacting the rolls driving the aprons which is a considerable distance from the nip of the front drafting rolls.

Still another system of drafting most commonly used in the woolen or jute industry is termed "gilling." Generally these processes comprise putting fibers through a mass of closely spaced pins to parallelize and draft the fibers. Such drafting techniques are generally suitable only for the longer length fibers common to the woolen and jute industry.

In all of the prior art drafting systems the minimum distance between positive nips is limited to the sum of radii of a front roll and back roll. In "apron drafting" or "gilling" the fibers may be placed under a sliding control to within a minimum distance of the front roll equal to the radius of the front roll. Furthermore, in most drafting systems the amount of pressure applied to the fibers to control them is limited by the weight of the upper roll. Greater pressure may be applied by increasing the weight of the upper roll or by substituting a stationary bar for one of the rolls and cantilevering the bar to increase the pressure.

In accordance with the present invention the minimum distance between positive nips is not limited by the sum of the radii on the front roll and back roll and in some instances may even be slightly less than the radius of the front roll. Furthremore, if desired the fibers may be placed under controlled draft to within a minimum distance of slightly less than the radius of the front roll.

In my improved apparatus, the fibers may be controlled almost up to the nip of the front rolls and hence, even the short fibers are under control during the drafting operation. The distance between the faster rotating rolls and the back control device may be less than the staple length of fibers without damaging the fibers as the back control adjusts itself and allows the longer fibers to slip without breakage. Furthermore, my improved type of back control tends to conform to the cross-sectional area of the sliver passing through the control to produce a more uniformly drafted sliver.

My improved apparatus for drafting fibers is adjustable over wide ranges and allows for very high degrees of draft as well as very low degrees of draft.

In accordance with the present invention sliver of staple fiber is drafted by gripping the leading ends of said fiber with the nip formed by a pair of rotatable surfaces while retarding the trailing ends of said fibers with the nip formed by a rotatable surface and a stationary surface.

In accordance with the present invention, roving or sliver is fed through a first or back nip formed by a rotatable surface, preferably a rotatable roll, and a stationary surface of a flexible nip blade, in tangential pressing contact with the rotatable surface. The nip blade is pivotally mounted with respect to the rotatable roll and is placed in pressing contact with the roll along a line running the length of the roll. The edge of the nip blade in contact with the roll is flexible so that this edge tends to conform to the cross-sectional area of the sliver passing between the roll and the blade. The pivotal mounting allows for control of the pressure applied to the roll along the tangential contact line and allows the blade to be pushed away from the roll surface as the fibers pass between the roll and the blade. The flexibility of the blade allows the thicker sliver areas to push the blade further away from the roll while allowing the blade to still remain in pressing contact with thin areas in the sliver and hence control substantially all the fibers making up the cross-sectional area of the sliver during the entire drafting operation. From this first or back nip the sliver or roving passes to a second or front nip comprising a pair of movable surfaces, preferably a pair of rotatable rolls, rotating in opposite directions.

The rotatable surface in the first or back nip moves at a slower speed than the surfaces in the second or front

nip. This differential in speed accompanied by the friction applied to the sliver by the nip blade in tangential pressing contact with the rotatable surface of the back nip controls the drafting of the sliver. Furthermore, the flexible nip blade allows the back nip to be placed extremely close to the front nip so that even the shorter fibers are placed under control draft and the slip-type drag of the flexible nip blade prevents breakage of fibers having a length greater than the distance between the front and back nip.

My improved drafting apparatus has three primary advantages as follows:

(1) Control of fibers from the time their leading edge is positively gripped and the draft started almost to the point where the fiber has completely passed through the positive grip drafting means;

(2) Control of substantially all the fibers making of the cross-sectional area of a sliver; and

(3) Control of the entire length of sliver in a uniform manner.

The sliver or roving processed in accordance with this invention may contain natural or synthetic, vegetable, animal or mineral fibers, such as, cotton, silk, wool, vicuna, mohair, alpaca, flax, ramie, jute, etc.; synthetic or man-made fibers, such as, the cellulosic fibers, notably cuprammonium, viscose or regenerated cellulose fibers; cross-linked cellulosic fibers, such as, "Corval" and "Topel;" cellulose ester fibers, such as, cellulose acetate "Celanese" and cellulose tri-acetate "Arnel"; the saponified cellulose ester fibers, such as, "Fortisan" and "Fortisan-36"; the polyamide fibers, such as, nylon 420, nylon 6 (polycaprolactam), nylon 66 (hexamethylene diamine-adipic acid), nylon 610 (hexamethylene diamine-sebacic acid), nylon 11 (11-amino undecanoic acid-"Rilsan"); protein fibers, such as, "Vicara"; halonegated hydrocarbon fibers, such as, "Teflon" (polytetrafluoroethylene); hydrocarbon fibers, such as, polyethylene, polypropylene, polybutadiene and polyisobutylene; polyester fibers, such as, "Kodel" and "Dacron;" vinyl fibers, such as, "Vinyon" and Saran; dinitrile fibers, such as, "Darvin"; nitrile fibers, such as, "Zefran"; acrylic fibers such as, "Dynel," "Verel," "Orlon," "Acrilan," "Creslan," etc.; mineral fibers, such as, glass, metal, etc.

The average lengths of the fibers in the starting sliver or roving are of textile length and may vary from about ⅜ inch or ½ inch up to about 2½ inches or more in length, depending upon the particular properties and characteristics required or desired in the resulting drafted sliver or yarn.

The denier of the individual synthetic fibers referred to above is preferably in the range of the approximate thickness of the natural fibers mentioned and consequently deniers in the range of from about 1 to about 5 are preferred. Where desired, special fiber deniers of down to about ¾ or even about ½ may be employed or deniers of up to about 5.5, 6, 8, 10, 15, or higher, may be used. The minimum and maximum deniers are naturally dictated by the desires or requirements for producing a particular drafted sliver, by the machines and methods for producing the same, and so forth.

The weight and size of sliver or roving processed will depend upon the amount of draft used and the size and weight of the yarns to be subsequently produced.

The invention will be more fully understood from the description which follows, taken in conjunction with the accompanying drawings in which there are illustrated preferred designs of machines and modes of operation embodying the invention. It is to be understood, however, that the invention is not to be considered limited to the constructions disclosed except as determined by the scope of the appended claims.

In the drawings:

FIGURE 1 is a simplified, fragmentary, schematic view in elevation showing one embodiment of the general principles of operation of the present invention;

FIGURE 2 is an enlarged view of a portion of FIGURE 1, drawn to a much larger scale showing in greater detail certain elements of the present invention;

FIGURE 3 is a simplified, fragmentary, schematic view in elevation showing another embodiment of the general principles of operation of the present invention; and

FIGURE 4 is a simplified, fragmentary, schematic view in elevation showing still another embodiment of the general principles of operation of the present invention.

In the embodiment of the invention illustrated in FIGURE 1 of the drawing, the back or first nip comprises a rotatable roll **20** having very fine flutes rotating on a shaft **21** mounted in a frame **22**. The roll has a diameter of from about 1 inch to about 6 inches and from about 1¼ inches to 3 inches. It is preferable that the roll have a gripping surface, i.e., a slightly roughened or textured surface, preferably by means of fine knurling, engraving, etching, or sandblasting. In many instances, a textured surface having very small cavities such as prevails in the case of natural or synthetic rubber, leather or leather-like surfaces is suitable, or even rolls having larger cavities such as standard fluted rolls may be used.

A relatively flat flexible nip blade **24** is adjustably positioned on a pivot **25** and is capable of being placed in pressing tangential contact with the roll **20**. Any suitable pressure-applying means, such as, a helical spring **26** may be employed to cause the nip blade to exert the desired pressure on the roll. If desired, the flexible nip blade may merely be placed in pressing contact with the roll and locked in that position. The nip blade may be made from various materials which have some amount of give or flexibility to them such as tempered steel, Phosphor bronze, or other suitable metals or even plastic materials which are flexible and not brittle. The blade must be rigid enough from its point of contact with the roll to its pivotal mounting point to allow pressure to be applied to the roll but the edge of the blade in contact with the roll must be flexible to tend to conform to the cross-sectional configuration of sliver.

The point of tangency of the nip blade and roll is so located that end **27** extends towards the nip formed by a pair of rotatable rolls **30** and **31** rotating on shafts **32** and **33** respectively, mounted in frame **22**. The pair of rolls **30** and **31** may be smooth-faced or slightly roughened or if desired, a pair of aprons may be substituted for the rolls or an apron and a roll may be substituted. The rolls rotate in the directions shown and at surface linear speeds faster than the speed of the first roll **20**. The rolls may rotate slightly faster up to 5 or 10 times faster or even more than roll **20**. Rolls having diameters of from about 1 inch to 3 inches have been found suitable. Pressure is applied to the nip formed by the rolls **30** and **31** by any of the various known pressure-applying means; these means are omitted from the drawings for the purpose of clarity.

FIGURE 2 is an enlarged view of the area of the first roll **20** adjacent its point of tangency A with nip blade **24** and the nip B formed by the rotating rolls **30** and **31**. The distance X from nip A to nip B may be slightly greater than the staple length of the fiber being drafted or it may be less than the staple length of fiber being drafted. In operation the sliver or roving to be drafted is passed through nip A and from nip A to nip B. The rolls **30** and **31** rotate in the directions shown and at a surface linear speed greater than the surface linear speed on roll **20**. The speed differential coupled with the drag on the sliver placed there by the nip blade as well as the frictional drag of adjacent fibers, especially those not yet gripped by nip B aligns the fibers in the sliver uniformly and without breakage of fibers even of those which are long enough to be simultaneously gripped by nips A and B.

As illustrated in FIGURE 3 the first roll **40** or back roll is provided with a peripheral surface having wire teeth **43** extending thereon. Such wire teeth may be either conventional fillets or metallic card clothing, as desired. Plush

or pile fabric surfaces may also be used. The remaining parts are the same as shown in FIGURE 1 and are given reference numerals 20 higher than their counterparts in FIGURE 1. The operation of the apparatus illustrated in FIGURE 4 is similar in principle to that of the apparatus illustrated in FIGURE 1 and described in conjunction therewith.

In FIGURE 4 there is illustrated another embodiment of the present invention wherein corresponding parts are given reference numerals 40 higher than their counterparts in FIGURE 1. The basic difference in the two embodiments is the use of textured surface roll **60** and a curved or arcuate nip blade **64** in this embodiment, as compared to the fluted roll and relatively planar of flat nip blade used in the embodiment of FIGURE 1. The use of such a curved nip blade which is convexly shaped with respect to the roll **60** decreases the area of tangency, and hence, controls the sliver over a smaller area allowing for more precise control over the drag exerted on the fibers as they are drafted.

In the drawings, no driving means, such as, motors, pulleys, belts, gears, sprockets, and the like have been illustrated for the rolls. It must be understood that this has been done because such driving means are conventional and well known in the art. Additionally, their omission from the drawings makes the individual figures thereof less complicated and easier to read and to understand.

Although several embodiments of the inventive concept have been described, the same should not be construed as limited thereby nor to the specific features mentioned therein but to include various other equivalent features as set forth in the claims appended hereto. It is understood that any suitable changes, modifications and variations may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for drafting sliver of staple fiber comprising:

(a) a first rotatable roll;

(b) a pivotally mounted nip blade in tangential contact with said first rotatable roll, the portion of said blade in tangential contact being flexible whereby said portion of the blade tends to conform to the cross-sectional configuration of the sliver being drafted;

(c) a pair of rotatable rolls forming a nip adjacent said tangential contact;

(d) said pair of rolls rotating in opposite directions with respect to each other and at a surface linear speed greater than the surface linear speed of said first rotatable roll whereby the fibers in the sliver are drafted under substantially uniform control without breakage of fibers.

2. Apparatus according to claim **1**, wherein, said first rotatable roll has flutes on its surface running substantially parallel to the axis of the roll.

3. Apparatus according to claim **1**, wherein, the distance between the nip formed by the rotatable rolls and the tangential contact is less than the radius of said rotatable rolls, whereby fibers are kept under control during substantially the entire time they are being drafted.

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MERVIN STEIN, *Primary Examiner.*

D. NEWTON, *Assistant Examiner.*