March 4, 1941. B. C. SHAW 2,233,963

DRAWING MECHANISM FOR TEXTILE FIBERS

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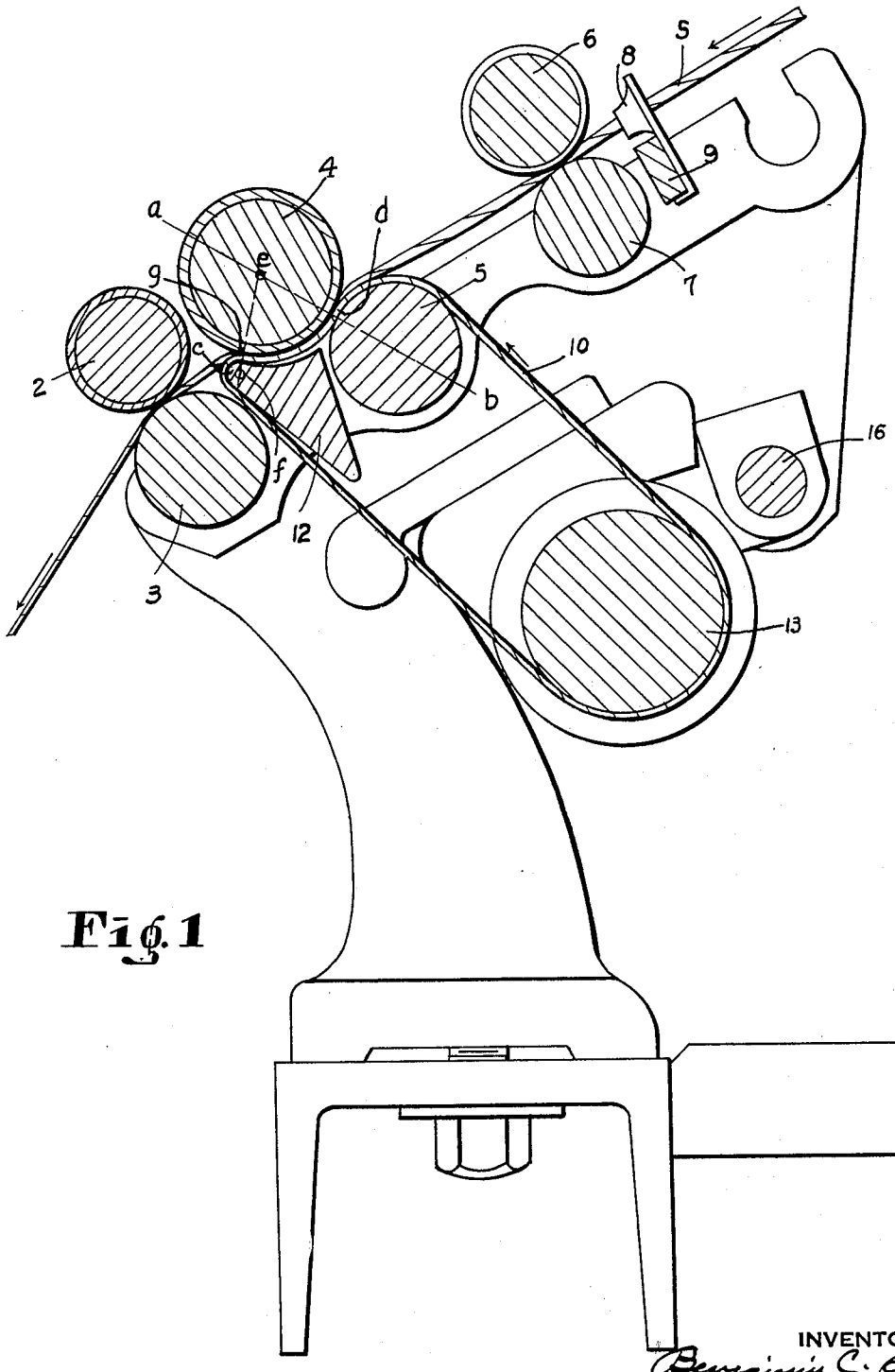

Fig. 1

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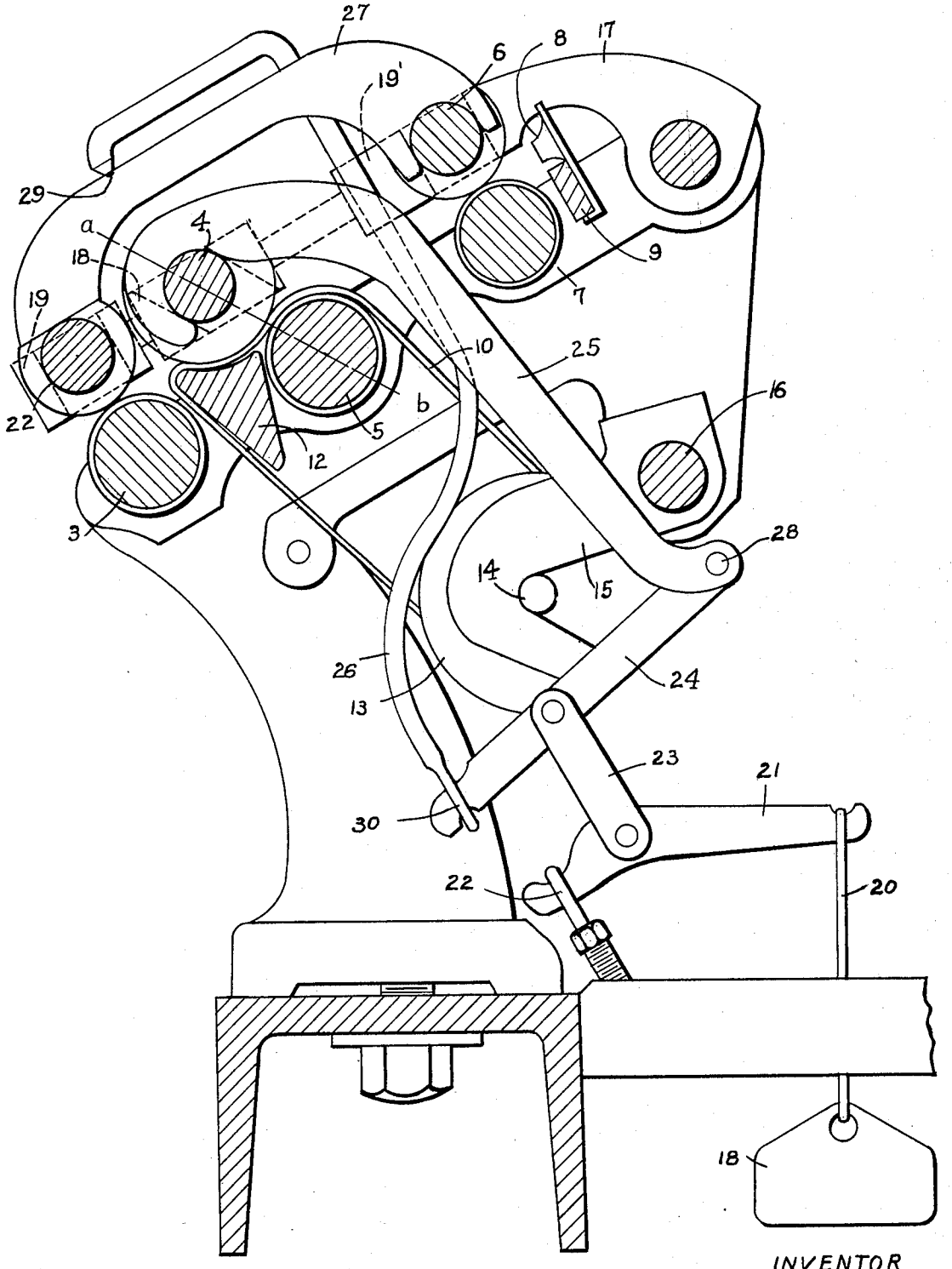

Fig 2

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UNITED STATES PATENT OFFICE

2,233,963

DRAWING MECHANISM FOR TEXTILE FIBERS

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12 Claims. (Cl. 19—131)

This invention relates to mechanisms for drafting fibrous material at various stages in its preparation for the operation of spinning as for example in the drawing mechanisms of roving and spinning frames.

As is well understood by those skilled in this art, it is a common practice to subject textile fibers to a series of these drafting or drawing operations designed more especially to bring the fibers into a more nearly parallel relationship so that when the final strand of loosely assembled fibers is twisted, the maximum strength of the fibers, so far as possible, may be utilized. The invention is especially concerned with the drafting operation performed on a cotton sliver as it travels to the spinning instrumentalities, and it will be herein disclosed as embodied in a mechanism designed especially for this purpose, it being understood, however, that the invention is not limited in its application to this particular use.

A typical drawing mechanism used in a spinning frame comprises several pairs of drawing rolls, usually three or four, each pair including a lower and a cooperating upper roll, and the pairs being arranged, one in advance of the other, so that they act successfully on a continuous strand of sliver guided through them. In a common arrangement each pair is revolved at a higher speed than the pair immediately preceding it so that during the travel of the sliver the fibers of which it is composed are drawn out, the sliver is attenuated, and the fibers are brought into a more nearly parallel relationship.

In recent years there has been a marked tendency to increase the draft produced in a single drawing operation and thus to reduce the number of these operations required to prepare the material for spinning. While the orderly drawing or drafting of the fibers has always been an important problem in these operations, the increase in degree of draft performed in a single step, while still producing a yarn having the desired degree of uniformity, has measurably increased the difficulty of maintaining that control of the fibers upon which the quality of the final product depends. In other words, the distribution of the fibers in the final product depends very largely upon the control of those fibers during the drafting operation and the release of the fibers in turn so that they will be drawn out in substantially a regular order.

The present invention is especially concerned with this problem, and it aims to devise a drafting mechanism in which such a control as that above described will be maintained.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a vertical, sectional view, with parts in elevation, of the drawing or drafting mechanism of a spinning frame embodying features of the present invention; and

Fig. 2 is a similar view illustrating more especially the weighting mechanism and its relationship to the drafting devices.

Referring first to Fig. 1, the mechanism there shown comprises three sets of drawing devices arranged to act successively on a sliver S. In this particular embodiment of the invention, these devices include a front pair of upper and lower drawing rolls **2** and **3**, respectively, an intermediate pair **4** and **5**, and a back pair **6** and **7**. A trumpet **8** mounted on a traverse bar **9** guides the sliver between the rear rolls. These three pairs of rolls are operated at the speeds necessary to produce the desired drafting action on the sliver between the bites of successive pairs. In a typical arrangement the peripheral speed of the middle rolls is in the order of perhaps 1.10 to 1.25, for example, times that of the back rolls so as to impart to the strand a pre-tension or stretch sufficient to produce a slight slippage of the fibers relatively to each other. This sometimes is referred to as a "break draft," since it serves to free the fibers somewhat from the slight degree of twist which the sliver has when it comes to the spinning frame.

Between the middle and front rolls a very much higher draft is applied, and it is in this higher drafting zone that the problem of controlling the fibers in the manner above described is presented. In order to effect such a control, the present invention replaces the orthodox middle rolls with a unique set of drafting elements. These devices include rolls **4** and **5**, a belt or apron **10** running between them, a guide **12** over which the belt runs after leaving the lower roll **5**, and a pulley or idler **13** for applying the necessary tension to the belt. This pulley has stub shafts projecting axially from opposite ends thereof, one of which is shown in Fig. 2 at **14**, and these shafts are engaged by arms **15** pivoted on the rod **16**, these arms thus serving to hold the pulley **13** in its operative position while allowing it to have a certain freedom of movement necessary because of some tendency of the belt **10** to change in length

and also to accommodate slight differences in lengths of different belts.

It should be understood that the bottom rolls 3, 5 and 7 are all positively driven in the usual manner by gearing located at one end of the frame, that these rolls are customarily made of steel and are fluted or roughened to afford a better grip on the sliver, or in the case of the middle roll, on the belt 10, and that the upper rolls 2, 4 and 6 are driven by the lower rolls, as in the common commercial construction. Each of these upper rolls customarily consists of a metal body provided with gudgeons for running in guides in the cap bars and usually has a covering of cork, leather, or other yielding material. The belt 10 also may be made of the same materials as those used heretofore for similar belts and aprons, leather generally being used.

The upper rolls are weighted, as will later be described, to hold them in suitable driving relationship to the lower rolls and to produce the necessary grip of the successive pairs of rolls on the sliver, and the weighting and guiding arrangement for the upper middle roll 4 is such that it presses this roll toward its cooperating lower roll 5 along the line *a*—*b*, Fig. 1, connecting the axes of the two rolls. The arrangement is such that the belt 10 has an ample arc of engagement with the lower roll 5 to enable it to drive the belt. Also, this driving relationship is aided by the pressure of the upper roll 4 which thus cooperates with the lower roll to grip the belt firmly between them, in addition to improving the driving connection between the lower roll and the upper roll. It should also be observed that the axis of the upper roll 4 is located considerably ahead of the axis of the lower roll 5, this upper roll bearing on the belt 10 at a point approximately midway of the upper length or run of this belt extending from the top of the roll 5 to the corresponding portion of the substantially cylindrical edge *c* of the guide 12.

With this arrangement, therefore, the sliver is gripped firmly between the bites of the back rolls 6 and 7, again between the roll 4 and belt 10 at approximately the intersection *d* of the latter with the line *a*—*b*, and finally between the bites of the front rolls or delivery rolls 2 and 3. As a given point in the sliver moves from the nip of the middle rolls toward the bite of the front rolls, it is conveyed in a restrained and compacted mass up to approximately the nearest mechanically practical point to the nip of the front rolls 2 and 3. At the latter point the fibers are seized and withdrawn from this mass in a ratio of attenuation depending upon the relative speeds of the front and middle rolls and which may, in a typical case, be in the order of 15 to 1. During this withdrawing step it is extremely important, for the reasons above described, to maintain such a control of the fibers held between the upper roll 4 and the belt 10 that they will be drawn out in as nearly their orderly turn as possible. As above stated, a strong grip is maintained on substantially the entire cross-section of the sliver as it passes through the point *d*, Fig. 1, this result being produced by the fact that the upper roll is weighted along the line *a*—*b*, and the further fact that the roll is restrained by the cap bar guides against lateral movement, except along this common center line connecting the two rolls. Consequently, as a given point in the sliver leaves this point of maximum pressure and moves toward the front rolls, while still held between the periphery of the roll 4 and the surface of the belt 10, it travels through a zone in which it is subjected to a reduced pressure. The preferred adjustment with a cotton sliver of typical fiber composition, size and density, is one in which a clearance of approximately .012" is maintained at the point *g* where the line *e*—*f* between the centers of the roll 4 and the cylindrical surface *c* intersects the periphery of the roll. It will be observed that the radial component of the pressure of the roll 4 against the belt, due to the action of the weighting mechanism, gradually decreases from the point *d* toward the point *g*. However, the degree of pressure with which the sliver will be gripped between said roll and the belt throughout the greater part of this region between the points *d* and *g* depends primarily on the tension maintained on the belt by the pulley 13, but it is always relatively light. Adjacent to the point *g* it is always affected also by the clearance between the roll 4 and the guide 12 which clearance, of course, is adjustable. The drawings show a typical arrangement for cotton sliver made of uncombed stock in which a very considerable variation in fiber length must be expected. In operating on such stock the nip of the front rolls should be spaced from the point *d* by a distance somewhat longer than the longest fiber. Since a maximum fiber length is about one and a quarter inches in stock of the character just mentioned, this means that the two nips will be spaced apart by, say, one and a half inches. The middle and front rolls are set as close together as practical so as to bring the point *g* as close to the nip of the front rolls as possible. With rolls of ordinary sizes this may mean a distance of one-half to five-eighths of an inch. Throughout the greater part of the distance, therefore, between the points *d* and *g*, namely from about three-quarters of an inch to approximately one inch, the rearward ends of the fibers being drawn by the front rolls are yieldingly restrained by the grip of the top middle roll and the belt. Thus these two controlling surfaces exert a retarding influence upon the rearmost end portion of any fiber being withdrawn by the front rolls. A further restraining action is applied to the rearward ends of the fibers by the fact that they are being drawn along a curve between the belt and the roll 4, and are then turned as they leave the point *g* and drawn around an opposite curve as they pass over the nose *c* of the guide 12. Consequently, the pull exerted on the forward end of any fiber while its rearward end is passing through this reversely curved path tends to straighten it out and to draw it into a common parallelism with adjacent fibers similarly acted upon. The fibers are free during this action from any retarding influence tending to deflect, bend, or distort them, which has been a serious factor in prior constructions.

This zone of retarding influence may readily be made long enough to exert a similar control on all except the shortest fibers. Those which fail to bridge the gap between the bite of the delivery rolls and the final nip of the belt 10 and roll 4 will be carried forward by the majority of the fibers that are controlled in the manner above described. Consequently, while these shorter fibers are not as well controlled as the longer ones, nevertheless the effect of the latter on the former is beneficial in controlling even these shorter fibers.

It should also be noted that the belt 10 is itself effectively controlled since the forward movement of the fiber conveying portion thereof, while pro-

duced primarily by the lower roll 5, is also assisted by the upper middle roll substantially throughout the entire length of its useful working area. While the length of contact of the roll 4 with the belt may be varied, it is preferable to have it extend through an arc of not less than 30° as measured along the periphery of the roll 4, and it is preferable to make it considerably greater when rolls of the ordinary sizes are used. As shown, this arc of contact is somewhat over 60°.

The pressure throughout the greater part of this area is such that the rearward ends of the fibers may be withdrawn by the front rolls without breaking the fibers.

Fig. 2 shows the cap bar 17 equipped with guides 19 and 19' of any suitable construction for the top rolls 2 and 6 and with a guide 18 for the top roll 4, the latter being provided with an inclined slot or guideway, as above described. Preferably these guides are mounted for adjustment toward and from the front of the machine. Such an adjustment is important in producing the desired clearance at the point *g*, Fig. 1.

Fig. 2 also illustrates a special weighting mechanism adapted for this roll organization. It will be observed that since the common center line of the two middle rolls is not parallel with the corresponding center lines of the front and back sets of rolls, some special provision must be made to apply pressure to the top rolls along the respective center lines so that the entire benefit of the weighting devices will be obtained.

In the arrangement illustrated, the weight 18 is suspended by a weight hook 20 from one end of a lever 21, the opposite end of which is pivoted on the rigid but adjustable fulcrum piece 22. Connected to this lever by a link 23 is a weight distributing bar or floating lever 24 to one end of which the stirrup 25 for weighting the middle roll 4 is pivoted. Another stirrup 26 is pivotally connected to the opposite end of the bar 24 and bears on a saddle 27, the opposite ends of which rest, respectively, on the gudgeons of the front roll 2 and the back roll 6. The distribution of weight between these two rolls is determined by the spacing of the bearing point 29 of the stirrup 26 on the saddle with reference to the rolls, considerably more pressure being applied to the front than to the back roll. It should be noted that the pivot 28 which connects the stirrup 25 with the end of the floating lever 24 is in the line *a*—*b* passing through the axes of the two middle rolls 4 and 5 and that, consequently, the pull exerted on this pivot by its connections with the weight 18 is directly in the common center line of said rolls. This is desirable for the reasons above pointed out. At the same time the weight applied by the saddle 27 to the front and rear rolls is exerted substantially in the common center lines of these respective sets of rolls.

Usually it is preferable to place the pivotal joint 30 between the stirrup 26 and the distributing bar 24 slightly ahead of a line through the bearing point 29 and parallel to the lines of pressure between the front and back sets of rolls so as to set up a component of force in the saddle 27 acting in the direction of travel of the sliver with a tendency to hold the back roll 6 forward at all times against the front walls of its guideways where it is positioned properly with reference to its cooperating lower roll 7. It will be observed that the rearward end of the saddle 27 fits around the neck or gudgeon of the top roll. Thus the arrangement just described prevents this roll from wandering or "hunting" while the machine is in operation. The forward end of the saddle, however, is provided with a flat surface to rest on the gudgeon of the top front roll 2.

It is contemplated that the stirrup 26 may be made of resilient material, such as spring steel, of sufficient cross-sectional dimensions to accommodate all stresses imposed by weighting, while still capable of cushioning and equalizing the weighting forces against any factors disturbing the rotative movement of the rolls, so that inertia of the weight and the connecting linkage may not be affected by such factors, should they be present. It is also contemplated that the stirrup 25 may likewise be made of a resilient material, but in practice it has been found that this is ordinarily not necessary since its linkage to the stirrup 26 through the equalizer bar tends to make the resiliency embodied in the latter stirrup effective for both lines of weight distribution. It will also be recognized that the middle roll which is affected by and mutually affects the stirrup 25 rotates at a much lower speed than the front roll 2 and hence does not require such an instantaneous degree of interaction between itself and its weighting member.

From the foregoing it will be evident that the invention provides a drafting mechanism which maintains an exceptionally effective control of the fibers in the region where the main draft takes place, and in which such control is most needed and is most difficult to produce.

While I have herein shown and described a typical embodiment of my invention, it will be understood that the invention may be embodied in other forms without departing from the spirit or scope thereof. For example, one or more of the rolls often is replaced by an equivalent device such as a belt and the number of pairs of rolls used varies considerably with the requirements of different situations and the preferences of individual manufacturers. Accordingly, the illustrated embodiment of the invention should be regarded rather by way of explanation than limitation.

Having thus described my invention, what I desire to claim as new is:

1. In a mechanism for drafting cotton sliver and the like, the combination of two sets of devices for gripping and feeding a sliver, said sets being arranged one in advance of the other to act successively on the sliver, the rear set of said devices comprising a belt and a top roll bearing on said belt, means for feeding said sliver into the bite of said top roll and said belt, means for supporting, driving, and guiding said belt comprising a guide adjacent to the front set of said devices and a lower driven roll behind it and over which the belt runs, said guide and said driven roll holding said belt stretched between them, said top roll bearing on the portion of said belt so stretched for an angular distance of at least 30°, a weighting mechanism acting on said top roll to force it against said belt and to press it firmly against said driven roll, and means for so guiding said upper rear roll that it exerts its maximum pressure on said belt approximately in the plane connecting the axes of said upper and lower rear rolls.

2. In a mechanism for drafting cotton sliver and the like, the combination of a pair of upper and lower rolls arranged to grip and feed a sliver, a second pair of upper and lower rolls behind the first pair and between which said sliver is fed

on its way to said front pair of rolls, a belt running over and driven by the lower of said rear rolls, a guide between said lower rolls over which said belt runs, said upper rear roll bearing on said belt between said guide and the lower rear roll, means for guiding said upper rear roll for movement toward and from its cooperating lower roll in a plane inclined downwardly and rearwardly with reference to the general direction of the path of travel of the sliver through the mechanism, said rolls pinching said belt between them, means for guiding a sliver into position to be gripped between said belt and said upper rear roll where it will be fed by them to said front rolls, said guide being so located with reference to said lower rolls that the belt is depressed to a substantial degree by the upper rear roll and is caused to travel in contact with the peripheral surface of the latter roll around the lower surface thereof and up to a releasing point closely adjacent to and substantially opposite the bite of the front rolls.

3. A drawing mechanism according to preceding claim 2, including weighting mechanism acting on said rear upper roll in the direction of said plane passing approximately through the axes of the two rolls.

4. In a mechanism for drafting cotton sliver, and the like, the combination of a pair of upper and lower rolls arranged to grip and feed a sliver between them, a second pair of upper and lower rolls behind the first pair and between which said sliver is fed on its way to said front pair of rolls, a belt running over the lower of said rear rolls, a guide between said lower rolls over which said belt runs, said upper rear roll bearing on said belt between said guide and the lower rear roll and depressing the belt, means for tensioning said belt, the guide cooperating with said belt and rear rolls to cause the belt and upper roll to grip the sliver between them from a releasing point closely adjacent to the bite of the front rolls through an angle of at least 45° measured rearwardly from said pointt around the lower circumferential surface of said rear top roll, means for driving said front and rear rolls at such relative speeds as to subject the sliver to a substantial draft during its passage from the rear rolls to the front rolls, and means adjustable to vary the clearance between said rear top roll and said guide, said guide including a portion extending backwardly under and close to said depressed portion of the belt to a point closely adjacent to the lower rear roll and also having a rounded edge over and around which the belt travels immediately after moving out of contact with said rear top roll.

5. In a mechanism for drafting cotton sliver, and the like, the combination of a pair of upper and lower rolls arranged to grip and feed a sliver between them, a second pair of upper and lower rolls behind the first pair and between which said sliver is fed on its way to said front pair of rolls, a belt running over the lower of said rear rolls, a guide between said lower rolls over which said belt runs, said upper rear roll bearing on said belt between said guide and the lower rear roll and depressing the belt, the guide cooperating with said belt and rear rolls to cause the belt and upper rear roll to grip the sliver between them from a releasing region closely adjacent to the bite of the front rolls backwardly to a point somewhat beyond the rearward ends of the majority of the fibers which are simultaneously gripped by the front rolls, said guide having a rounded edge over which the belt makes its turn out of contact with the sliver, said releasing region being at the rearward side of said rounded edge so that the same portion of the belt is in contact substantially simultaneously with said edge and with said upper rear roll as it passes through said releasing region.

6. In a mechanism for drafting cotton sliver, and the like, the combination of a pair of upper and lower rolls arranged to grip and feed a sliver between them, a second pair of upper and lower rolls behind the first pair and between which said sliver is fed on its way to said front pair of rolls, a belt running over the lower of said rear rolls, a guide between said lower rolls over which said belt runs, said upper rear roll bearing on said belt between said guide and the lower rear roll and depressing the belt, the guide cooperating with said belt and rear rolls to cause the belt and upper rear roll to grip the sliver between them from a releasing point closely adjacent to the bite of the front rolls backwardly for a circumferential distance around said rear roll of at least 30°, said guide having a rounded edge positioned closely adjacent to the peripheral surfaces of both said rear top roll and said bottom front roll in approximately the region in which they are closest to each other, said edge being positioned so close to the surface of said rear top roll that the belt makes a reverse turn in passing from the latter roll, out of contact therewith and around said rounded edge of the guide.

7. In a mechanism for drafting cotton sliver and the like, the combination of three pairs of upper and lower drafting rolls arranged in series to feed and draw a cotton sliver, a belt interposed between the middle rolls, means for guiding the top rolls for movement toward and from their respective bottom rolls along paths parallel to the planes connecting the axes of the respective top and bottom rolls, said plane between the middle pair of said rolls extending at a substantial angle to the planes connecting the axes of the other pairs of said rolls, the latter planes being parallel to each other, and a weighting mechanism common to all of said rolls for pressing the top rolls against their cooperating bottom rolls in directions lying in said respective planes, said weighting mechanism including a distributing bar, a stirrup pivoted at its lower end to one end of said distributing bar and having its upper end hooked on to the gudgeon of said top middle roll, a saddle straddling said top middle roll and having its opposite ends bearing on the gudgeons of said top front and rear rolls, respectively, a second stirrup, the upper end of which bears on said saddle while its lower end is jointed to the end of said bar opposite to the point of connection of the latter with the first stirrup, a link pivoted to said distributing bar between its ends, and weighting means connected with said link to pull it downwardly.

8. In a mechanism for drafting cotton sliver and the like, the combination of three pairs of upper and lower drafting rolls arranged in series to feed and draw a cotton sliver, a belt interposed between the middle rolls, means for guiding the top rolls for movement toward and from their respective bottom rolls along paths parallel to the planes connecting the axes of the respective top and bottom rolls, said plane between the middle pair of said rolls extending at a substantial angle to the planes connecting the axes of the other pairs of said rolls, the latter planes being parallel to each other, a weighting mechanism

common to all of said rolls for pressing the top rolls against their cooperating bottom rolls in directions lying in said respective planes, said weighting mechanism including a distributing bar, a stirrup pivoted at its lower end to one end of said distributing bar and having its upper end hooked on to the gudgeon of said top middle roll, a saddle straddling said top middle roll and having a flat forward end bearing on the gudgeon of said top front roll and a grooved rear end embracing the gudgeon of the top rear roll, a resilient stirrup, the upper end of which bears on said saddle while its lower end is connected with the end of said bar opposite to the point of pivotal connection of the latter with the first stirrup, a link pivoted to said distributing bar between its ends, and weighting means connected with said link to pull it downwardly.

9. In a mechanism for drafting uncombed cotton sliver, and the like, the combination of a pair of upper and lower rolls arranged to grip and feed a sliver between them, a second pair of upper and lower rolls behind the first pair and between which said sliver is fed on its way to said front pair of rolls, a belt running over the lower of said rear rolls, a guide between said lower rolls over which said belt runs, said upper rear roll bearing on said belt between said guide and the lower rear roll and depressing the belt, the guide cooperating with said belt and rear rolls to cause the belt and said upper rear roll to grip the sliver between them from a releasing point closely adjacent to the bite of the front rolls backwardly to a point somewhat beyond the rearward ends of the longest fibers simultaneously gripped by the front rolls, and means for so positioning said rolls and said guide with reference to each other that the rear ends of the longer and medium length fibers in the sliver will be yieldingly restrained between said belt and rear top roll while their forward ends are gripped and fed by said front rolls, said guide having a rounded edge positioned in the space between said upper rear roll and said lower front roll, said edge being separated from said upper rear roll by a maximum distance only slightly greater than the thickness of said belt, and said belt running over and around said edge.

10. In a mechanism for drafting cotton sliver, and the like, the combination of a pair of upper and lower rolls arranged to grip and feed a sliver between them, a second pair of upper and lower rolls behind the first pair and between which said sliver is fed on its way to said front pair of rolls, a belt running over the lower of said rear rolls, a guide between said lower rolls over which said belt runs, said upper rear roll bearing on said belt between said guide and the lower rear roll and depressing the belt, the guide cooperating with said belt and rear rolls to cause the belt and upper rear roll to grip the sliver between them from a releasing region closely adjacent to the bite of the front rolls backwardly to a point somewhat beyond the rearward ends of the majority of the fibers which are simultaneously gripped by the front rolls, said guide having a rounded forward edge positioned in the space between said upper rear roll and said lower front roll and around which edge said belt runs immediately after passing out of contact with said upper rear roll, said rounded forward edge being separated from said upper rear roll and said front roll only by approximately the clearance space necessary for the travel of the belt.

11. In a mechanism for drafting uncombed cotton sliver, and the like, the combination of a pair of upper and lower rolls arranged to grip and feed a sliver between them, a second pair of upper and lower rolls behind the first pair and between which said sliver is fed on its way to said front pair of rolls, a belt running over the lower of said rear rolls, a guide between said lower rolls, said guide having a rounded forward edge over which said belt runs, said upper rear roll bearing on said belt between said guide and the lower rear roll and depressing the belt, the guide cooperating with said belt and rear rolls to maintain the upper roll and belt in contact with opposite faces of the sliver from a position of firm bite at the lower side of said upper rear roll forwardly for a distance of at least one half an inch and up to a releasing point within three-quarters of an inch of the bite of the front rolls, said belt leaving the upper rear roll and turning around said rounded front edge of said guide approximately at said releasing point.

12. In a mechanism according to preceding claim 11 means for guiding the upper rear roll for movement toward and from its cooperating lower roll in a direction downwardly and rearwardly, whereby the maximum grip exerted on the sliver by the latter rolls and the belt pinched between them is approximately in the plane connecting the axes of these rolls.

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