

Nov. 17, 1936.

W. F. BIRD

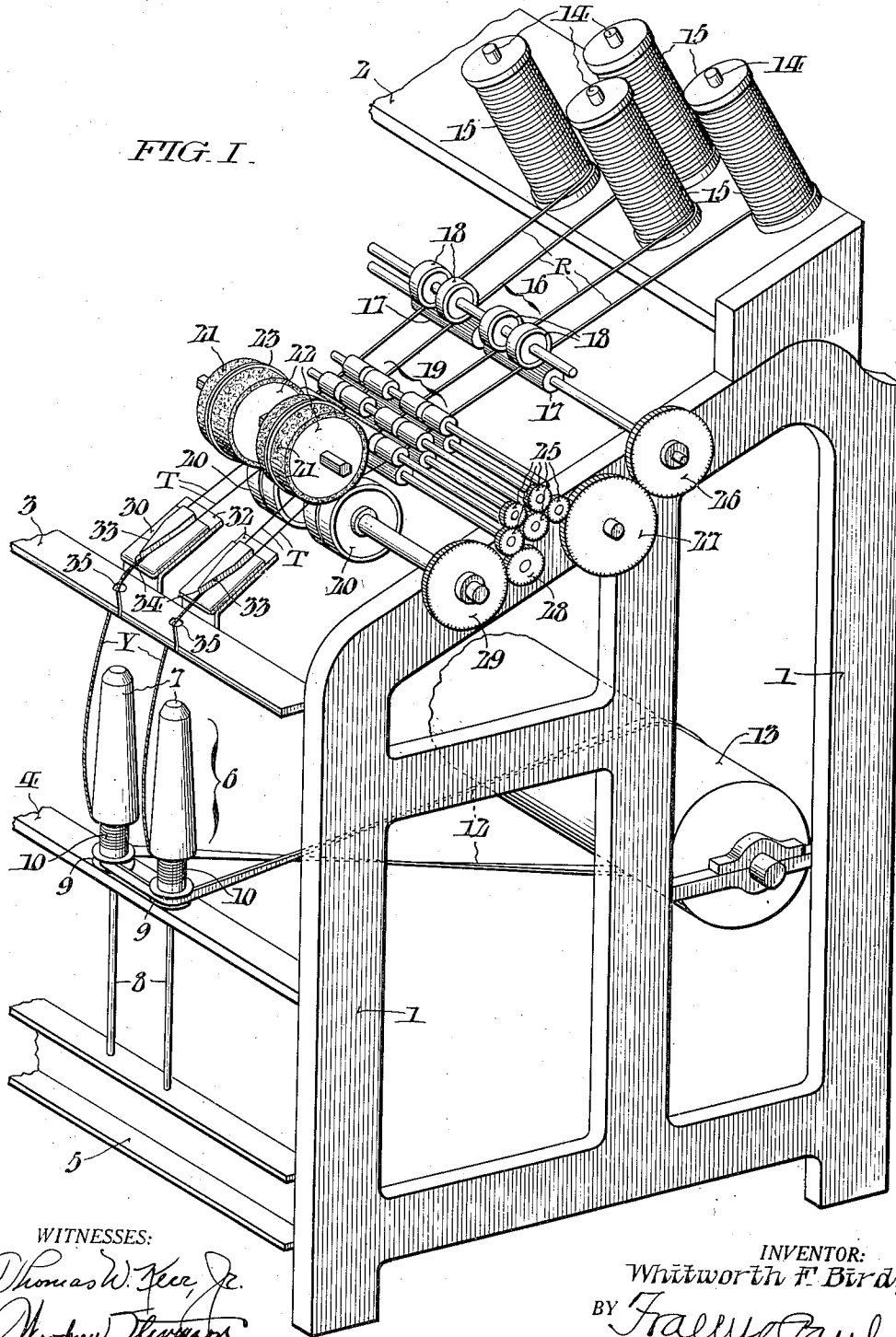
2,061,498

METHOD AND MEANS FOR PRODUCING PLY YARN

Filed May 18, 1935

2 Sheets-Sheet 1

FIG. I.



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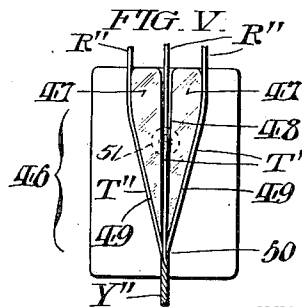
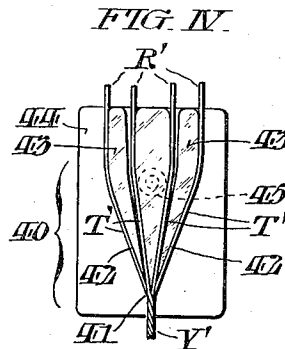
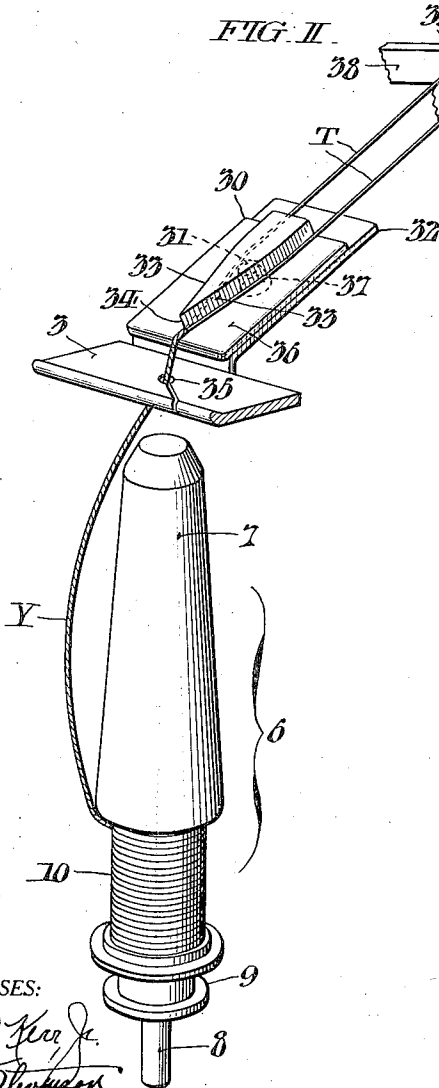
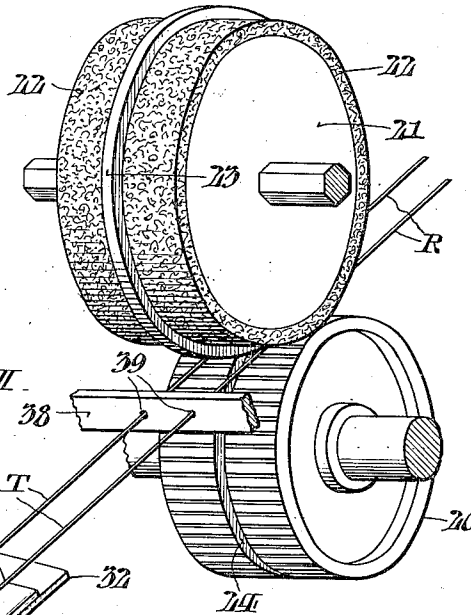
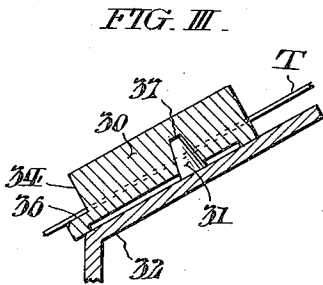
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METHOD AND MEANS FOR PRODUCING PLY YARN

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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METHOD AND MEANS FOR PRODUCING
PLY YARN

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20 Claims. (Cl. 118—38)

The chief aim of my invention is to make possible the production of ply yarns wherein the individual component ends are of a relatively low twist and smooth without entanglement of projecting fibers of one with those of another, and wherein said ends are combined or doubled with a relatively low twist in the same direction as that of the individual ends. Yarn so constructed is especially desirable and advantageous in the production of cut pile fabrics, since, through absence of entanglement between the fibers of the component ends, the formation of fabric imperfections such as "pock marks" and "nigger heads" are effectively precluded, and since by virtue of the unidirectional low twist in the component ends and in the doubling, the pile opens up readily and freely in the finishing with resultant production of a soft uniformly smooth face.

These desiderata I attain, as hereinafter more fully disclosed, through provision of a simple method as well as a simple apparatus suitable for the practice of such method, whereby two or more rovings of loosely compacted fibers are concurrently spun both with unidirectional twist incident to convergent travel with maintenance in definite separation and running contact with smoothing surfaces, to a twist point afforded by a divider element, so that the fibers of the individual ends are held in check and prevented from entanglement and said ends while so controlled combine the said twist point under the pull induced by a rotating collecting unit. By carrying out the spinning and doubling in one operation as just explained, I am able to produce highly satisfactory and amply strong ply yarn for cut pile fabrics in which the twist of the individual ends may be very low. U. S. Patent No. 1,802,671 dated April 28, 1931 is directed to smoothing of the plies on a twisting or doubling machine.

In a method of ply yarn production for pile fabric use wherein the individual component ends are separately spun in one operation and then doubled in another operation, the singles must be given a twist of at least fourteen turns per inch for capacity to withstand the tensional strains induced in the subsequent doubling operation. Accordingly in such yarns, the component ends tend to retain their individuality in the pile; and on account of the relatively hard twist, the pile does not readily open and form the uniformly smooth surface characteristic of cut pile had with yarn made in accordance with my invention.

I am aware that twist ply yarns have been

heretofore produced by first individually twisting the component ends as above, and then in the doubling resorting to reverse twisting with attendant reduction, to a certain extent, of the individual twist of the singles. In yarns made under this principle, the fibers of the singles, due to the initial relatively hard twisting of the latter, take on a permanent set and do not therefore open readily in the finishing of the fabrics to form the cut pile tufts.

I am also aware that twisting and doubling in one operation is not strictly new, but under pre-existent methods, the yarns were produced without definite control of the component ends up to the point of twisting, with the result that the projecting fibers of one would become entangled with those of another, to which cause the formation of the hereinbefore mentioned "pock marks" and "nigger heads" in the pile fabrics was directly traceable.

In connection with improved spinning and doubling apparatus having the aforementioned attributes, it is the further aim of my invention to provide for free lateral movement or "floating" of the twist point element so that it can adapt itself positionally in compensating for differences in the draft of the individual rovings and so maintain them under uniform tension incident to the twisting of the individual ends.

Other objects and advantages of this invention will be pointed out in the following detailed description thereof, or will be apparent from such description.

In order that the invention may be readily understood and its practical advantages fully appreciated, reference will now be had to the accompanying drawings which illustrate one form or embodiment thereof. However, it is to be understood that changes in the details of construction may be made within the scope of the claims, without departing from the fundamentals of the invention.

In the drawings:

Fig. I is a fragmentary perspective view of a ply yarn producing apparatus or machine embodying the present improvements.

Fig. II is a similar perspective view showing, in part, certain of the elements embodied in one of the spinning and twisting sections of the machine.

Fig. III is a longitudinal section through one form of divider element embodied in the apparatus and hereinafter fully described.

Fig. IV is a top plan view of a modified form of divider element whereby four roving strands

are separately spun and the resulting threads concurrently-combined to form a ply yarn; and,

Fig. V is a similar view of another form of divider element suitable for the spinning and twisting of three strands.

Referring more particularly to Fig. I, a machine adapted to the practice of this invention includes spaced end frames whereof one is shown at 1, said end frames being rigidly connected by a number of longitudinals including an inclined creel-board 2 at the top, and vertically-spaced parallel girts 3 and 5 at the front. This frame structure constitutes a support for a multiplicity of duplicate spinning-and-twisting sections, each of which includes a spinning unit 6 which may be of the form featured in U. S. Letters Patent No. 1,969,685, dated August 7, 1934, with a conical cap 7 supported at the top of a vertical spindle 8 fixed in the girt 4, and a whorl 9 rotatable about said spindle and which carries the bobbin 10, whereon the ply yarn Y is collected. The whorl 9 of the spinning unit 6 is supported on a rise-and-fall rail 4 which is adapted to be actuated by a suitable builder mechanism, not illustrated, said whorl being rotated by a belt-connection 12 from a driving drum 13 journaled at the rear of the machine frame.

A pair of spaced holder pins 14 are provided on the creel-board 2 for each spinning and twisting section of the machine, and serve as supporting axes for spools 15 of prepared textile fiber roving strands R from which individual threads T are spun. As shown, the roving strands R are drawn from the spools 15 by a set of nip rolls 16, including a fluted bottom roll 17 and a pair of laterally-spaced contacting upper rolls 18, which are individual to said strands. By the rolls 16 the roving strands R are directed to a group of draft-rolls 19 such as are ordinarily used on spinning machines, and, after being attenuated thereby in the known manner, said roving strands pass to a pair of delivery nip-rolls whereof the lower one 20 is circumferentially-corrugated, and the contacting upper one 21 is clothed with a soft yieldable covering 22 of felt or the like. Except as hereinafter noted, the illustrated delivery and draft means is to be considered as typical of other known forms which may be substituted if desired or found more convenient in practice. The upper roll 21, as shown in Fig. II, has a central dividing flange 23 which engages a correspondingly-located groove 24 in the lower roll 20, whereby a barrier is provided to keep the two roving strands R separated. The draft rolls 19 are differentially rotated, as required, by intermeshing spur gears 25, respectively secured to their shafts, in proper timed relation with the lower feed rolls 17 and corresponding delivery rolls 20, by coordinating gear wheels 26, 27 and 28, 29. The means for driving the various moving parts of the machine may be of any of the many approved types ordinarily employed in conventional spinning and twisting machines.

After leaving the delivery rolls 20, 21, the roving strands R pass to a divider element in the form of a spear-shaped block 30 which is fulcrummed on a conical pivot-projection 31 integral with, or attached to, a bracket 32 conveniently secured to the girt 3 of the machine. As shown, the divider block 30 has counter-sloped sides 33 at an acute angle to each other and meeting in a comparatively-sharp edge 34 that constitutes a twist-point and which is in line with a yarn guide-eye 35 in the girt 3, over the cap spinning unit 6. The divider-block 30

is preferably made of porcelain with a smooth glazed surface and embodies a laterally extending base flange 36 for a purpose later on explained, while the socket-hole 37 therein does not extend wholly through said block so that the ingress of dust or other impedimenta to the pivot projection 31 is prevented.

As the roving strands R pass along the sloping sides 33 of the divider-block 30 to the edge or twist-point 34, they are individually maintained in definite separation against entanglement of their fibers while being smoothed and spun into the threads T through concurrent linear advance and torsion induced by the gyratory action of the cap spinning unit 6, and, in meeting at the block point 34, they are concurrently-twisted together to form the ply yarn Y which is continually collected on the rotating bobbin 10. It is also to be noted that the basal flange 36 of the block 30 constitutes a guard to keep the strands R in engagement with the sloping sides 33 of said block. By pivoting the divider-block 30 in the manner described, it is made self-adjusting and is thus automatically maintained always in substantial alignment with the guide-eye 35; while any inequalities developed during formation of the threads T that may tend to mar the "twist", are similarly counteracted.

In order to distribute the wear on the delivery rolls 20, 21, there is provided, as shown in Fig. II, a traversing bar 38 with suitably spaced eyes 39, in pairs of multiples, to guide the threads T, said bar having been omitted in Fig. I to avoid complication in that view, which is suitably reciprocated so that the roving strands R are shifted back and forth in the nip-rolls 20, 21, the control flange 23 and the block 30 keeping said strands separated, as hereinbefore explained. By virtue of its capacity for self-positioning, the block 30 can compensate for variations in the draft and tension induced by the lateral traversing of the rovings R and so insure a uniformly smooth and evenly twisted product.

It is to be understood other forms of spinning units, for example of the ring or flier types, may be substituted for the cap unit 6 herein illustrated, without any change in the operation of the apparatus as above set forth. It is also to be understood that the traversing bar 38 may be located otherwise than shown without change in the operation of the machine.

In Fig. IV there is shown a modified form of guide block 40 whereby four roving strands R' are separately spun and the resulting threads T' concurrently twisted at 41, to form a ply yarn Y'. In this case two additional strands R' are passed along the outer counter-sloped faces 42 of supplemental block projections 43 on the base 44 and symmetrically disposed relative to the central divider block 40, which is like the divider-block 30 of the first described form of my invention. It is to be observed that the counter-sloped faces 42 of the supplemental block projections 43 are convergent with respect to the twist point 41 of the central block 40 where the twisting of the component four threads T' into the yarn Y' takes place exactly as hereinbefore described in connection with two ply yarn production. It will, of course, be understood that the three projections 43 of the divider block 40 are preferably formed on the common base 44, which has a pivot-socket 45 corresponding with the socket hole 37 of the previously described divider-block 30. By providing additional divider blocks flanking the supplemental block

projections 43, the machine can, obviously, be adapted for concurrently spinning and twisting higher even numbers of roving strands R' into ply yarn Y'.

Fig. V illustrates a further modified form of divider-block 46 enabling concurrent spinning and twisting of three roving strands R'' into ply yarn Y'', said block having two projections 47 defining a medial slot 48 for guiding the third strand R'', while the outer two strands R'' follow the counter-sloping faces 49 of said block, so that the twisting of the threads T'' into the yarn Y'' is effected, as before explained, at the point 50. By providing the divider-block 46 with two or more supplemental projections, the machine may, obviously, be adapted to spinning and twisting higher uneven multiples or roving strands R'' into the ply yarn Y''. 51 designates the pivot socket for this form of the invention.

From the foregoing it is evident that my invention affords an improved method and means whereby ply yarns may be more economically and expeditiously produced with pre-assurance of more uniform spinning of the strands and more positive equalization of the twist than heretofore.

Having thus described my invention, I claim:

1. In a machine for producing ply yarn the combination of plural nip rolls for delivering multiples of strands, a pivoted divider-block guiding the individual strands to a common twist point, and a suitable unit aligned with said point to effect twisting of the strands into ply yarn at such point.

2. In a machine for producing ply yarn the combination of plural nip rolls for delivering multiples of strands, a pivoted divider-block guiding the individual strands to a common twist point, a suitable unit aligned with the twist point to effect twisting of the strands into ply yarn incident to convergence toward such twist point, and means for continuously shifting the strands back-and-forth in the nip of the delivery rolls to distribute the wear on the latter.

3. In a machine for producing ply yarn the combination of a pair of nip rolls for delivering multiples of strands, a pivotally-mounted divider-block guiding the individual strands to a common twist point, a suitable unit aligned with the twist point to cause individual spinning of the strands into threads incident to convergence toward the twist point and to concurrently effect twisting of the threads into ply yarns at such point, and means for continuously shifting the strands back-and-forth in the nip of the delivery rolls to distribute the wear on the latter.

4. In a machine for producing ply yarn the combination of a pair of nip rolls for delivering multiples of strands, a pivotally-mounted divider-block guiding the individual strands to a common twist point, a suitable unit aligned with the twist point to cause individual spinning of the strands into threads incident to convergence toward the twist point and to concurrently effect twisting of the threads into ply yarns at such point, means for continuously shifting the strands back-and-forth in the nip of the delivery rolls to distribute the wear on the latter, and means for maintaining said strands in definite separation laterally incident to passage through the nip of the delivery rolls.

5. In a machine for producing ply yarn the combination of a pair of nip rolls for delivering multiples of strands in definite lateral separation, a pivotally-mounted divider-block having faces

converging to a common twist point, a revolving spinning unit axially aligned with the twist point to cause individual spinning of the strands into threads incident to progression toward the twist point and to concurrently effect twisting of such threads into ply yarn at said point.

6. In a machine for producing ply yarn the combination of a pair of nip rolls for delivering multiples of strands, said nip rolls forming a barrier whereby the strands are maintained in definite separation laterally, a pivotally-mounted divider-block embodying sloped faces converging to a common twist point, a revolving spinning unit axially aligned with the twist point to cause individual spinning of the strands into threads incident to convergence toward the twist point and to concurrently effect twisting of such threads into ply yarn at said point, and means for continuously shifting the strands back-and-forth in the nip of the delivery rolls to distribute the wear on the latter.

7. The combination of claim 6 wherein the divider-block is provided with a medial groove longitudinally between the convergently-sloping faces, whereby said block is adapted for guiding and spinning uneven multiples of strands.

8. As an article of manufacture a divider-block for ply yarn producing machines comprising a base with a projection thereon, said projection having inclined faces converging to a common twist point, and said block having an orifice therein whereby it can be pivotally-mounted.

9. As an article of manufacture a divider-block for ply yarn producing machines comprising a base with multiple projections thereon, each said projection having sloping faces upwardly-directed relative to the base and merging to a common twist point, and a socket-hole in said block whereby it is pivotally-mountable.

10. As an article of manufacture a divider-block for ply yarn producing machines comprising a base embodying plural projections thereon separated by an intervening longitudinal slot, each said projection having inclined faces converging to a common twist point, and a socket-hole in said block whereby it is pivotally-mountable.

11. In a machine for producing ply yarns, means for delivering a plurality of threads, a unit for spinning the threads into yarn, and an interposed element affording a twist point and means for maintaining the threads in definite separation incident to convergence toward the twist point, said element being mounted for free movement to automatically align the twist point with respect to the spinning unit.

12. In a machine for producing ply yarns, means for delivering a plurality of threads, a unit for spinning the threads into yarn, and an interposed element affording a twist point and means for maintaining the threads in definite separation incident to convergence toward the twist point, said element being pivotally mounted to permit self-centering of the twist point with respect to the rotary axis of the spinning unit.

13. The method of producing ply yarn which comprises advancing a plurality of roving strands of loosely compacted fibers; inducing twist into a portion of each strand to form a spun thread by concurrently rotating and linearly advancing the roving and thread portions while maintaining the thread portions in definite separation and in running contact with smoothing surfaces to control and definitely lay the fibers incident to

convergence; and twisting the spun ends into ply yarn as they move forwardly out of running contact with the smoothing surfaces.

14. The continuous method of producing ply yarn which comprises drawing multiple roving strands of loosely compacted fibers; spinning the drawn strands into threads while concurrently and linearly advancing the rovings and threads, and while maintaining the threads in definite separation and in running contact with smoothing surfaces incident to convergence to control and definitely lay the fibers; and twisting the spun ends into ply yarn as they move forwardly out of running contact with the smoothing surfaces, whereby the twist in the singles is in the same direction as in the ply.

15. The continuous method of producing ply yarns which comprises drawing laterally transverse roving strands of loosely compacted fibers; spinning the drawn strands into threads while concurrently and linearly advancing the rovings and threads, and while maintaining the threads in definite separation and in running contact with smoothing surfaces incident to convergence to control and definitely lay the fibers; and twisting the spun ends into a ply yarn as they move forwardly out of running contact with the smoothing surfaces, whereby the twist in the singles is in the same direction as in the ply.

16. In a spinning and doubling machine for producing ply yarn, the combination of feeding means for multiple roving strands of loosely compacted fibers; drafting means for attenuating roving strands; divider means for maintaining the several strands in definite separation incident to spinning and affording mutually convergent smoothing surfaces for said strands; and means for inducing rotation and concurrent linear advance of the strands while twisting the spun threads into ply yarn at said twist point, said divider means being positioned intermediate the drafting means and the means for inducing rotation and concurrent linear advance of the strands.

17. In a spinning and doubling machine for producing ply yarn, the combination of feeding means for multiple roving strands of loosely compacted fibers; drafting means for attenuating roving strands; means for maintaining the several strands in definite separation during

spinning and affording mutually convergent smoothing surfaces for said strands; and an aligned spinning unit for inducing rotation and linear movement of the roving strands while twisting the spun threads into ply yarn at said twist point, said divider means being positioned intermediate the drafting means and the spinning unit.

18. In a spinning and twisting machine for producing ply yarn, the combination of means for feeding and laterally traversing multiple roving strands of loosely compacted fibers; divider means for maintaining the several strands in definite separation during spinning and affording mutually convergent smoothing surfaces for said strands; means for supporting the divider means with capacity for self-adjustment to compensate for lateral traverse of the strands; and means for inducing rotation and linear movement of the strands while twisting the spun threads into ply yarn at said twist point.

19. In a spinning and twisting machine for producing ply yarn, the combination of feeding means for multiple strands of loosely compacted fibers; divider means for maintaining the several roving strands in definite separation during spinning and affording mutually convergent smoothing surfaces for said strands; means for supporting the divider means pivotally with capacity for self-adjustment to compensate for lateral traverse of the roving strands; and means for inducing rotation and linear movement of the strands while twisting the spun threads into ply yarn at said twist point.

20. In a spinning and twisting machine for producing ply yarn, the combination of feed and draft means for multiple roving strands of loosely compacted fibers; divider means for maintaining the several drawn roving strands in definite separation during spinning and affording mutually convergent smoothing surfaces for said strands; and means for inducing rotation and linear movement of the strands while twisting the spun threads into ply yarn at said twist point, said divider means being positioned intermediate the feed and draft means and the means for inducing rotation and concurrent linear advance of the strands.

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