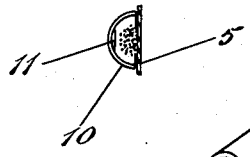
June 16, 1953 N. E. KLEIN 2,641,804

PROCESS AND APPARATUS FOR CONVERTING TEXTILE FIBERS

Filed June 26, 1946

Fig. 3.



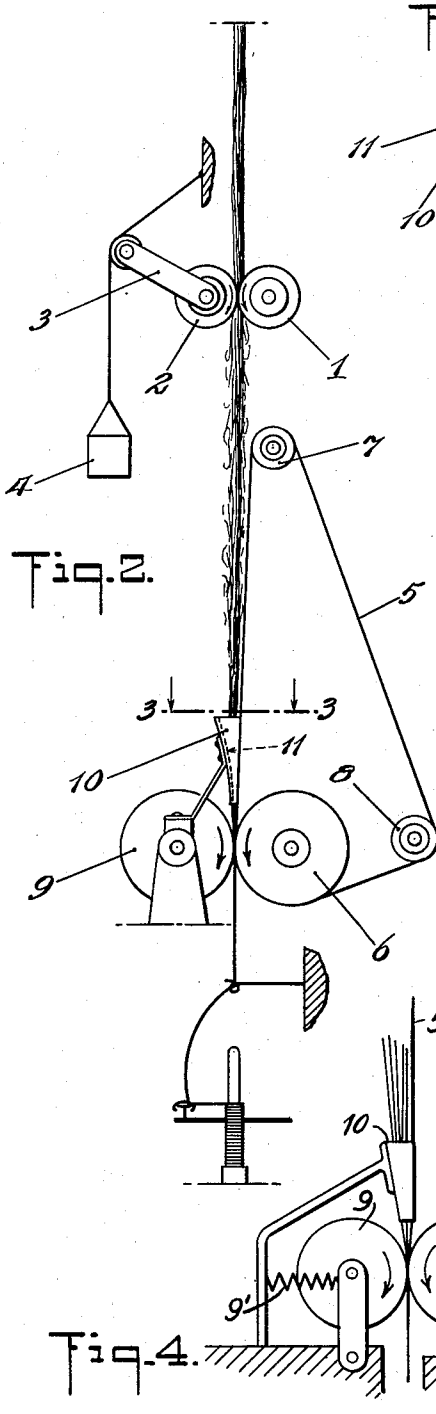


Fig. 2.

Fig. 1.

Fig. 4.

INVENTOR
NORMAN EDWARD KLEIN
BY
ATTORNEY

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PROCESS AND APPARATUS FOR CONVERTING TEXTILE FIBERS

Norman Edward Klein, Clemson, S. C., assignor to Deering Milliken Research Trust, Pendleton, S. C., a nonprofit trust of Maine

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6 Claims. (Cl. 19—.35)

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The present invention relates to a process of producing yarn from relatively long or continuous fibres and, more particularly, to a novel method for drafting artificial textile fibres from a continuous tow of continuous filaments to a sliver or roving of staple fibres, and to an apparatus for carrying out such process.

For the past seventy-five years the textile art has appreciated that slivers of long fibres, such as flax, hemp and the like, can be formed into rovings or yarns containing fibres of staple length by subjecting the sliver to tension between sets of draft rollers operating at successively increasing speed to break the individual fibres into staple lengths. In this manner, a continuous sliver of such fibres in staple length no greater than the ratch length is produced. Upon the introduction of artificial fibres in continuous filaments, the textile art of course applied the same method to the formation of rovings and yarns of these fibres in staple lengths from tows or slivers containing a multiplicity of these continuous filaments and, as expected, with some success.

One difficulty experienced in this operation is due to the fact that, when a filament breaks within the ratch in accordance with this method, the forward part is under the control of the draft set of rollers but the part within the feed or retaining rollers is no longer under control. For this reason, many of these filaments snap back after breaking and, having their forward ends loose within the ratch, tend to leave the sliver and to produce a frayed or snarled surface. The broken ends are therefore not in position to be nipped by the lower rollers in proper sequence relative to the point at which the break has occurred. As the feed rollers continue to feed into the ratch the filaments thus broken, they are carried by the sliver toward the draft rollers, and the frays are turned back upon the sliver and extend too widely to be seized by their forward ends. After a number of these filaments are thus piled up, they are seized by the draft rollers at a point removed from their ends and are pulled through to form a slub in the roving or yarn. This gives a yarn variation which is undesirable for many purposes.

It is an object of the present invention to provide a novel method for producing relatively uniform rovings and yarns of staple fibres from long textile fibres.

It is another object of this invention to provide a controlled method for drafting long or continuous textile fibres to produce yarns which are relatively free of slubs and similar variations.

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A further object of the invention is to provide an improved apparatus for drafting a tow of long or continuous fibres into relatively uniform rovings and yarns containing fibres of staple length.

Other objects and advantages of this invention will be apparent from the following description, taken in conjunction with the accompanying drawing, wherein:

Fig. 1 illustrates an apparatus for carrying out the process of the present invention;

Fig. 2 shows a modification of the apparatus of this invention;

Fig. 3 is a horizontal section of the apparatus of Fig. 2, taken on line 3—3 of Fig. 2, looking in the direction of the arrows; and

Fig. 4 is a fragmentary view illustrating a further modification of the apparatus of the invention.

In general, the present invention is directed to a process for drafting a multiplicity of continuous filaments between two points which determine the ratch, breaking the filaments within this ratch, and confining the free ends of the broken filaments in sufficiently narrow compass to facilitate their being nipped at the second point. The invention also provides a device having a pair of rollers in substantial contact with each other at their peripheries and adapted to feed filaments in a sliver therebetween, and a pair of movable endless belts having their adjacent surfaces converging from in front of said rollers to a point removed from the rollers by a distance equivalent to the ratch length desired and there in substantial surface contact with each other. The endless belts are adapted to move at a higher surface speed than the peripheral speed of the feed rollers in order to draw out and break the filaments nipped between them at the point of substantial contact or of draft. If desired, a roller may be substituted for one of the endless belts employed for drafting the filaments, and means may be employed for putting twist, either true or false twist, in the sliver between the feed rollers and the draft point.

Referring now to Figs. 1, 2 and 4, reference characters 1 and 2 indicate a pair of rollers in substantial contact with each other. One of these rollers 1 is driven through an appropriate gear system by a power source not shown, and roller 2 is weighted by weight 3 acting through arm 4 to rotate in the opposite direction by frictional contact with roller 1, the two rollers being adapted to feed a sliver of continuous filament therebetween at a desired linear speed.

Spaced from these rollers, and preferably below

them, are a pair of endless belts 5; each belt is mounted upon a drive wheel 6, and upon idler pulleys 7 and 8, and the respective drive wheels 6 are set closer together than the idler pulleys 7. The surface contact of the two belts provides the point of draft for the sliver being fed through rollers 1 and 2. Referring more particularly to Figs. 2 and 4, a roller 9 may be substituted for one of the movable belts, and the periphery of roller 9 is in substantial contact with the belt at the desired point of draft. It is advantageous that the drive wheels 6 upon which the movable belts 5 are mounted be set opposite each other, so that a line drawn between the axes of the respective wheels is perpendicular to the direction line of travel of the sliver and that the point of intersection of these two lines is the point of draft; in this way, the strongest nip can be obtained at the draft point. Similarly, where a roller is substituted for one of the movable belts, this roller is desirably set opposite the drive wheel of the remaining belt.

The feed rollers 1 and 2 are of any suitable material and may vary widely in composition depending upon the physical characteristics of the sliver and its component filaments passing between them. It is usually preferred to provide a smooth rubber-surfaced roller for the driven roller 1 and to use a knurled or milled metallic roller for the weighted friction roller 2. Similarly, the movable belts 5, while usually rubber-surfaced, may have a textile or metallic surface if desired; it will be appreciated that the belts are made of a flexible and resilient material. When drafting tow down to fine yarn sizes, it may be advantageous to drive only one of the belts and to move the other belt by frictional contact with the driven belt. A roller substituted for one of the belts is normally weighted or spring-urged, as by the compression spring 9' of Fig. 4, to provide frictional contact between belt and roller, and the surface of this roller may also be of any suitable material, such as rubber, textile, metal, sandpaper, carborundum, etc.

The idlers 7 (or in the case of only one belt, as in Fig. 2, the idler 7) are so positioned as to provide only slight contact between the belts (or belt) and the tow or sliver in the ratch. The contact is preferably sufficient only to confine the free ends of the broken filaments and to prevent their being wafted so far out from the sliver that they are not readily caught in the nip of the belts, that is, at the draft point. Besides tending to prevent the peeling back of loose end fibres projecting from the body of the tow, the slight contact of the belt with the tow from right below the feed rollers to the point of draft or nip helps to advance the tow in the ratch area and reduces the tendency of the tow to part in this area.

If desired, a guide for the tow in addition to the moving wall of the belt may be employed where only one belt is used. Thus, a semi-trumpet 10 as shown at Figs. 2, 3 and 4 or similar device for retaining the tow in decreasing compass as it approaches the nip may be provided. It has also been found advantageous to apply a lining 11 of radium or other suitable radioactive material inside the semi-trumpet in order to decrease static attraction of the loose ends of fibres in the tow for the walls of the trumpet.

The operation of the device of the present invention is very simple. A tow or sliver of continuous filaments is continuously fed to the feed rollers 1 and 2 at desired tension, and roller 1 is driven at a suitable speed to feed the tow into the ratch. The tow is guided by the endless belt or belts 5 toward the point of draft or point toward which the belts converge and is there nipped between the belts (or between the belt and roller 9). The belts are driven at a considerably higher linear speed than the peripheral speed of the feed rollers, say at a ratio of about 5 to about 150 for the belts to 1 for the feed rollers, and the individual filaments in the tow are elongated and attenuated to the breaking-point under the resulting tension. The filaments break at random in the ratch, and the lower portions, still nipped by the moving belts, are rapidly pulled away from the upper portions being fed into the ratch through the slower feed rollers. This causes a slippage of fibres past each other in the tow and a further drafting or elongation and attenuation of the continuous tow or sliver.

When the filaments are stretched and break, there is a tendency for them to snap back, and some of the upper portions, being loose, project out of the tow. The moving belts prevent these free ends from wafting out too far and, being in slight contact with the advancing tow, have a smoothing action upon it, tending at the same time to hurry the upper portions along at a speed somewhat higher than the peripheral speed of the feed rollers but not nearly approaching the linear speed of the belts.

As each upper portion of a broken filament is again nipped between the belts 5 or between belt 5 and roller 9, there is a new stretching and breaking of this filament and a continuation of the drafting action. The random breaking of the multiplicity of filaments provides a continuity of the tow or sliver, and the fibres comprising this sliver are all of staple length, maximum length being determined by the ratch length.

It is preferred to pass the drafted sliver containing staple fibres from the movable belts directly to the spinning operation. For a given spindle speed, the number of twists per inch in the resulting yarn is, of course, dependent upon the linear speed of the movable belts.

Although the present invention has been described with respect to particular embodiments, it will be apparent to those skilled in the art that variations and modifications of this invention can be made and that equivalents can be substituted therefor without departing from the principles and true spirit of the invention. Thus, it will be apparent that this invention is as applicable to the drafting of relatively long natural fibres, such as flax, hemp, etc., to uniform staple lengths as it is to the treatment of artificial fibres such as continuous filaments of regenerated cellulose. Moreover, while a random breaking of the filaments has been contemplated in the previous discussion of the drafting operation, the invention is equally applicable to use with tow which has been treated to weaken the fibres at certain intervals or to strengthen the fibres except at such points. Similarly, means may be employed, as known to the art for twenty years, for breaking the filaments at substantially desired lengths instead of into staple lengths which may vary anywhere from zero up to the length of the ratch. These and other variations and modifications of the invention are believed to be within the scope of the present specification and within the purview of the appended claims.

I claim:

1. A device for producing relatively uniform rovings of staple fibres which comprises feed

rollers for movably retaining a continuous sliver of relatively long textile fibres, a movable endless belt spaced below said feed rollers and having a side thereof disposed beneath the rollers and substantially parallel to the path of travel of the sliver, rotatable means in fixed position and in contact with the inner surface of said side at a portion thereof removed from the rollers, a roller positioned at the outer surface of said side at said portion, and a gathering element having an inverted substantially conical inner surface portion in association with said belt and having the apex thereof above the portion where belt and rotatable means are in substantial contact, said rotatable means being adapted to cause said belt and the surface of the roller in engagement therewith to travel at a speed substantially higher than the peripheral speed of said feed rollers whereby long fibres are stretched and broken into fibres of staple length.

2. A device for producing relatively uniform rovings of staple fibres which comprises feed rollers for movably retaining a continuous sliver of relatively long textile fibres, a movable endless belt spaced below said feed rollers and having a side thereof disposed beneath the rollers and substantially parallel to the path of travel of the sliver, rotatable means in fixed position and in contact with the inner surface of said side at a portion thereof removed from the rollers, a roller positioned at the outer surface of said side at said portion, means adapted to urge said roller into substantial contact with said outer surface, a gathering element having an inverted substantially conical inner surface portion in association with said belt and having the apex thereof above the portion where belt and rotatable means are in substantial contact, and a radioactive liner for said gathering element, said rotatable means being adapted to cause said belt and the surface of the roller in engagement therewith to travel at a speed substantially higher than the peripheral speed of said feed rollers whereby long fibres are stretched and broken into fibres of staple length.

3. A device for producing relatively uniform rovings of staple fibers which comprises feed rolls for movably retaining a continuous sliver of relatively long textile fibers, a movable endless belt spaced below said feed rollers and having a side thereof disposed beneath the rollers substantially parallel to the path of travel of the sliver, rotatable means in fixed position and in contact with the inner surface of said side at a portion thereof removed from the rollers, a roller positioned at the outer surface of said side at said portion and a gathering element presenting to said sliver a surface slightly inclined with respect to said path of travel, said surface and said belt progressively converging toward said portion where said belt and rotatable means are in substantial contact whereby the fibers are restrained against traverse displacement, said rotatable means being adapted to cause said belt and the surface of the roller associated therewith to travel at a speed substantially higher than the peripheral speed of said feed rollers whereby long fibers are stretched and broken into fibers of staple length.

4. A device, as in claim 3, wherein said gathering element is a second movable endless belt spaced below said feed rollers, having a side slightly inclined with respect to said path of travel and having the inner side of a portion thereof removed from the feed rollers in contact with said roller whereby the outer surfaces of the aforementioned sides of said belts progressively converge into contacting relationship at the portion where said first belt and rotatable means are in substantial contact.

5. The device as in claim 3 wherein said belt functions to support said fibers and deliver them to the nips of said roller and rotatable means and said gathering element is an inverted semiconical member, the open face of said member being disposed adjacent the outer surface of said belt whereby the inner surface of said member and the outer surface of said belt converge and cooperate to progressively constrain said fibers.

6. A stretchbreaking apparatus comprising spaced sets of driven feed and draft rolls for producing uniform rovings of staple fibers from a continuous sliver of relatively long textile fibers, an endless belt disposed between said rolls, one side thereof being substantially parallel to the path of travel of said fibers and adjacent thereto, said belt extending around the periphery of one of said draft rolls, being driven at the speed thereof to urge said fibers in the direction of the nips of said draft rolls, a semi-trumpet-shaped gathering member disposed adjacent said belt in the neighborhood of said draft rolls, the open side of said member facing said belt whereby as said belt functions to support said fibers in the region of the draft rolls, the inner surface of said member and said belt cooperate to constrain said fibers in progressively narrowing compass.

NORMAN EDWARD KLEIN.

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