Dec. 29, 1942. W. F. BIRD ET AL 2,306,377

METHOD FOR PREPARING WORSTED YARNS

Filed March 8, 1941

FIG. I.

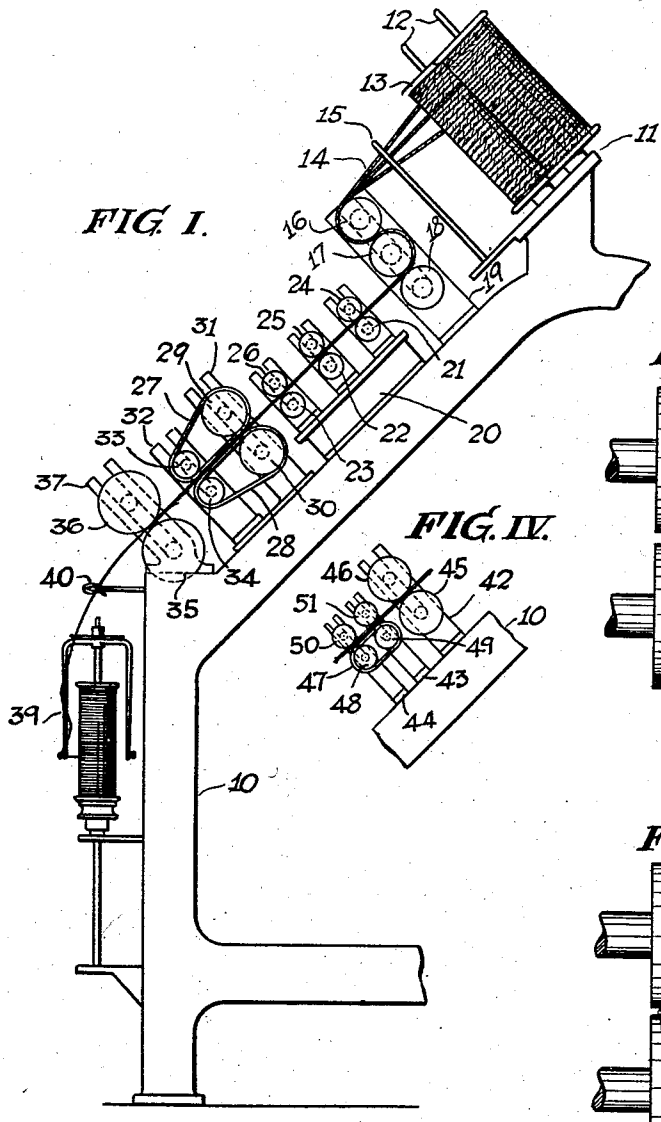


FIG. II.

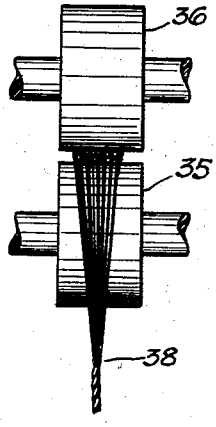
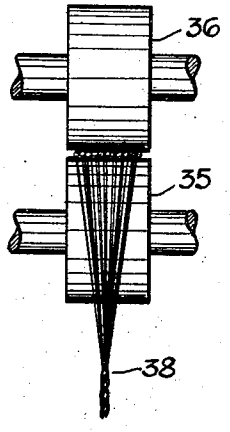


FIG. IV.

FIG. III.



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METHOD FOR PREPARING WORSTED YARNS

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8 Claims. (Cl. 57—156)

This invention relates to the spinning of worsted yarns or yarns of the worsted type by a high draft system, comprising either one or two essential stages, depending on the type of stock being worked. These improvements eliminate many of the steps conventional to the worsted system and superior yarns of like characteristics are produced in a relatively simple manner with the accompanying saving in direct and indirect labor, overhead, maintenance, and the like.

More particularly, these improvements contemplate that in both the one and two essential draft stage concepts there be no twist in the stock in the single or last draft stage and that the interfacial friction of the fibers be such that there is no relative motion between fibers which are not engaged by the forward nip of the single or last draft stage. We have discovered that when these conditions are present, as will be more fully explained hereinafter, the permissible draft in the last or single stage may be as high as desired, single stage drafts of fifty and upward being entirely feasible.

According to a preferred embodiment of these improvements, a substantially uniform strand of worsted yarn forming stock is twisted. This strand may be prepared specially for the operations which are to follow or may be a result of a normal prior twisting operation. The twisted strand is then mounted behind feed rolls and fed forwardly. The feed rolls may constitute the back rolls for the first drawing operation. From the feed rolls the stock passes over a set of driven carrier rolls which support the stock and rotate as the stock advances into a forward pair of drawing rolls each of which is covered with a traveling endless apron or belt. The draft induced by this operation is sufficient to remove the twist from the strand as it passes the nip point of the belt. The stock is thus controlled by the twist until engaged by the nip, after which the endless aprons act as a conveyor and control medium for the wholly untwisted stock as it approaches the forward set of drawing rolls.

Worsted yarns consist of wool fibers of non-uniform length and which are relatively parallel. The worsted stock fibers are non-uniform in length. These fibers may be processed alone or with other fibers such as mohair or staple synthetic fibers of like lengths to form worsted type yarns, as is well understood.

According to this invention, worsted fibers or fibers of the worsted type are fed to or positioned within a draft stage without twist, excessive condensation or thickness, the width being such that when the fibers emerge from the front rollers of the draft stage they will all be formed into twisted stock at the twist point near the nip which is created by a twisting or spinning device conveniently positioned forwardly of and below the forward rolls. When these conditions are met the draft may be a great deal higher than the length in inches of the bulk of the longest fibers or of the longest fibers of the worsted stock.

The present invention is of great importance to the worsted and allied industries in that it permits the elimination of many steps common to the conventional worsted systems such as the Bradford system, and may be performed on relatively simple mechanism. The concept is characterized by its departure from the concept of condensation of the fibers being drawn, heretofore believed necessary in both the cotton and so-called high draft and worsted processes. Cotton fibers, which are relatively short and substantially uniform in length, are normally twisted together in the last stage. In the case of worsted drawing as in multi-stage drafting, it has been suggested to condense the stock between the stages with the result that the stock in the final stage is so thick that individual positive fiber control is impossible and the amount of draft is restricted. A draft of 10 is considered very high in a single stage and fiber breakage, slubs and twitty yarn is very likely to result even at this draft. It has heretofore been considered a rule in conventional worsted drafting that the drafts be low, i. e., of the order of 6 or 7, and that a sliver must never be drafted twice in the same direction. According to these improvements, the draft may be made in a single stage and may be as high as desired.

An object of this invention is to provide a high draft apparatus and method of spinning fibers of non-uniform length.

Another object is to provide a high draft apparatus for yarns of the worsted type.

Another object is to provide a two stage high draft apparatus for yarns of the worsted type in which any desired draft may be accomplished.

Another object is to provide a draft stage unit in which the fibers are positioned in a relatively thin flat band which is controlled by vertical top and bottom pressure only as the band approaches a twisting device.

Another object is to limit the width of the flat band as it emerges from the single or last draft stage unit to the range controlled by the twist point created by a twisting device.

Another object is to provide a system of worsted spinning having a stage wherein there is no relative movement of fibers within the stage except between those actually engaged by the forward nip and those not actually engaged by the forward nip.

Another object is to provide a plural stage system for twisted strands in which the fibers in the last stage have no relative movement except between those actually engaged by the forward nip and those not actually engaged by the forward nip.

These and other objects of invention will be manifest from a consideration of the following description, claims and drawing, in which:

Figure I is a diagrammatic assembly in side elevation showing the arrangement of a preferred embodiment of the invention.

Figure II is a detail view showing the front draft rollers and the thin band of fibers emerging therefrom being twisted.

Figure III is a detail view similar to Figure II showing a band of fibers in which each fiber engages both rollers.

Figure IV is a modification of the belt assembly.

Referring to Figure I, a frame 10 has an inclined support 11 for pins 12, over which the worsted stock supply bobbins 13 carrying twisted stock 14 are positioned. The amount of twist may vary within reasonable limits, but should be sufficiently high to effect some control of the stock in the first stage and sufficiently low so that all or substantially all of the twist is removed by the first drafting operation.

A forked guide 15 guides the twisted stock 14 from the supply bobbins 13 through positively driven pressure rollers 16, 17 and 18, mounted on a pair of brackets such as 19. These pressure rollers will cause the twisted stock to lie side by side to form a band of twisted stock. The rollers 17 and 18 constitute feed rollers and are the back rollers of the first draft stage.

Brackets 20 support positively driven carrier rollers 21, 22 and 23, over which removable rollers 24, 25 and 26 rest. The rollers 24, 25 and 26 are not positively driven and merely rest on the worsted stock. As the stock advances it enters between the endless belts 27 and 28 which pass about the rollers 29 and 30 respectively to form a nip to complete the first draft stage. The ratch of this stage will depend on the length according to accepted worsted drawing and will be slightly longer than the length of the bulk of the longest fibers. If the bulk of the longest fibers is 8 inches, for example, the ratch may be 9 inches.

The belts 27 and 28 function first as a nip and then as a conveyor for the worsted stock 14, which is without twist between the belts and in the form of a flat thin band. The roller 30 is positively driven, whereas the roller 29 may rest in slotted bracket 31. Bracket 32 is movable along bracket 31 and supports belt guide rollers 33 and 34. The bracket 31 is also adjustably mounted on the frame 10 and the rollers 29 and 34 may be weighted to effect desired control. The belt 28 should provide a firm surface for controlling the fibers and, of course, additional support may be provided along its length if desired.

The control is regulated so that the weight of the upper rollers 29 and 33 and belt 27 retains the thin band of untwisted fibers against any movement due to the interfacial friction of the fibers, and only those fibers are drafted which have passed under the nip of the forward roller 35 and idle roller 36 which rests in slotted bracket 37. The exact permissible thickness of the band between the belts will depend on the size and nature of the stock being worked, and its width will be such as can be converged to the twist point 38 forwardly of the forward rollers 35 and 36 of the second stage. As before stated, there must be no excessive compression of fibers prior to leaving the belt 27—28. The wild fibers at the extreme edges of the band on leaving the belt may, however, be lightly pressed toward the body of the band to insure that all are within the twist range.

As the stock leaves the rollers 35 and 36 it converges to a twist point 38 created by a twisting device generally depicted as 39. A pigtail guide 40 may be mounted on the frame 10 between the front rollers and the twisting unit.

The belts 27 and 28 act as a conveyor, moving at the same rate as the nip of the first draft stage, and the arrangement of the second draft stage insures that fibers engaged by rollers 35 and 36 extend to between the belts. While we prefer the belts to encircle the rollers 29 and 30, they may be about and independently driven by separate rollers and/or the upper belt may be entirely removed.

The invention may be used prior to present day equipment to produce rovings for the final spinning frame, or may itself constitute the final spinning frame. In the first case, a typical run to produce a roving for the final spinning frame is as follows:

Three strands of stock, the bulk of the longest fibers of which is approximately 8 inches in length and each weighing 166 drams per 40 yards, are fed to the squeeze rolls 16, 17 and 18. The stock carries a twist of .24 turn per inch. The stock is approximately .375 inch in diameter and will be positioned side by side by the squeeze rolls. A draft of 5 in the first stage will provide completely untwisted stock in the form of a thin flat band within the second stage. The band is approximately 1⅛ inches wide between the belts and as it emerges from the rollers 35 and 36 it converges to the twist point 38. A draft of 20 in the second stage will result in a two stage draft of 100 and a roving weighing 5 drams per 40 yards. Like rovings may be made from 3 ends of 300 drams, .5 inch wide, of twisted worsted stock having .18 turn per inch. In this case the draft may be 5 and 36 respectively in the first and second stages. Two ends of 500 drams worsted stock having .10 turn per inch will require drafts of 5 and 40 to produce a similar roving. The unit of weight in each case is in per 40 yards, as will be understood.

As hereinbefore stated, the draft may be considerably higher but, of course, sufficient fibers must be within the untwisted band width to converge and form a twisted strand without excessive breakage. To insure this condition, the stock may be run through two similar machines, the first producing worsted forming twisted stock having, for example, .88 turn per inch and weighing 35 drams per 40 yards. Each strand is approximately ⅛ inch wide. By introducing 2 of these twisted strands and providing successive drafts of 5 and 21½, a final yarn weighing .65 dram per 40 yards may be formed. The strand as it leaves the front rollers will be approximately ¼ inch wide and may be twisted as desired, for example to 13.7 turns per inch.

It is to be understood that twisted stock is used to simplify control in the feeding to the second draft stage and that a plurality of ends are used to provide for any lack of uniformity which may exist in a single end. A uniform untwisted strand may, however, be fed directly to the second stage and then drafted and twisted as described.

Figure II shows the band of stock being converged to the twist point after leaving the front rollers in untwisted condition. It will be seen that there is no excessive condensation of the fibers and that they will move with the belt until actually engaged by the forward nip.

Figure III illustrates all the fibers being in contact with the rollers with just sufficient stock to converge without excessive breakage. The critical point will, of course, be determined by the nature of stock being worked.

Figure IV illustrates a modification of the belt assembly in which only one belt which does not form the nip is used. In this modification, brackets **42**, **43** and **44** are mounted on the frame **10**. The rollers **45** and **46** constitute the back rollers of the forward draft stage and conveyor belt **47** passes around driven rollers **48** and **49**. The rollers **45**, **48** and **49** are driven so that the belt **47** acts as a conveyor for the untwisted stock. The surface speed of the belt is substantially the same as the surface speed of the nip forming rollers. Rollers **50** and **51** rest on the stock and may be weighted if desired. As in Figure I, the distance between the belt and forward rolls is very short, i. e., about one inch, or even less. In general, this distance should be as short as possible to effect positive control of all of the fibers.

The illustration used for the production of final yarns recites successive drafts of 5 and 21½, drafts of approximately 20 in the second stage being convenient and very workable for worsted stock according to the invention.

The several illustrations contained herein are not intended to constitute definite limits, and desiring to be restricted only by the scope of the attached claims of the invention, we claim:

1. In a process of making worsted type yarn from fibers of non-uniform length, the steps of feeding a plurality of twisted strands of stock into a draft stage so that the strands enter the drafting area relatively close to one another, correlating the draft stage to the twist in the strands of stock so as to remove all of the twist from the stock, advancing the untwisted stock into a second draft stage, providing a top and bottom retaining drag on all of the untwisted fibers of the second draft stage, said retaining drag being such as to allow a longitudinal movement of the fibers without breakage but preventing any substantial relative fiber movement due to the interfacial friction of the fibers, positively drawing off the untwisted fibers progressively, and then twisting the drawn off fibers together.

2. In a process of making worsted type yarns from fibers of non-uniform length, the steps of feeding a plurality of twisted strands of stock into a draft stage so that the strands enter the drafting area relatively close to one another, correlating the draft of the draft stage to the twist in the strands of stock so as to remove all of the twist from the stock, advancing the untwisted stock into a second draft stage in the form of a single band of fibers, providing a top and bottom retaining drag on all of the untwisted fibers in the second draft stage, said retaining drag being such as to allow a longitudinal movement of the fibers without breakage but preventing any substantial relative fiber movement due to the interfacial friction of the fibers, positively drawing off the untwisted fibers progressively, and then twisting the drawn off fibers together.

3. In a process of making worsted type yarns from fibers of non-uniform length, the steps of feeding a plurality of twisted strands of stock into a draft stage so that the strands enter the drafting area relatively close to one another, correlating the draft of the draft stage to the twist in the strands of stock so as to remove all of the twist from the stock, advancing the untwisted stock into a second draft stage, providing a top and bottom retaining drag on all of the untwisted fibers of the second draft stage, said retaining drag being such as to allow a longitudinal movement of the fibers without breakage but preventing any substantial relative fiber movement due to the interfacial friction of the fibers, positively drawing off the untwisted fibers progressively at approximately twenty times the rate of feed into the second draft stage, and then twisting the drawn off fibers together.

4. In a final or intermediate process of making worsted type yarns from fibers of non-uniform length without folding or other substantial centralizing of the fibers, the steps of feeding a plurality of twisted strands into a draft stage so that the strands enter the drafting area relatively close to one another, correlating the draft of the draft stage to the twist in the strands of stock so as to remove all of the twist from the strands, advancing the untwisted stock into another draft stage in the form of a single relatively wide band of fibers, providing a top and bottom pressure retaining drag on the untwisted fibers which make up the strand in the second stage, positively drawing off the untwisted fibers substantially progressively, and then twisting the relatively wide band of drawn off fibers together.

5. In a final or intermediate process of making worsted type yarns from fibers of non-uniform length without folding or other substantial centralizing of the fibers, the steps of feeding a plurality of twisted strands into a draft stage so that the strands enter the drafting area substantially side by side, correlating the draft of the draft stage to the twist in the strands of stock so as to remove all of the twist from the strands, advancing the stock over a relatively wide area into another draft stage, providing a top and bottom pressure retaining drag on the untwisted fibers in the second draft stage, positively drawing off the untwisted fibers substantially progressively, and then twisting the drawn off fibers of the relatively wide area together.

6. In a final or intermediate process of making worsted type yarns from fibers of non-uniform length without folding or other substantial centralizing, the steps of feeding a plurality of twisted strands into a draft stage so that the strands enter the drafting area relatively close to one another, correlating the draft of the draft stage to the twist in the strands of stock so as to remove all of the twist in the stock, advancing the untwisted stock into a second draft stage, providing a top and bottom pressure retaining drag on all of the untwisted fibers of the second draft stage, said retaining drag being such as to allow a longitudinal movement of the fibers without breakage by preventing any substantial relative fiber movement due to the interfacial friction of the fibers, positively drawing off the untwisted

fibers progressively, and then twisting the drawn off fibers together.

7. In a final or intermediate process of making worsted type yarns from fibers of non-uniform length without folding or other substantial centralizing, the steps of feeding a plurality of twisted strands into a draft stage so that the strands enter the drafting area relatively close to one another, correlating the draft of the draft stage to the twist in the strands of stock so as to remove all of the twist in the stock, advancing the untwisted stock into a second draft stage in the form of a single band of fibers, providing a top and bottom pressure retaining drag on all of the untwisted fibers of the second draft stage, said retaining drag being such as to allow a longitudinal movement of the fibers without breakage but preventing any substantial relative fiber movement due to the interfacial friction of the fibers, positively drawing off the untwisted fibers progressively, and then twisting the drawn off fibers together.

8. In a final or intermediate process of making worsted type yarns from fibers of non-uniform length without folding or other substantial centralizing, the steps of feeding a plurality of twisted strands into a draft stage so that the strands enter the drafting area relatively close to one another, correlating the draft of the draft stage to the twist in the strands of stock so as to remove all of the twist in the stock, advancing the untwisted stock into a second draft stage, providing a top and bottom pressure retaining drag on all of the untwisted fibers of the second draft stage, said retaining drag being such as to allow a longitudinal movement of the fibers without breakage but preventing any substantial relative fiber movement due to the interfacial friction of the fibers, positively drawing off the untwisted fibers progressively at approximately twenty times the rate of feed into the draft stage, and then twisting the drawn off fibers together.

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