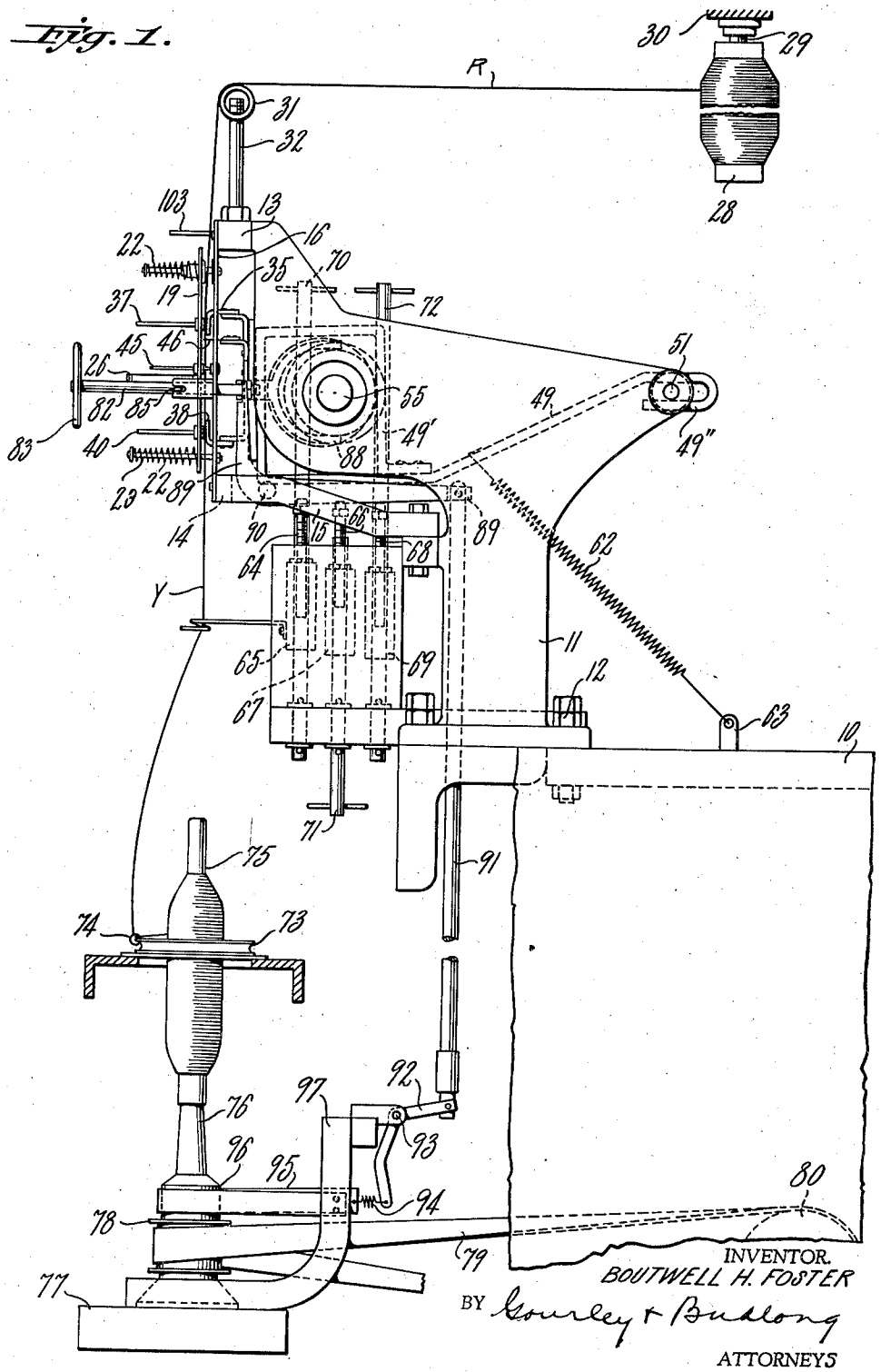
Dec. 6, 1938. B. H. FOSTER 2,139,320

METHOD AND APPARATUS FOR TREATING TEXTILE FIBERS AND FOR MAKING ELASTIC YARN

Filed March 4, 1938 4 Sheets-Sheet 1

Fig. 1.



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METHOD AND APPARATUS FOR TREATING TEXTILE FIBERS AND FOR MAKING ELASTIC YARN

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Fig. 2.

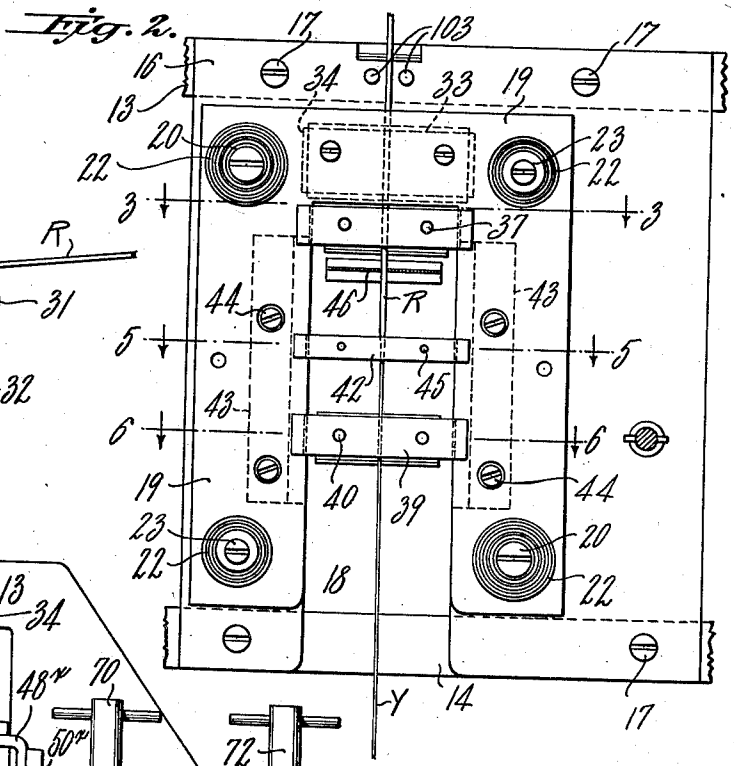


Fig. 4.

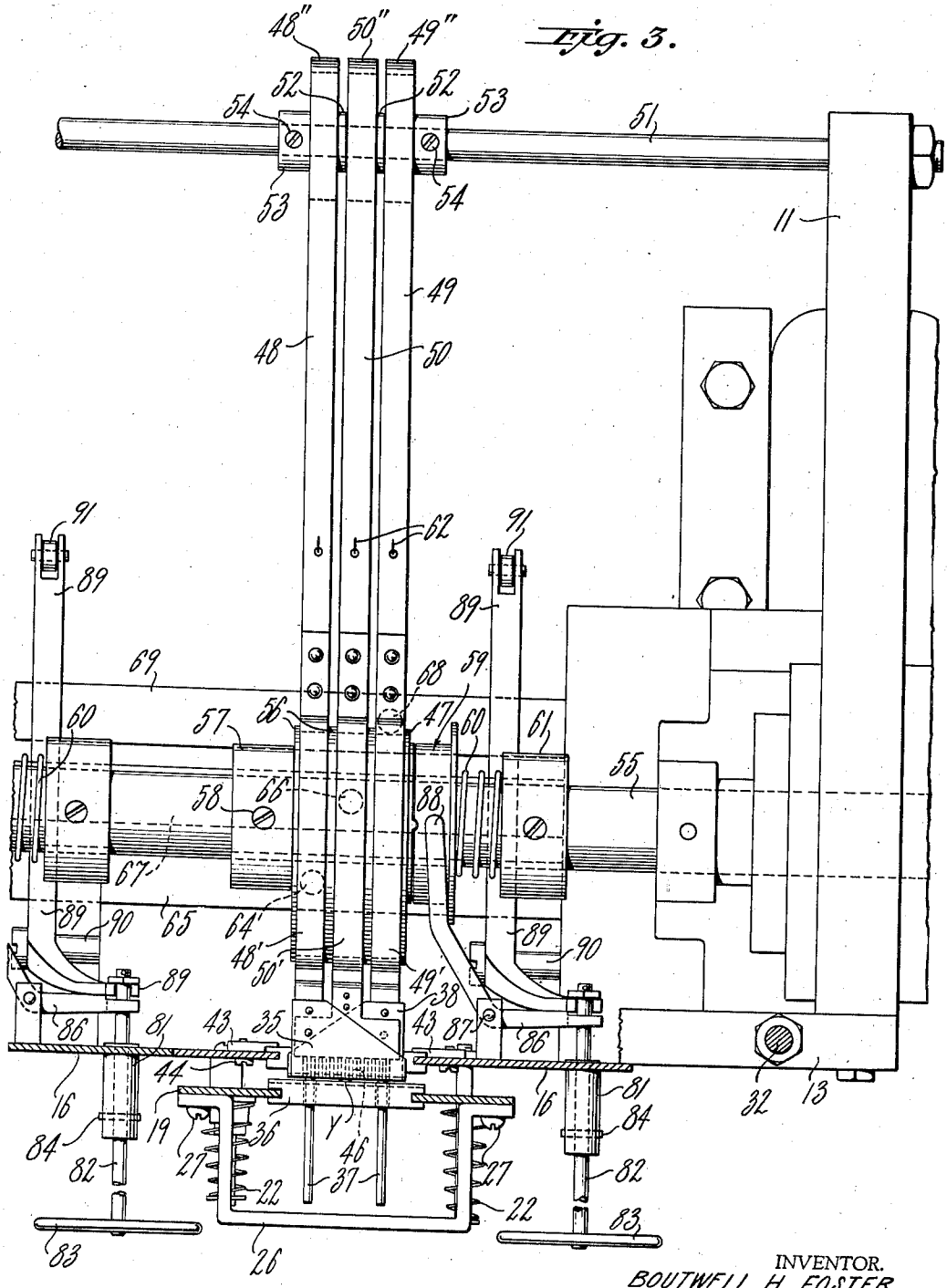
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METHOD AND APPARATUS FOR TREATING TEXTILE FIBERS AND FOR MAKING ELASTIC YARN

Filed March 4, 1938 4 Sheets-Sheet 3

Fig. 3.



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METHOD AND APPARATUS FOR TREATING TEXTILE FIBERS AND FOR MAKING ELASTIC YARN

Filed March 4, 1938 4 Sheets-Sheet 4

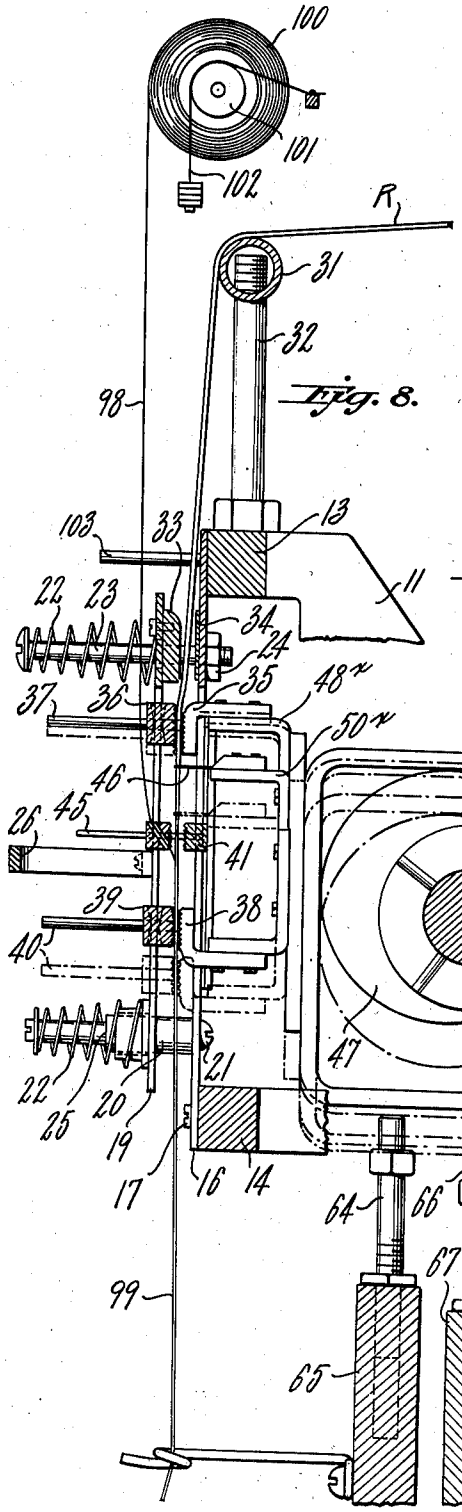


Fig. 8.

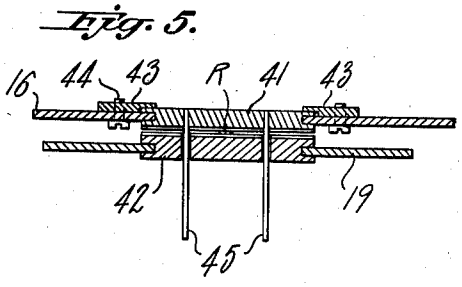


Fig. 5.

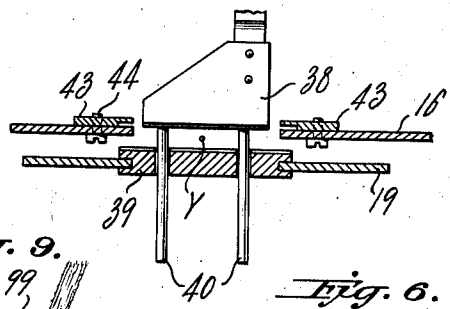


Fig. 6.

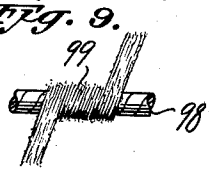


Fig. 9.

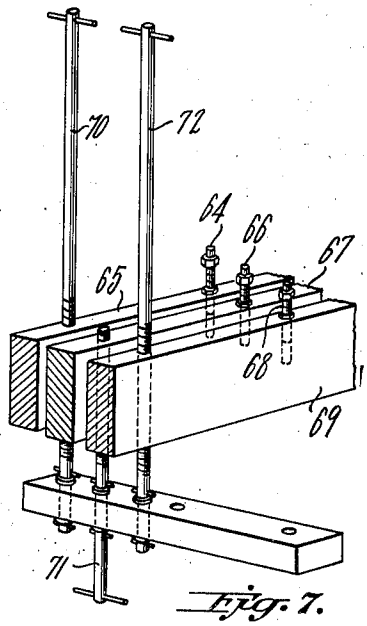


Fig. 7.

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Patented Dec. 6, 1938 2,139,320

UNITED STATES PATENT OFFICE

2,139,320

METHOD AND APPARATUS FOR TREATING TEXTILE FIBERS AND FOR MAKING ELASTIC YARN

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Application March 4, 1938, Serial No. 193,842

30 Claims. (Cl. 117—35)

This application is a continuation in part of my prior application Serial No. 105,698 filed October 15, 1936.

The present invention relates to a new and improved method and apparatus for drafting and spinning textile fibers such as the usual animal and vegetable fibers and also the much shorter asbestos fibers. The invention also relates to a new method and apparatus for forming elastic yarn consisting of an elastic thread having the drafted fibers wound thereupon as a cover.

The usual method of drafting a strand or roving heretofore has been to pass the same between spaced pairs of drafting rolls which are operated at successively increasing surface speeds in the direction in which the strand or roving travels between the rolls. The effect of this is to cause a forward pair of rolls to grip and pull the strand or roving forward at a higher speed than the rate at which it was being advanced by the preceding pair of rolls, to thereby draft or attenuate the fibers forming the strand or roving.

Such prior drafting rolls however are not well adapted to draft very short fiber such as the shorter length asbestos fibers because the pairs of rolls can not be placed close enough together to handle these short fibers without making the rolls too small for thoroughly practical use. Furthermore these drafting rolls subject the fibers being drafted to a severe strain due to the fact that when they pass from one pair of rolls to the next pair of higher speed they are jerked forward with a severe pull.

The present invention contemplates reciprocating drafting means which can be operated much closer together than the usual drafting rolls, and it also contemplates the operation of such reciprocating drafting means with a variable speed whereby the drafting pull is slow at the start but increases in the direction in which the fibers are being attenuated.

The above mentioned co-pending application is directed to said reciprocating drafting means, but the present invention contemplates important improvements in the construction and operation over the apparatus of said prior application, and also the provision of means for combing the fibers as they are being drafted. The present invention also contemplates a novel method of making elastic yarn whereby the fibers are drafted by said reciprocating drafting means and are immediately wrapped about an elastic thread to cover the same.

One important feature of the present invention resides in pairs of cooperating jaws adapted to engage and operate upon the roving or strand to be drafted, and in means for operatively connecting the jaws forming a pair so that they are retained at all times in proper alignment and the movement of one jaw is imparted to the other.

Another important feature of the present invention resides in a comb which is adapted to engage and comb the fibers while they are being drafted or attenuated. This comb serves not only to straighten the fibers and arrange them more nearly parallel but also helps to draw the fibers forward to attenuate them.

Another feature of the invention resides in the mechanism for imparting the desired reciprocating movement to the comb and strand engaging jaws, and to manually controlled means whereby each drafting and spinning unit may be started and stopped without disturbing the operation of the other units.

Another highly important feature of the present invention resides in the method of producing an elastic yarn by drafting the roving as herein contemplated and simultaneously applying these drafted fibers about an elastic thread as a helically wrapped cover. It is found that this method of producing an elastic yarn provides an elastic yarn having a substantially uniform stretch, and that the yarn is well covered with the helical coils disposed smoothly over the rubber core and tightly connected so that the cover will not strip off of the core. It is further found that this elastic yarn knits and weaves well.

The above and other features of the invention and novel combination of parts will be more fully understood from the following description when read in connection with the accompanying drawings, wherein:

Fig. 1 is an end elevation with parts in section of a drafting and spinning machine constructed in accordance with the present invention.

Fig. 2 on a larger scale is a front view of the drafting mechanism of Fig. 1.

Fig. 3 is an enlarged top plan view of the mechanism of Fig. 1, parts being shown in section, as taken on line 3—3 of Fig. 2.

Fig. 4 is a vertical sectional view through the mechanism of Fig. 3 showing an operating arm in side view and the drafting mechanism in section.

Fig. 5 is a section taken on the line 5—5 of Fig. 2.

Fig. 6 is a section taken on the line 6—6 of Fig. 2.

Fig. 7 is a perspective sectional view of adjustable stop mechanism to be described;

Fig. 8 is a sectional view similar to Fig. 4 but shows the apparatus being used to make elastic yarn; and

Fig. 9 is a side elevation of a piece of elastic yarn constructed upon the apparatus of Fig. 8.

The method and apparatus of the present invention may be employed for drafting textile fibers which may vary in length from the very short asbestos fibers to the much longer wool, cotton and other textile fibers, and it may be used to draft a single roving or two or more rovings may be drafted together to form a single strand of attenuated fibers.

In the drafting and spinning machine illustrated, only the drafting and spinning unit adjacent one end of the frame of the machine is shown, but it will be understood that this machine may be provided with a large number of such units adapted to operate simultaneously side by side and that all of these units may be driven from a single source of power.

In the construction shown an end frame 10 is provided upon which is mounted an upstanding bracket 11 which is secured to the frame 10 by the bolts 12. To the front portion of this bracket 11 is secured an upper longitudinally extending rail 13, and below the rail 13 is provided a longitudinally extending rail 14 which is supported from the frame 10 by the bracket 15. The rails 13 and 14 serve to support a series of fixed plates 16, only one of these plates and part of another being shown in the drawings, but a number of such plates may be secured to these supporting rails lengthwise of the machine and each may constitute a portion of a drafting unit similar to the unit herein shown and described. The fixed plate 16 is rigidly secured to the upper and lower supporting rails by the screws 17 and this plate is provided with a vertical slot or opening 18 providing a clearance space for the operating of the drafting mechanism to be described.

In front of the fixed plate 16 in slightly spaced relation thereto is mounted the movable plate 19 and this movable plate is supported for a limited sliding movement horizontally towards and from the fixed plate for a purpose to be described. This front plate 19 is supported for sliding movement towards and from the rear plate by the diagonally disposed guide-pins 20 which pass slidably through guide holes in the front plate and these guide-pins are rigidly secured to the fixed plate by the clamping screws 21.

The movable plate 19 is provided with a slot or opening similar to the opening 18 formed in the rear plate and the front plate 19 is continuously urged towards the rear plate 16 by four coiled springs 22 two of which encircle the guide-posts 20 and the other two encircle the guide-pins 23 which pass through clearance holes formed in the front plate and are rigidly secured to the fixed plate by the clamping nuts 24. It will be noted that one end of each coil spring 22 rests against the movable plate 19 while the other end of each of these springs abuts against the head of a screw provided at the outer end of the posts 20 and pins 23, which the springs surround.

When the apparatus of the present invention is being threaded up it may be desirable to retain the movable plate 19 spaced well away from the fixed plate 16 and this is accomplished in the construction shown by providing each of the diagonally disposed guide-posts 20 with the shoulder 25 with which the plate 19 may be readily engaged by pulling this plate outwardly and shifting it slightly to cause its inner face to engage and rest against these shoulders 25. The movable plate is preferably provided with a bow shaped handle 26 extending transversely across the central portion of the plate and it is secured thereto by the screws 27. This handle may be engaged to pull the plate forward and to engage it with and release it from the holding shoulders 25.

In accordance with the present invention the strand or roving to be drafted is pulled forward step by step by a pair of jaws which are opened and closed and which are also reciprocated along a short path. The drafting of the strand or roving is effected by a second pair of jaws spaced from the first and which are likewise opened and closed but are reciprocated along a longer path of travel so that the second pair of jaws will draft or attenuate the fibers while the strand or roving is held by the first pair of jaws. These two pairs of jaws are moved simultaneously into and out of gripping engagement with the strand or roving and since these jaws are open at the same time, it is important to provide means to hold the strand or roving to thereby maintain it in place when it is released by said jaws. The plate 19 above described supports and operates the holding means just mentioned and also facilitates the operation of the reciprocating jaws.

The strand or roving R to be drafted may be formed of any of the usual fibers and may be supplied from a bobbin 28 which in the construction shown is mounted upon a spindle 29 that is suspended from a supporting bar 30. The roving R in the construction shown is led from the bobbin 28 horizontally to a guide-bar 31 supported by the upright rods 32 extending upwardly from the rail 13 and this roving then passes downwardly from the guide-bar 31 to the drafting mechanism which will now be described.

In accordance with the present invention, the roving R is pulled forward step by step by a pair of reciprocating feed jaws, and in order to prevent the roving from pulling back due to its tension, when it is released by these jaws, means is provided for clamping this roving at a point above these feed jaws when the latter are open. This clamping means in the construction shown comprises the clamping plate 33 which is secured by screws or otherwise to the inner face of the front plate 19 and upon the rear plate 16 is provided a roughened surface 34 which may take the form of a piece of emery cloth adhesively secured to the outer face of the plate 16. It will be seen from what has just been said that the springs 22 acting upon the movable plate 19 tend to force this plate rearwardly to clamp the roving between the members 33 and 34.

The means shown for feeding the roving forward step by step comprises a rear jaw 35 which operates in the clearance slot 18 formed in the rear plate 16 and a front jaw 36 which is slidably secured to the front plate 19 to slide within its vertical slot. The rear jaw 35 is moved in somewhat of an elliptical path by means to be described to thereby reciprocate the jaws and open and close them, and in accordonce with the present invention, the front jaw 36 is at all times maintained in proper alignment with the rear jaw 35 and is operated by the latter. This is accomplished by providing the guide-pins 37 which are rigidly secured to the rear jaw 35 and extend frontwardly through guiding holes formed in the front jaw 36 so that this jaw is slidably mounted upon these pins. The jaw

36 is also slotted at its ends to thereby slidably engage the front plate 19 at the marginal edges of the opening formed therein. The slots at the ends of the jaw 36 preferably flare outwardly somewhat as shown in dotted lines in Fig. 4 to permit this jaw to rock slightly as it is reciprocated by the rear jaw 35 in a manner to be described. The roving engaging faces of the jaws 35 and 36 are preferably roughened or serrated as shown to increase their grip upon the roving. The guide-pins 37 are considered an important feature of the present invention in that they insure that the teeth of the jaws will mesh accurately to firmly grip the fibers and they prevent relative slippage between the jaws. They also simplify the construction and insure that the jaws will move together.

The present invention contemplates the use of a second pair of jaws adapted to draft or attenuate the roving while it is being held by the first pair of jaws 35, 36. This second pair of jaws is spaced from the first a distance at least approximately equal to, and preferably slightly greater than, the length of the fibers to be drafted and comprises a rear jaw 38 and a front jaw 39. These two jaws may be similar in construction to the feed jaws above described and the jaw 39 is operatively connected to the jaw 38 and is held in alignment therewith by the pins 40 extending frontwardly from the jaw 38 through holes formed in the jaw 39. This jaw 39 like the jaw 36 is provided with slots at its opposite ends by means of which it is slidably secured to the front plate 19.

It is found important to hold the roving being drafted not only at a point above the feeding jaws 35 and 36 but also at a point between the feeding jaws and the drafting jaws 38 and 39. Therefore, in the embodiment shown, the lower clamping jaws 41 and 42 are provided. The rear jaw 41 is slotted at its opposite ends to engage the marginal edges of the opening 18 of the fixed plate 16, and the front jaw 42 is likewise slotted at its end so as to engage the opposite marginal edges of the opening in the front plate 19. The jaws 41 and 42 are not moved lengthwise of the roving during the operation of the machine but the rear jaw 41 may be adjusted up and down to vary its distance from the feeding jaws in accordance with the length of the fibers to be drafted. Clamping means are therefore provided upon the rear face of the fixed plate 16 and comprising the clamping plates 43 which overlie the end portions of the jaw 41 and are held in clamping engagement therewith by tightening the screws 44. The front jaw 44 is held in alignment with the rear jaw 41 by the frontwardly projecting pins 45 which are secured to the rear jaw and extend frontwardly through openings in the front jaw.

The movement imparted to the jaws 38 and 39 in the roving drafting direction should exceed the movement imparted to the feeding jaws 35 and 36 by an amount substantially corresponding to the amount it is desired to draft the fibers of the roving. That is, if an 8 draft is desired wherein the fibers are drafted in the ratio of 8 to 1 then the travel imparted to the drafting jaws should be approximately 8 times the travel imparted to the feeding jaws.

While the mechanism so far described constitutes good practical means for drafting or attenuating a roving it is found that this operation may be improved by employing combing means constructed and arranged to comb the portion of the roving being drafted while this roving is held by the feeding jaws and drafting jaws. Another important feature of the present invention therefore resides in a reciprocating comb 46 adapted to operate in the space between the feeding jaws 35 and 36 and the fixed clamping jaws 41 and 42 to thereby comb the fibers and straighten them out and arrange them in a more nearly parallel relation. The advancing of the comb in the fibers serves also to facilitate the attenuation or drafting of these fibers.

While various forms of mechanism may be employed to impart the desired movements to the comb, jaws and clamping means above described, one good practical means to this end will now be described.

In the construction shown, the upper jaw 35, lower jaw 38, and comb 46 are all operated from a single eccentric 47 adapted to move them along a more or less elliptical path. This movement serves to move the jaws 35 and 38 frontwardly into gripping engagement with strand or roving, and this frontward movement of these jaws serves also to force the moveable plate 19 frontwardly sufficiently to release the roving between the gripping means 33 and 34 and the gripping jaws 41 and 42. The movement imparted to the jaw 35 serves also to move it downwardly through the short distance indicated by the dotted lines in Fig. 8 to thereby feed the roving R forward step by step, and at the same time the lower jaw 38 is moved downwardly through a much greater distance as indicated by the dotted lines in Fig. 8 to thereby draft the strand or roving while it is held by the upper jaws 35 and 36. As the jaws 35 and 38 reach the lower portion of their path of movement they are retracted to permit the front plate 19 to move towards the fixed plate 16 and grip the strand at 33 and 42, whereupon the jaws 35 and 38 continue to travel rearwardly to move them out of engagement with the fibers. At the same time a somewhat similar movement is imparted to the comb 46 so as to move it forward into engagement with the fibers and then downwardly to comb the fibers and then rearwardly out of engagement therewith.

The movement just described of the upper jaw 35 is imparted to this jaw in the construction shown by a rock arm 48. The movement just described of the lower jaw 38 is imparted thereto by a rock arm 49, and the comb 46 is supported and actuated by the rock arm 50. Each of these rock arms is shown as formed of a metal strap, the forward portion of which is bent to form a hollow rectangular enclosure 48', 49' or 50' adapted to surround the operating eccentric 47. The rearwardly extending portion of each of these rock arms projects upwardly in an inclined direction and is formed with a horizontally extending hook portion 48'', 49'' or 50''. These hook portions are adapted to slidably embrace a fixed rod 51 extending lengthwise of the machine at some distance back of the drafting mechanism. This rod is supported by a rearwardly extending portion of the bracket 11. The supporting rod 51 cooperates with the hook portions of the rock arms 48, 49 and 50 to support the rear ends of these arms for sliding movement frontwardly and rearwardly in a horizontal plane and allows them to rock about the rod 51 as a fulcrum. The rock arms 48, 49 and 50 are prevented from being displaced laterally by providing a spacing washer 52 upon the rod 51 at each side of the inner rock arm 50 and by

providing the stop collars 53 upon the rod 51 in engagement with the outer faces of the arms 48 and 49; these collars are rigidly secured to the rod 51 by the set screws 54.

The eccentric 47 is long enough to operate all three of the rock arms and is mounted upon a power shaft 55 which is driven by power means (not shown) at any desired speed. The eccentric 47, it should be noted, is not positively secured to the power shaft 55, but is rotatably mounted thereupon and is driven from the power shaft by clutch means to be described. The construction is such that the operation of the rock arms for any one of the drafting units may be started and stopped without the necessity of stopping the rotation of the power shaft 55 which operates the entire series of these units. The rectangular portions 48', 49' and 50' of the rock arms are retained in slightly spaced relation to each other and are held against lateral movement by the relatively large spacing washers 56 which are mounted upon the operating eccentric 47. One end of the eccentric 47 abuts against a stop collar 57 which is rigidly secured to the operating shaft 55 by the set screw 58, and the opposite end of this eccentric is engaged by the clutch member 59 which is keyed to the power shaft 55 for sliding movement lengthwise of this shaft. This clutch member 59 is continuously urged towards the eccentric 47 by the coiled spring 60 confined between this clutch member and a collar 61 secured to the operating shaft, and the eccentric and clutch member are provided with the cooperating grooves and driving ribs shown.

It will be noted from Fig. 4 that the size of the rectangular opening formed in each of the rock arms to receive the operating eccentric is such that the vertical inner walls of this opening snugly receive the eccentric 47 whereas a substantial clearance space is provided between the eccentric and the upper and lower inner walls of this opening. As a result of this construction each rock arm will be moved frontwardly and rearwardly an amount corresponding to the throw of the eccentric 47, whereas the clearance space provided between the eccentric and the lower wall of each rock arm permits an adjustment to be made whereby the vertical movement imparted to each of these rock arms may be less than the throw of the eccentric 47. In the construction shown the eccentric 47 serves to raise each rock arm and move it frontwardly, and the movement downwardly and rearwardly of each rock arm is secured by the tension of a downwardly inclined spring 62, there being one of these springs for each of the rock arms and the upper end of each spring is secured to an intermediate portion of a rock arm while the opposite end of each spring is secured at 63 to a projection upon the supporting frame as will be apparent from Fig. 1.

It was pointed out above that a shorter up and down stroke is imparted to the upper jaw 35 than to the lower jaw 38, and it may be desirable to increase or decrease the length of the vertical stroke of each of these jaws to accommodate the particular requirements of the fibers being drafted. This may be readily secured through the provision of the clearance space between the eccentric 47 and the lower wall of the enclosing rectangular frame, and by providing a stop for each of the rock arms to arrest its downward movement. In the construction shown the rock arm 48 which carries the upper jaw 35 has its downward movement arrested by an adjustable stop 64 which is adjustably mounted in a bar 65 extending lengthwise of the machine. The downward movement of the comb operating arm 50 is arrested by the adjustable bolt or stop 66 carried by the longitudinally extending bar 67. The rock arm 49 which carries the jaw 38 has its downward movement arrested by the adjustable bolt 68 carried by the longitudinally extending bar 69. It may be desirable to adjust simultaneously all of the stops 64, for the various drafting units extending lengthwise of the machine or to likewise adjust all of the stops 66, or 68. To accomplish this the bar 65 is provided at its opposite ends with the screw adjusting means 70, the bar 67 is provided with similar screw adjusting means 71 while the bar 69 is provided with the adjusting means 72. As a result of these adjusting means any one of these bars may be raised or lowered to control the stopping position of the selected rock arms for all of the drafting units provided lengthwise of the machine. In addition to the means just described for adjusting the stroke of each rock arm, provision is made whereby the jaws 35 and 38 may be adjusted upon their arms 48 and 49 respectively and the comb may be adjusted upon the arm 50. This is accomplished by providing the supporting brackets 48^x, 49^x, and 50^x that are adjustably secured to their respective arms.

When the eccentric 47 is in its uppermost position of Fig. 4 all three rock arms, 48, 49 and 50 will be in their uppermost positions and will be advanced part way forward. As the eccentric rotates 90° in the direction indicated by the arrow in Fig. 4, each of these arms will be in its partly lowered position and will be in its maximum forward position. As the eccentric rotates through another 90° to its lowest position, each of these arms will be partly retracted and will be lowered into engagement with its particular stop, and as the eccentric reaches its rearmost position, all three arms will be moved to their maximum rearward position and may be partly elevated. The above described construction and operation is such that the strand or roving R is at all times gripped at at least two spaced points.

The present invention contemplates that the strand or roving upon being drafted will be twisted into a yarn Y. This twisting or spinning of the yarn may be effected by any suitable means, such, for example, as the well-known ring 73 and traveler 74 which serve to wind the yarn Y about the usual bobbin 75 as the ring rail which supports the ring 73 is traversed up and down. The bobbin 75 is mounted upon the spinning spindle 76 which is rotatably supported in a casing 77. This spindle may be provided with the usual pulley or whirl 78 and is driven by the belt 79 from a drum 80 extending lengthwise of the machine.

It will be understood from the foregoing that the present invention contemplates the use of reciprocating means for feeding the roving R forward step by step and reciprocating means for drafting the roving, and that it also contemplates continuously rotating spinning means for twisting or spinning the drafted fibers. As a result of this construction the twisting operation is applied intermittently to a portion of the fibers being drafted as will be apparent from comparing Figs. 4 and 8 of the drawings wherein it will be seen that when the lower jaws 38 and 39 are open as shown in Fig. 4 the twist will extend upwardly to the closed stop jaws 41 and 42, whereas when the lower jaws 38 and 39 are closed as shown

in Fig. 8 the twist does not pass upwardly beyond these jaws. As a result of this construction, the drafting of the fibers mainly occurs between the stop jaws 41 and 42 and the feed jaws 35 and 36. The twist imparted to the drafted fibers above the jaws 38 and 39 passes upwardly slightly beyond the stop jaws 41 and 42 when the latter are open, and facilitate the drafting operation.

It is found in practice that the yarn produced in accordance with the present invention is much softer than that produced on the ordinary drafting and spinning mechanism employing drafting rolls and a ring and traveler. In other words, the yarn produced in accordance with the present invention has the softness characteristic of a mule spun yarn rather than the harsher properties of the usual ring spun yarn. It is not entirely understood just why the yarn produced in accordance with the present invention should have this pronounced softness but it may be due at least in part to the fact that in the present construction the twist is permitted to extend upwardly to some extent into the drafting range and in this respect resembles the conditions which occur in producing yarn upon a mule spinning machine.

As above stated, it is contemplated that a machine constructed in accordance with the present invention will be provided with a number of drafting and spinning units so that a large number of strands or rovings may be spun into yarns at the same time. It is desirable to provide manually controlled means whereby any drafting unit and its cooperating spinning mechanism may be stopped without disturbing the operation of the other drafting and spinning units. This is accomplished in the construction shown by mounting upon each fixed plate 16 at one side of the drafting operation a sleeve 81 adapted to slidably support an operating rod 82 having a hand wheel 83 at its outer end. This rod 82 is provided with a transversely extending pin 84 which may be seated in a slot 85 formed in the outer end of the sleeve 81. The inner end of the rod 82 is operatively connected to one end of a bell crank lever 86 which lever is pivotally supported intermediate its end upon a pin 87 carried by a support projecting inwardly from the inner face of the fixed plate 16. The opposite end of the lever 86 is provided with curved fingers 88 adapted to engage and operate the clutch member 59. The inner end of the rod 82 is also operatively connected to a second bell crank lever 89 which is pivotally supported intermediate its end upon the post 90 and the opposite end of this bell crank lever has pivotally secured thereto a downwardly extending rod 91 adapted to operate brake means for the spindle 76. The lower end of the rod 91 is pivotally connected to one end of a bell crank lever 92 which is pivotally supported at 93 and the opposite end of this bell crank lever is attached to one end of a coiled spring 94, the other end of which is attached to a strap which is looped around an enlarged portion 95 upon the spindle 76. The opposite end of the strap 95 is secured to the fixed upwardly extending bracket 97.

The arrangement just described in such that when it is desired to stop the operation of a drafting and spinning unit, it is merely necessary to grasp the hand wheel 83 and pull the rod 82 forward and then rotate this spindle slightly so that the pin 84 will rest against the outer end of the sleeve 81 and hold the rod in its retracted position. This moves the clutch member 59 to the clutch open position and also tightens the strap 95 about the portion 96 of the spindle to stop the spinning operation. At this time the driving belt 79 will slip around the pulley 78 without rotating the spindle 76. To start the spinning and winding operation it is merely necessary to rotate the handwheel 83 slightly so that the pin 84 may enter the slot 85 and permit the rod 82 to move inwardly under the action of the compressed spring 60 and thereby close the clutch 59 to drive the eccentric 47, and at the same time release the tension of the strap 95 so that the spindle 76 will be driven by its belt 79.

In order further to illustrate the operation of the present invention, the following specific example is given showing the setup that was employed in producing a low draft yarn.

Example

1. Side of roving	hank	2.3
2. Length of stroke—top jaw	inch	3/32
3. Length of stroke—comb	do	1/2
4. Length of stroke—bottom jaw	do	1/2
5. Draft—approximate		5
6. Average length of fibers—about	inches	1 1/32
7. Distance from feed jaws to fixed clamping jaws (maximum opening)	inch	7/8

It is to be understood, however, that a much higher draft may be produced on the present apparatus if desired. It will also be understood that this example is only one of many that could be given and that it is not given with any intention of limiting the invention but simply in order that the invention may be more clearly understood.

It has been found that the present invention is not only well adapted to draft fibers varying in length from that of the very short asbestos fibers to that of the much longer cotton, wool and other textile fibers, and is capable of operating rapidly, and of producing a soft yarn which is highly desirable in many fields of uses, but that it is also extremely well adapted for use in producing an elastic yarn as will now be described.

It is found that the apparatus of the present invention may readily be employed to produce an elastic yarn such as shown in Fig. 9 and which consists of an elastic or rubber thread 98 about which is helically wound the covering 99 of loosely aggregated fibers such as cotton or wool. In order to produce this elastic yarn, it is merely necessary to deliver the rubber thread or core 98 to the strand or roving R at approximately the point where the drafting operation is completed and the spinning operation begins.

This may be accomplished as shown in Fig. 8 by providing a spool or other package 100 of the elastic thread 98 from which this thread may be drawn under any desired tension. Such tension may be secured by providing the brake pulley 101 about which passes the weighted brake strap 102, or other forms of braking or retarding means may be used. In the construction shown the elastic thread 98 extends downwardly between the spaced roving guiding pin 103 to the front stop jaw 42 which jaw is provided with a rearwardly and downwardly inclined guide-hole through which the thread 98 passes to the covering material 99, whereupon the twist which is imparted to this rubber thread and to the textile material by the spinning mechanism serves to twist the rubber core and textile fibers to wind the latter helically about the core as shown in Fig. 8. The twist imparted to the rubber core

by the spinning mechanisms in the present construction however serves not only to twist this core during the covering operation but also to impart a twist to the uncovered portion of the rubber core where it travels upwardly through the opening in the jaw 42 toward the supply package 100. The elastic yarn of Fig. 8 may if desired be provided with a second or outer cover spun or wrapped thereupon in the opposite direction.

This pre-twisting of the rubber thread 98 appears to improve the covering operation and causes the covering fibers to cling better to the rubber core. It is found that the present method of producing an elastic yarn is highly satisfactory as the elastic yarn thus produced has the cover uniformly applied thereupon and the helical coils of the cover blend and cling together so well that it is extremely difficult to remove the cover from the rubber core. It is also found that elastic yarn constructed in accordance with the present invention can be given a highly uniform range of stretch and that such elastic yarn is well adapted for use in the production of knitted and woven fabric and may be used for other purposes.

Having thus described my invention what I claim and desire to protect by Letters Patent is:

1. The method of treating textile fibers which comprises feeding a strand of fibers, intermittently drafting said strand, combing the portion of the strand being drafted, and twisting the fibers as they are drafted.

2. The method of treating textile fibers which comprises drafting a strand of fibers by intermittently extending and thinning successive small portions of the strand, the rate of extension for each portion increasing from a minimum to a maximum speed, and combing the portion of the strand being drafted.

3. The method of treating textile fibers which comprises feeding a strand of fibers, drafting the strand by extending and thinning successive small portions at a rate of extension which increases from a minimum to a maximum, combing the portion of the strand being drafted, and twisting the drafted strand.

4. The method of treating textile fibers which comprises feeding a strand of fibers, applying successive independent step by step drafting impulses to successive overlapping small portions of the fed strand, and simultaneously combing the portion of the strand being drafted.

5. The method of treating textile fibers which comprises feeding a strand of fibers, applying successive independent step by step drafting impulses to successive overlapping small portions of the fed strand, and simultaneously combing the portion of the strand being drafted with synchronized strokes.

6. The method of treating textile fibers which comprises gripping and feeding at intervals successive small increments of a strand of fibers, applying successive independent step by step drafting impulses to successive overlapping small portions of the fed strand, and combing the portion of the strand being drafted with strokes synchronized with the gripping of the strand.

7. The method of drafting a strand of loosely aggregated fibers comprising gripping the strand at spaced points and while firmly holding the strand at these points increasing the distance between said points to thereby draft the fibers, and combing the portion of the strand being drafted.

8. The method of drafting a strand of loosely aggregated fibers comprising gripping the strand at spaced points and while firmly holding the strand at these points increasing the distance between said points to thereby draft the fibers and simultaneously combing the strand between said points.

9. The method of treating a strand of loosely aggregated fibers which comprises alternately twisting and gripping the strand between spaced points and while the strand is gripped at said points increasing the distance between said points to draft the fibers, and combing the strand between said points.

10. The method of making elastic yarn comprising gripping a strand of loosely aggregated fibers at spaced points and while firmly holding the strand at these points increasing the distance between said points to thereby draft the fibers, delivering an elastic thread to the portion of the strand being drafted, and twisting the thread and drafted fibers to wrap the fibers about the elastic thread as a cover.

11. The method of making elastic yarn comprising gripping a strand of loosely aggregated fibers at spaced points and while firmly holding the strand at these points increasing the distance between said points to thereby draft the fibers, delivering an elastic thread to the portion of the strand being drafted, and twisting the thread and drafted fibers to thereby twist the covered and uncovered elastic thread and wrap the fibers about the elastic thread as a cover.

12. The method of making elastic yarn comprising advancing a strand of loosely aggregated fibers, alternately twisting and gripping the strand between spaced points and while the strand is gripped at said points increasing the distance between said points to draft the fibers, delivering an elastic thread to the strand between said points, and imparting a twist to the thread as well as the strand to wrap the fibers about the elastic thread as a cover.

13. The method of making elastic yarn which comprises feeding a roving, intermittently drafting the fibers of said roving by step by step drafting impulses each of which increases in speed in the drafting direction, delivering an elastic thread to the portion of the roving being drafted, and twisting the thread and drafted fibers to wrap the fibers about the elastic thread as a cover.

14. The method of making elastic yarn comprising advancing a strand of loosely aggregated fibers, gripping at intervals successive small increments of said strand, applying successive independent step by step drafting impulses to successive overlapping small portions of the fed strand, delivering an elastic thread to the portion of the strand being drafted, and twisting the thread and drafted fibers to wrap the fibers about the elastic thread as a cover.

15. A textile fiber treating mechanism comprising a plurality of means for gripping a strand of loosely aggregated fibers at spaced points, mechanism for bodily moving said gripping means so that one moves with a greater amplitude than the other to draft the strand, and a comb positioned between said gripping means and operable to comb the portion of the strand being drafted.

16. A textile fiber treating mechanism comprising spaced pairs of means for gripping a strand of loosely aggregated fibers, means for forcing both pairs of said gripping means so that one pair moves a greater distance than the

other to draft the strand, and a comb located between said pairs of gripping means and operable to comb the portion of the strand being drafted.

17. A textile fiber treating mechanism comprising a first and second pair of means for gripping a strand of fibers at spaced points, a comb positioned between said pairs of means, and mechanism for reciprocating said comb and said first and second pair of gripping means but with different amplitude to thereby comb and draft said strand.

18. A textile fiber treating mechanism comprising a pair of jaws for gripping a strand of loosely aggregated fibers, a second pair of jaws for gripping said strand at a distance from the first jaws, a comb operable in the space between said pairs of jaws, means for operating the first pair of jaws to feed the strand and the second pair of jaws to draft the strand, and means for operating the comb to comb the strand while it is held by both pairs of jaws.

19. A textile fiber treating mechanism comprising a pair of jaws for gripping a strand of loosely aggregated fibers, a second pair of jaws for gripping said strand at a distance from the first jaws, a comb operable in the space between said pairs of jaws, and means for reciprocating the comb and pairs of jaws to comb and draft the strand.

20. A textile fiber treating mechanism comprising a pair of jaws for gripping a strand of loosely aggregated fibers, a second pair of jaws for gripping said strand at a distance from the first jaws, means for reciprocating one jaw of each of said pair of jaws and for imparting a greater movement to one than the other to thereby draft the strand, and means for continuously connecting the two jaws forming a pair to hold them in alignment and operate one from the other.

21. A textile fiber treating mechanism comprising a pair of jaws for gripping a strand of loosely aggregated fibers, a second pair of jaws for gripping said strand at a distance from the first jaws, means for continuously connecting the two jaws forming a pair to hold them in alignment and operate one from the other, and means for reciprocating at least one pair of said jaws to draft said strand.

22. A textile fiber treating mechanism comprising a pair of jaws for gripping and feeding a strand of fibers, a second pair of jaws for gripping and drafting the strand while it is held by the first pair of jaws, means associated with each pair of jaws for continuously connecting the two jaws forming a pair to hold them in alignment and operate one from the other, and means for synchronously and intermittently moving said feeding jaws and drafting jaws including means for imparting a movement of greater amplitude to the drafting jaws.

23. A textile fiber treating mechanism comprising strand gripping and feeding means, strand gripping and drafting means adapted to draft the strand while held by said first means, a comb operable in the space between said first and second means to comb the strand being drafted, rock arms for actuating the comb and said first and second means respectively, and an eccentric for actuating said rock arms to thereby feed, comb and draft said strand.

24. A textile fiber treating mechanism comprising strand gripping and feeding means, strand gripping and drafting means adapted to draft the strand while held by said first means, a comb operable to comb the strand being drafted, rock arms for actuating the comb and said first and second means respectively, an eccentric for actuating said rock arms to raise them and move them forward, and spring means for pulling said arms down and rearward.

25. A textile fiber treating mechanism comprising strand gripping and feeding means, strand gripping and drafting means adapted to draft the strand while held by said first means, a comb operable to comb the strand being drafted, rock arms for actuating the comb and said first and second means respectively, an eccentric for actuating said rock arms to raise them and move them forward, spring means for pulling said arms down and rearward, and adjustable stops for limiting the downward movement of said arms.

26. A textile fiber treating machine including a series of units each comprising feeding means having intermittent strand engaging and feeding movements and drafting means having intermittent strand engaging and drafting movements, means for operating all of said units simultaneously to operate their feeding and drafting means and imparting a movement of greater amplitude to the drafting means, and manualy controlled means for starting and stopping the operation of any unit independently of the other units.

27. A textile fiber treating machine including a series of units each comprising feeding means having intermittent strand engaging and feeding movements and drafting means having intermittent strand engaging and drafting movements, spinning means associated with each unit for twisting the drafted strand, and manually controlled means for starting and stopping the drafting and spinning mechanism of any unit independently of the other units.

28. A textile fiber treating machine including a series of units, each unit comprising feeding means having intermittent strand engaging and feeding movements and drafting means having intermittent strand engaging and drafting movements and also having combing means, each unit having rock arms for actuating said comb and said feeding and drafting means respectively, an eccentric for actuating all three arms of a unit, driving means for said eccentric, and a manually operated clutch for controlling said eccentric.

29. A machine for making elastic yarn comprising a pair of jaws for gripping and feeding a roving, a second pair of jaws for gripping and drafting the roving, means for actuating said jaws and for moving one pair relative to the other to draft the roving, means for delivering an elastic thread to the roving at a point between the pairs of jaws, and means for twisting the thread and drafted fibers to wrap the fibers about the thread as a cover.

30. A machine for making elastic yarn comprising a pair of roving feeding jaws, a pair of roving drafting jaws, means for opening and closing said jaws and for moving the second pair of jaws a greater distance than the first pair to draft the roving, a third pair of jaws located between the first and second pair and adapted to grip the roving when it is released by the first and second pair of jaws, means for delivering an elastic thread to the roving at said third pair of jaws, and means for twisting the thread and drafted fibers to wrap the fibers about the thread as a cover.

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