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METHOD OF DRAFTING TEXTILE FIBERS

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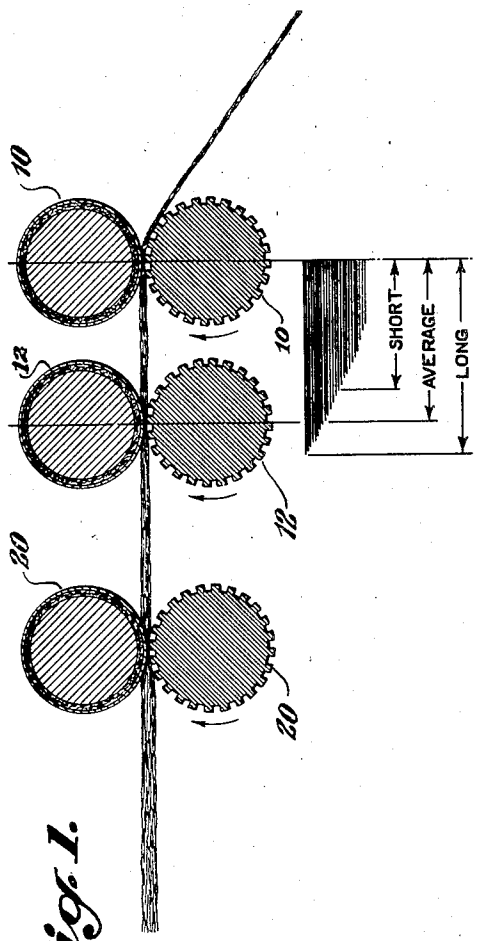


Fig. 1.

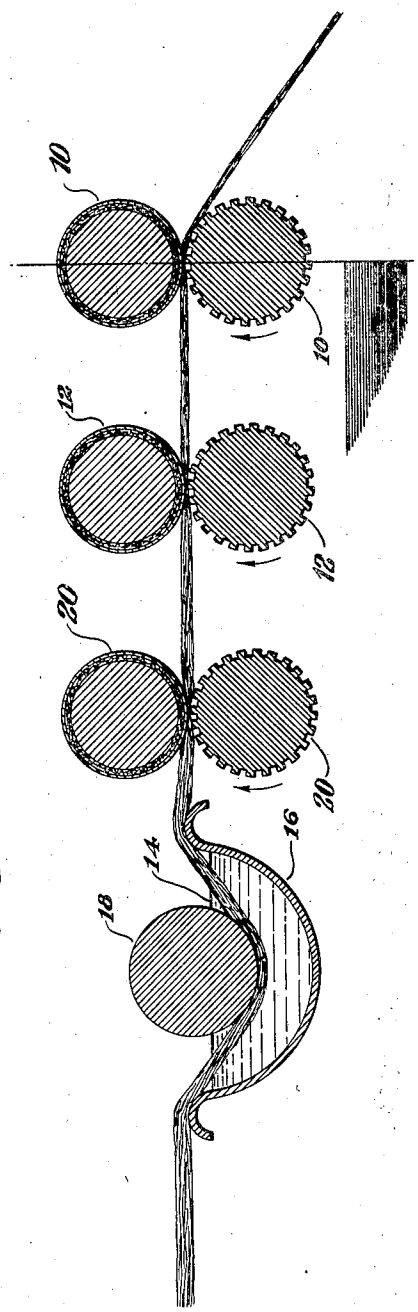


Fig. 2.

Witness

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UNITED STATES PATENT OFFICE

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METHOD OF DRAFTING TEXTILE FIBERS

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The present invention relates to a method of drafting textile fibers from cotton or similar staple.

In the art of producing textile yarns from cotton or other fibers which reoccur and overlap successively in the length of the strand, it is the common practice to lay such fibers in approximate parallelism by taking one or more strands of loosely-massed and lightly-twisted fibers and passing such strands through a series of sets of pressure rolls, each set having a progressively increased peripheral speed for the purpose of drawing out and attenuating the strand, with the result that the component fibers are caused to slip one part past the other and so to lay longitudinally and with their axes in the direction of the common strain.

This drafting process is repeated many times in the production of yarns from such fibers, the practice being to take a plurality of heavy strands, combine them together for the purpose of evening and levelling the yarn mass which they comprise, and to draft and attenuate the combined yarn mass. The resultant strands are again combined and drafted, and such process is duplicated again and again until the strand is of the proper size or count to receive its final drafting and subsequent twisting into usable yarn.

A typical example of such drafting in the production of 40/1 warp yarn would be to take six card slivers, sizing each 145.8 yards to the pound, combine them, and draft them into a single strand sizing 133.3 yards to the pound. Six of such strands are next combined together and drafted to form a strand sizing 127.2 yards to the pound. This strand is then singly drawn out so that it will size 546 yards to the pound and two of such attenuated strands are combined and drafted to size 1640 yards to the pound. Two of the resultant strands are combined and drafted to form a strand sizing 5880 yards to the pound, and two of such strands are combined in the final process of spinning, and are drafted to size 33,600 yards to the pound, at which process the strand is twisted with perhaps thirty turns per inch and becomes yarn suitable for use.

The reason for such extensive and expensive duplication of the process of drafting is almost entirely due to the fact that the amount of draft between each set of rolls is limited in present practice, and to obtain the best results in even yarn composed of parallel fibers, the original yarn mass must be drawn out and attenuated to nearly fifty thousand times its original length.

In the drawing Fig. 1 illustrates diagrammatically a typical arrangement of drafting rolls on a spinning frame with the setting of the rolls commonly employed for normal draft; and Fig. 2 represents diagrammatically a suitable apparatus for carrying out the wet spinning method with a separation of brake and delivery rolls greater than the longest fiber length.

In any drafting operation, the drawing rolls must be carefully set in their relative position and speed, for if the brake rolls and delivery rolls have the points of their common tangents, at which the yarn is seized and held and which is termed the nip, set further apart than the average length of the staple which they are drafting, the amount of fiber slip and the resultant attenuation will vary with the number of fibers and their relative length in the immediate section of the strand being drafted. Such section, having left the brake rolls and floating until arrival at the delivery rolls, will be controlled by neither set, with the result that the fiber slippage will be uneven and the delivered strand will have a poor distribution of fibers in its length. If the brake rolls and delivery rolls are set closer together than the average length of fiber, the staple will be badly broken, or in some cases the strand will not draw but will slip in either or both sets of rolls.

Even if the drafting rolls are set with the distance between their nips exactly coinciding with the average length of staple of the fibers which they are drafting, the amount of draft to obtain the best results is limited, since even though those fibers which are of the average length are seized at their forward end by the delivery rolls

immediately their rearmost end is released by the brake rolls, and are drawn through and along the fibers still retarded by the brake rolls, there are many fibers of greater length than the average, and these are broken between the two rolls, causing lint and fly, and there are likewise many fibers of less length than the average, and these, being uncontrolled in their passage between the two rolls, may fall off from the yarn body and become lint, or they may become bent upon themselves by the friction of the slipping fibers with which they are in immediate contact, so that the resulting strand will have loose and tangled fibers protruding from its body. It will be readily seen that the greater the draft and the attendant fiber slip, the more such inherent imperfections will show in the resultant strand so that the yarn mass must be drafted slightly many times to secure the necessary attenuation.

A typical roll setting with relation to the staple of fiber is shown in Figure 1, which illustrates the drafting rolls on a spinning frame in the final process of drafting which the yarn undergoes.

Many efforts have been made to overcome these inherent difficulties, particularly in the spinning process, so that the draft between the rolls may be increased, thereby eliminating at least one prior process of drafting. These efforts have comprised some means of controlling the fibers mechanically in their passage between the rolls, usually by interposing between the rolls light pressure rolls or aprons, revolving or travelling in the same direction as the drafting rolls and at a speed slightly greater than the circumferential speed of the brake rolls and less than the circumferential speed of the delivery rolls. The brake and delivery rolls are set further apart than the greatest length of the staple, and the light pressure or control rolls or aprons tend to draw the fibers released by the brake rolls along and through the fibers still held, and to conduct and control the fibers in their passage to the delivery rolls and to brake the fibers against the pull of the delivery rolls. With certain classes of fibers and strands this general method may be used to advantage and the draft of the rolls increased.

The disadvantages of this method lie in the fact that the fibers are unequally controlled, in that those fibers that are in direct contact with the controlling means are more affected than those fibers on the inside of the yarn mass, and because of the fact that the pressure and control forces are entirely vertical and the yarn section becomes roughly elliptical under such pressure, the fibers disposed at the ends of the horizontal diameter are not under the influence of the controlling means at all, so this method is limited in obtaining the best results in perfect yarns.

The present invention contemplates controlling all the component fibers equally in the drafting process whether such fibers be longer or shorter than the average length of staple, and regardless of their disposition or position in the yarn mass being drafted.

It has been found that if the strand to be drafted is first wet with a liquid that seeks to spread itself quickly and evenly over the surfaces with which it comes in contact and so be drawn into the yarn mass and over the surfaces of the component fibers thereof, such wet fibers will be caused to adhere lightly one to the other, and because the mutual adhesion between the fibers is along their length when they are lying substantially parallel one to the other, they resist the tendency to break down the adhesive bond and remove them from such parallel proximity. In the drafting process, the nips of the brake rolls and the delivery rolls may be set farther apart than the longest staple of the fibers being drawn, and the wet fibers are controlled by the adhesion to the fiber mass so that the fibers being pulled away from the yarn mass by the delivery rolls tend to pull with them such fibers as are floating between the brake and the delivery rolls while such floating fibers are retarded by their adhesion to those held by the brake rolls. A slipping along the adhesive bond is accordingly set up as being the line of least resistance to the force employed, with the result that all of the fibers are at all times equally under the influence of the drafting process and a uniformly strong and even yarn is produced.

By utilizing such a fluid as a means of controlling the fibers being drafted, the amount of draft in any of the drawing operations may be greatly increased, as comparatively illustrated in Figure 2, which shows the strand being drafted in the spinning operation. Since with this method the rolls are set considerably farther apart than the longest length of staple, such fibers are never under sufficient strain for their breakage, and yet, because of the adhesive action of the fluid, the shortest fibers are always bound to the yarn mass and controlled thereby so that lint and fly are eliminated, and such short fibers are spun into the final yarn instead of falling off and being lost to the advantage of the yarn both in strength and evenness. A very valuable corollary to this feature is that mixed stocks of staples are permitted, so that the cheaper short staples may be combined with the longer and more expensive staples without being lost in the drafting processes, producing a yarn approximately equivalent in evenness and strength to one produced entirely from long

and expensive staples. It is also true that the present troublesome and expensive practice of humidifying the room in which the drafting operation is carried out is eliminated since the yarn, being wet, does not require the advantages of a moist atmosphere.

For wetting the fibers prior to or during the drafting process, it is desirable to utilize a penetrant liquid, such as alcohol, benzine, carbon tetrachloride, or water conceivably treated with a reagent such as alcohol or soap for the purpose of reducing the normal surface tension. With this method of treating, the fluid tends to spread itself evenly over the surface of the fibers with which it comes in contact, regardless of their position or disposition in the fiber mass.

Referring particularly to the partially diagrammatic illustration of the invention, the figure illustrates approximately the method of drafting now and commonly in vogue. In this showing, delivery rolls indicated at 10 cooperate with brake rolls 12 to draw out and attenuate the fibrous strand. The long, short and average fiber lengths are indicated immediately below the delivery and brake rolls, and from this showing it will be evident that the separation between the nips of the rolls approximates the average fiber length. In the proposed method of drawing, the usual delivery and brake rolls 10 and 12 are employed, but before engaging therewith the fibrous strand is passed through and completely immersed in a bath of penetrant 14 in a trough 16, the strand being engaged and caused to pass through the liquid by a roll 18. Thereafter the wet strand is delivered to back rolls 20 and thence to the brake rolls 12 and delivery rolls 10. By pre-wetting and forming a coherent strand in this manner, the separation of the rolls, as indicated, may be such as to exceed the longest staple in the mass, as indicated, below the rolls.

What is claimed is:

1. The method of preparing cotton for spinning which consists in laying individual fibers in approximate parallelism and overlapping relationship to produce a roving or sliver strand, subjecting the strand to a bath of liquid of sufficiently low surface tension to so thoroughly wet the strand that it becomes a coherent strand of mutually adhering wet fibers, and attenuating the wet strand by passing it between successive sets of rolls or the like.

2. The method of preparing cotton for spinning which consists in laying the individual fibers in approximate parallelism and overlapping relationship to produce a roving or sliver strand, subjecting the strand to a bath of liquid of substantially lower surface tension than that of water to so thoroughly wet the strand that it becomes a coherent strand of mutually adhering wet fibers, and attenuating the wet strand by passing it between successive sets of rolls or the like.

3. The method of preparing cotton for spinning which consists in laying the individual fibers in approximate parallelism and overlapping relationship to produce a roving or sliver strand, subjecting the strand to a bath of liquid of sufficiently low surface tension to so thoroughly wet the strand that it becomes a coherent strand of mutually adhering wet fibers, and attenuating the strand of mutually adhering wet fibers by passing between successive sets of drawing rolls or the like, spaced apart by an amount which exceeds approximately the greatest fiber length in the strand to avoid the imposition of mechanical control throughout the region of fiber slippage.

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