April 15, 1947. S. E. THOMAS ET AL 2,418,995

METHOD FOR MANUFACTURING LONG FIBER INTO YARN

Filed Sept. 30, 1940 7 Sheets-Sheet 1

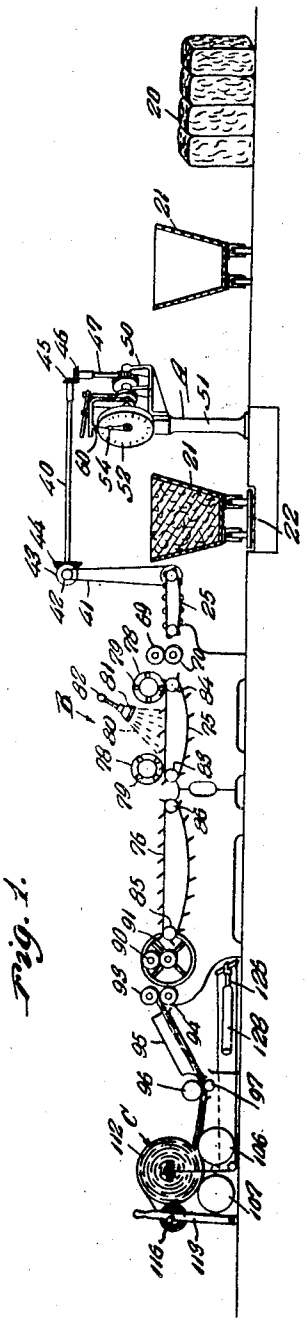


Fig. 1.

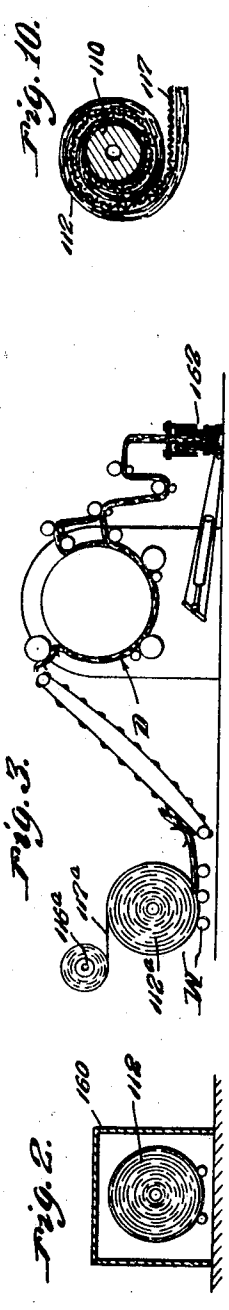


Fig. 3.

Fig. 2.

Fig. 10.

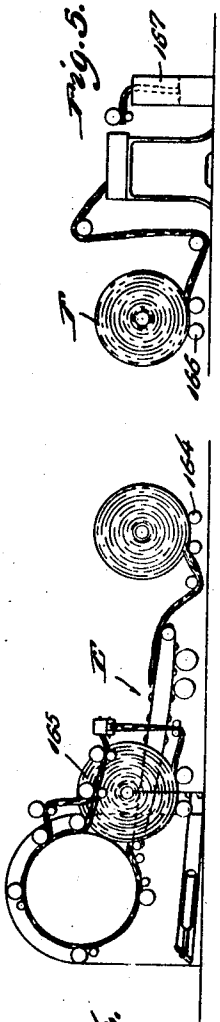


Fig. 4.

Fig. 5.

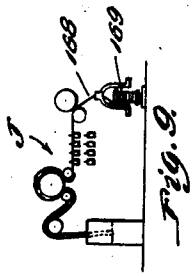


Fig. 9.

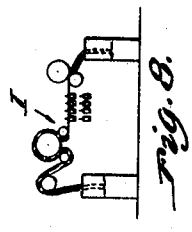


Fig. 8.

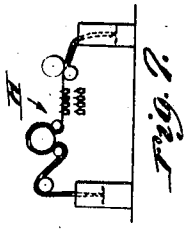


Fig. 7.

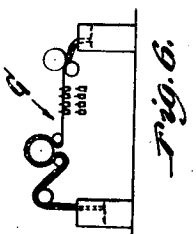


Fig. 6.

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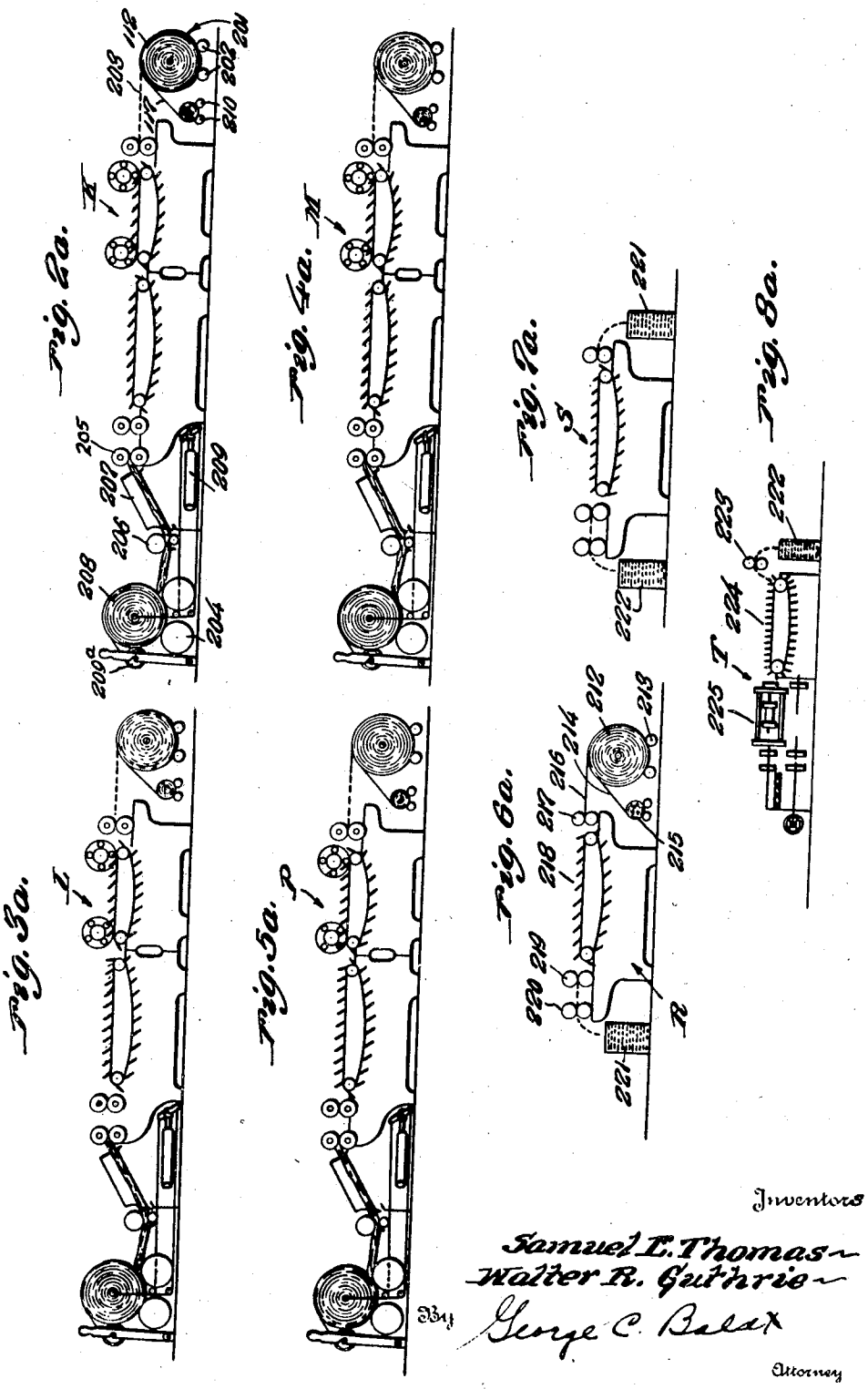
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METHOD FOR MANUFACTURING LONG FIBER INTO YARN

Filed Sept. 30, 1940 7 Sheets-Sheet 2



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METHOD FOR MANUFACTURING LONG FIBER INTO YARN

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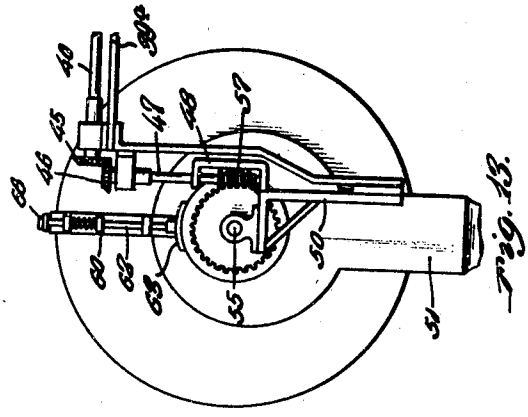


Fig. 19.

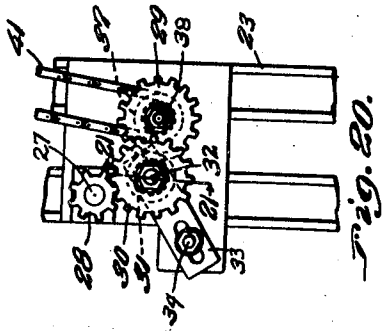


Fig. 20.

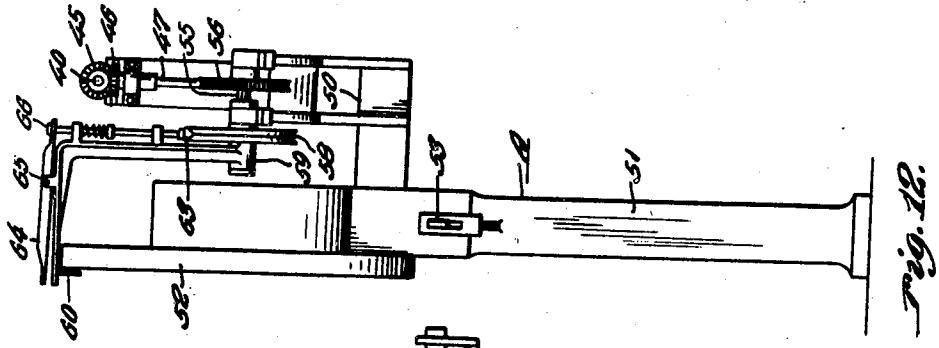


Fig. 18.

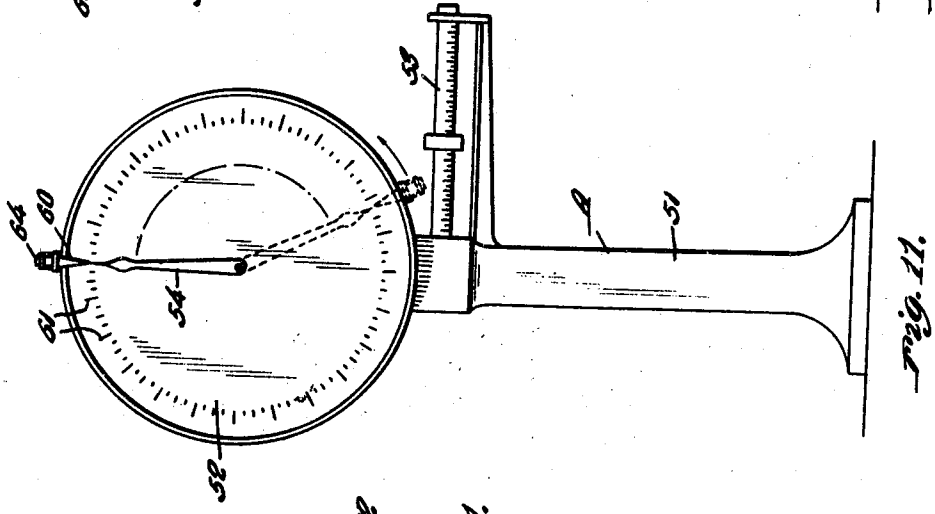


Fig. 17.

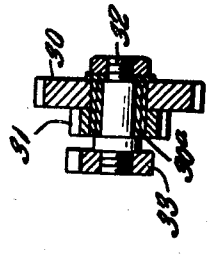


Fig. 21.

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METHOD FOR MANUFACTURING LONG FIBER INTO YARN

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Fig. 14.

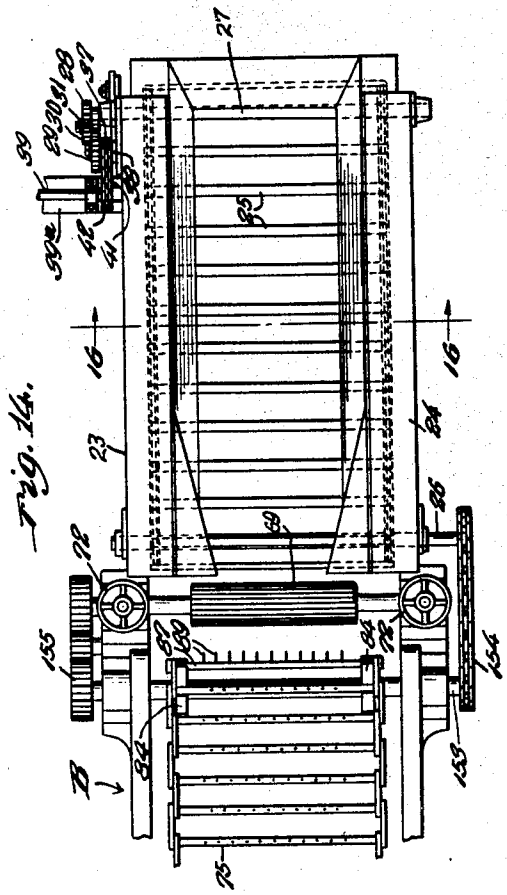


Fig. 15.

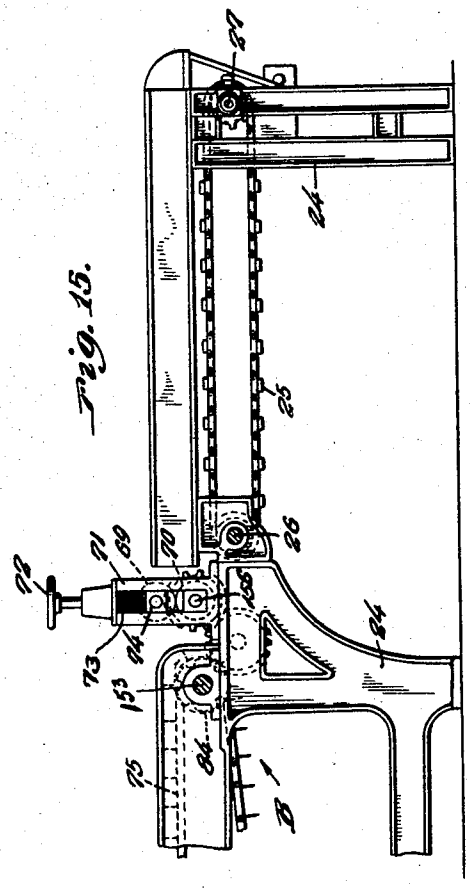
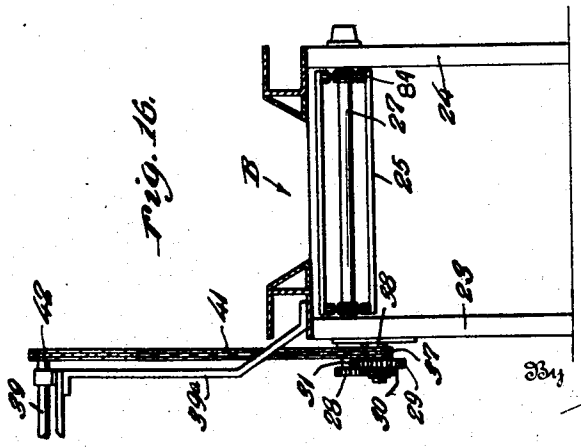


Fig. 16.



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METHOD FOR MANUFACTURING LONG FIBER INTO YARN

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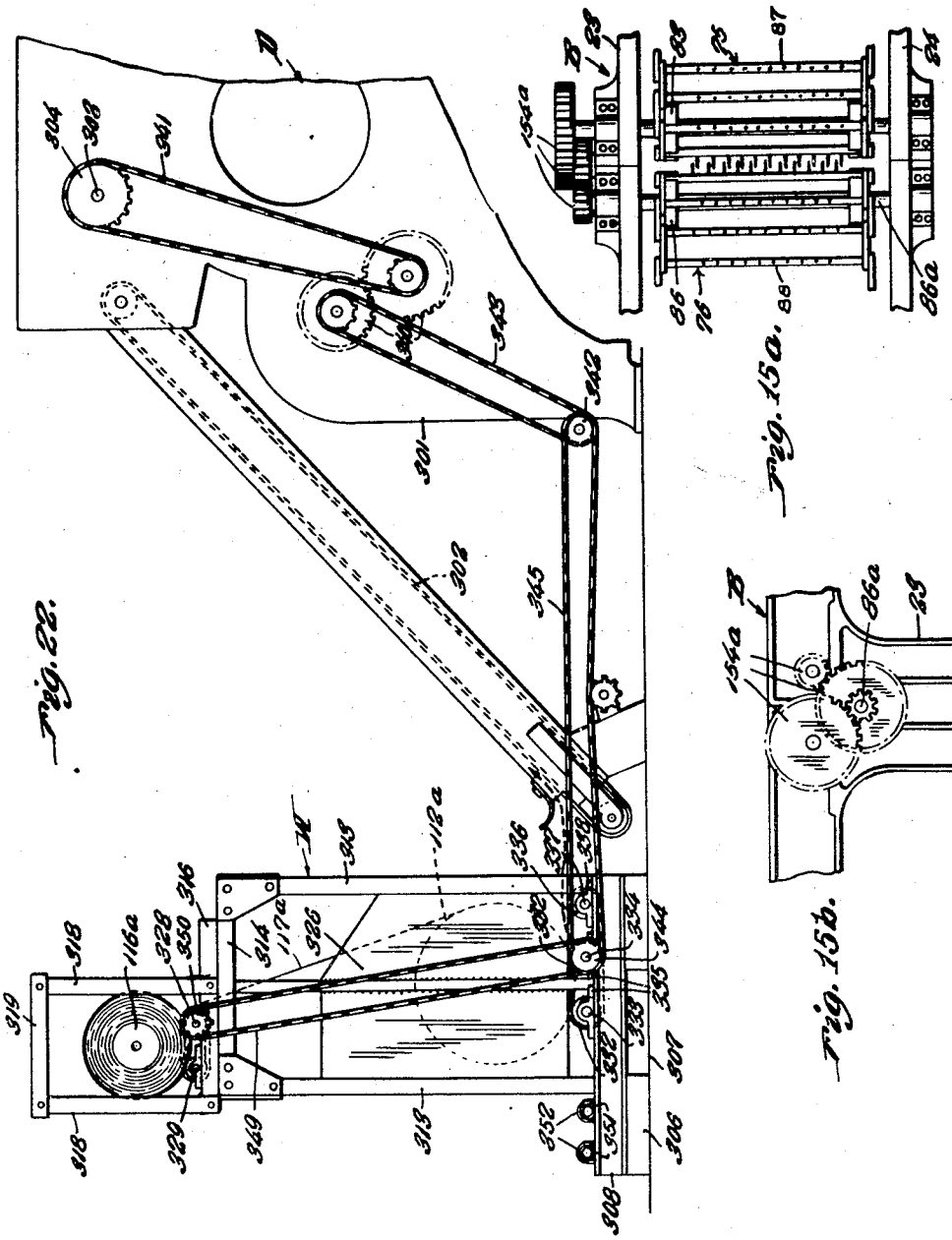


Fig. 15a.

Fig. 15b.

Fig. 22.

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METHOD FOR MANUFACTURING LONG FIBER INTO YARN

Filed Sept. 30, 1940 7 Sheets-Sheet 6

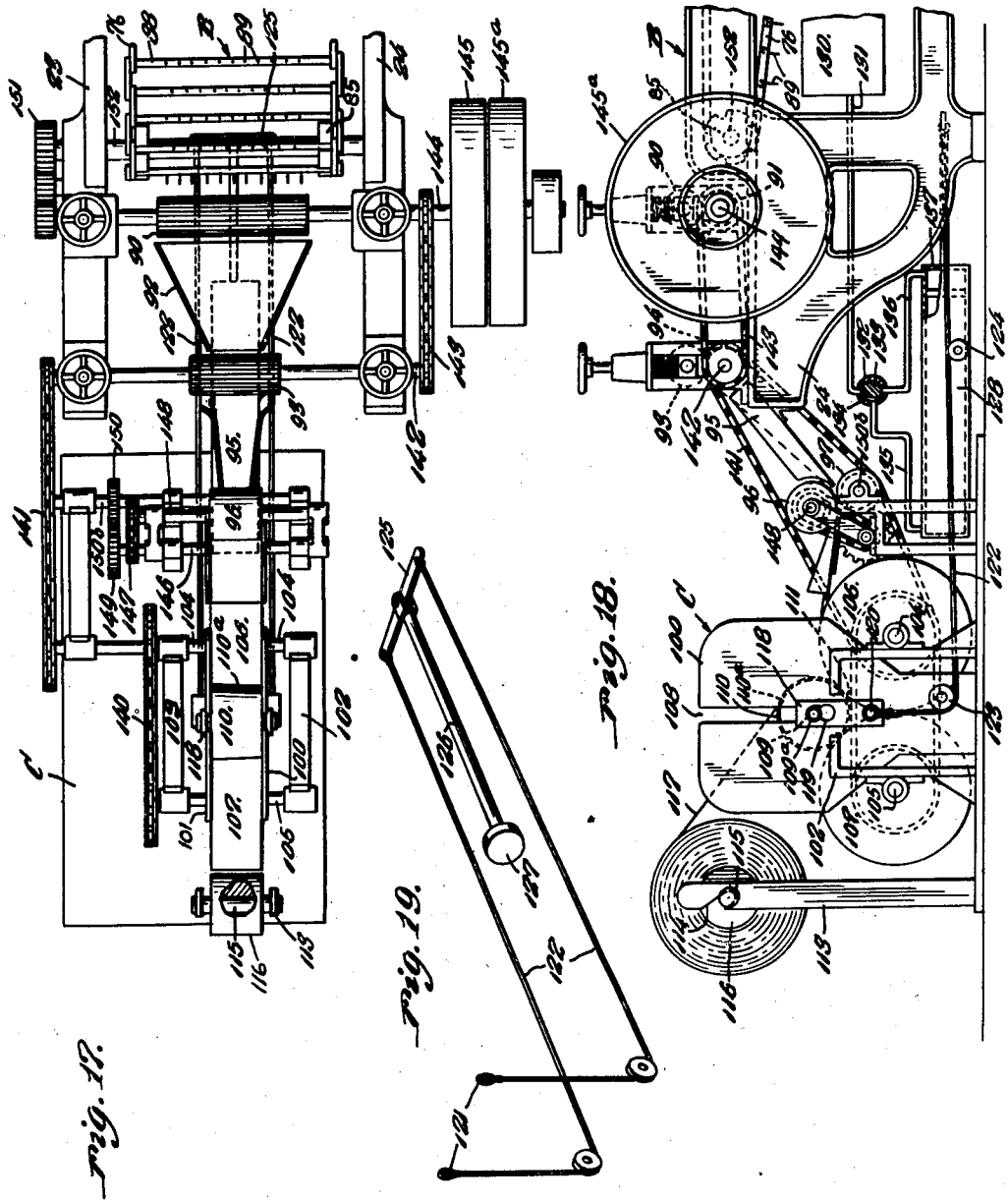


Fig. 18.

Fig. 19.

Fig. 17.

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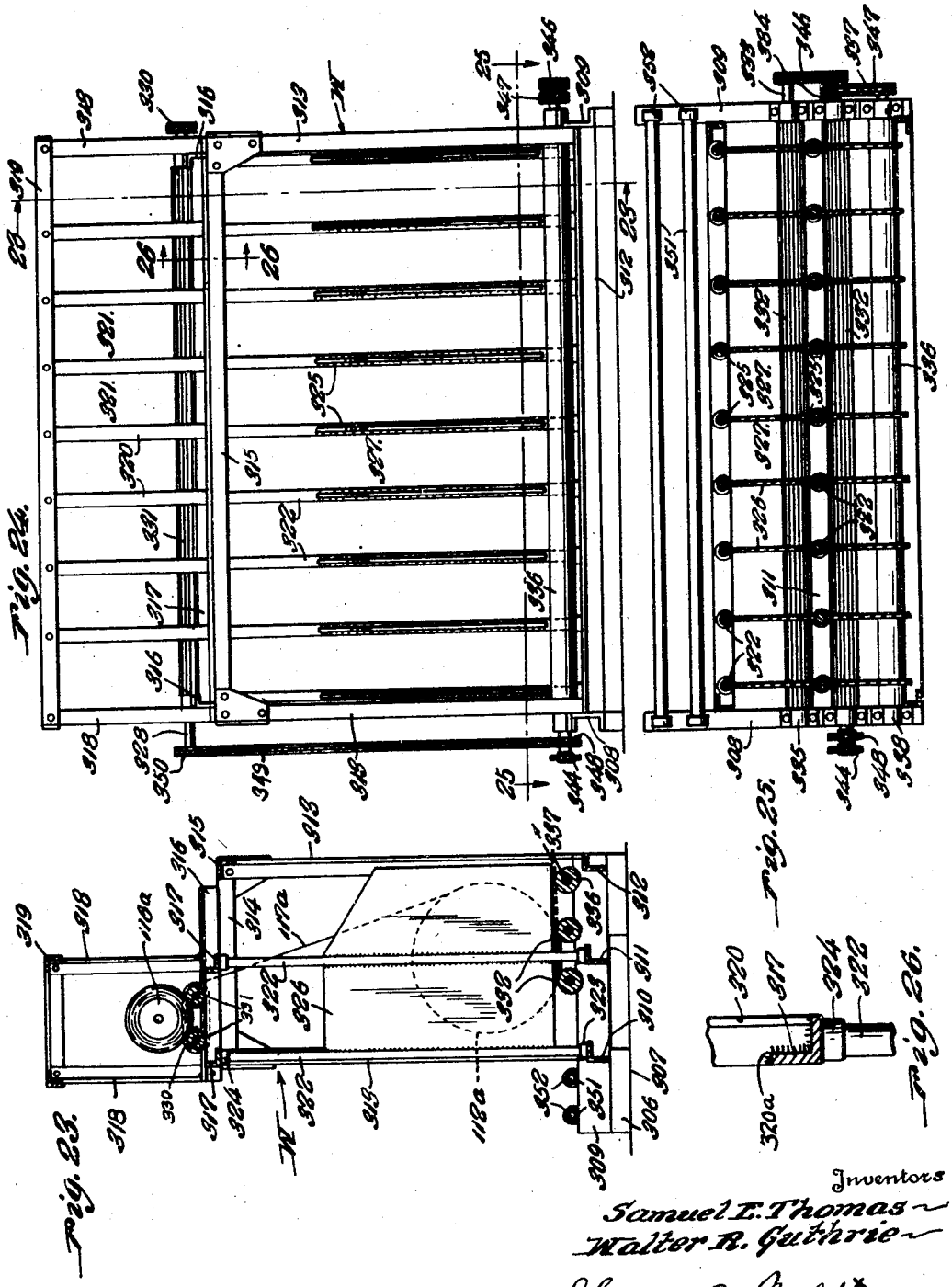
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METHOD FOR MANUFACTURING LONG FIBER INTO YARN

Filed Sept. 30, 1940 7 Sheets-Sheet 7



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Patented Apr. 15, 1947 2,418,995

UNITED STATES PATENT OFFICE

2,418,995

METHOD FOR MANUFACTURING LONG FIBER INTO YARN

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Application September 30, 1940, Serial No. 359,126

7 Claims. (Cl. 57—156)

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This invention relates to a method and apparatus for manufacturing long fibre into yarn.

Fibres for manufacturing yarns have many classifications. There are the vegetable, animal, and artificial fibres, which may be subdivided into long and short fibres. Another classification presented in a survey by Charles Richard Dodge, at page 31, of "Useful Fibre Plants of the World" of the U. S. Department of Agriculture, published by the Government Printing Office in 1907, reveals that fibres adapted for spinning may be divided into fabric, netting, and cordage fibres. Cordage fibres are rarely used in weaving and netting because they are a hard fibre, and they are also long fibres. The method and apparatus of the present invention has particular application to the manufacture of a yarn from long vegetable fibre. It also has particular application to any long artificial fibres such as synthetic cellulose fibres prepared by the viscose, acetate, cuprammonium, nitrocellulose, and other processes, the product being known as "rayon"; or the artificial fibres of cellulose xanthate, known as "Cellophane"; or the artificial fibres from the relatively new protein-like polyamides known as "nylon." Flax, ramie, jute, etc., are examples of the long, soft, vegetable fibre, while coir and manila, sisal, and common hemp are examples of long, hard, vegetable cordage fibre referred to herein.

One of the objects of the present invention resides in a simplified method of manufacturing long fibre, both hard and soft, into yarn. The initial step in the manufacture of the yarn is performed on the Good's principle, well known in the art, and which step is practiced by a combined combing and stretching or straightening machine of Good disclosed in U. S. Patent 95,462 of October 5, 1869. In the machine revealed in the aforesaid patent, the resulting sliver was of uneven weight, and no provision was made for delivering it in a unit for subsequent treatment. The advantage of the simplified method of the present invention includes the feeding of the raw fibre to the Good's machine, in discontinuous lengths and under precision control to produce uniform weight, applying a softening emulsion to the raw fibre as it travels through the machine; and collecting the fibre under pressure in a continuous layer, such as a roll, in relatively large compact units adapted for treatment in subsequent operations in transforming the units into yarn. The initial step hitherto unknown in the industry will process the long soft fibre in a manner that has many advantages over regulation methods, among which are:

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It has been found unnecessary to subject the raw fibre to the preliminary and customary crushing and opening operation by passing it through a series of softening rolls.

The raw fibre does not have to be pieced out in small heads accurately when the stock is controlled by the precision feed, but on the contrary, larger, and less uniform heads of raw fibre may be used.

The softening emulsion permeates the unit of material delivered by Good's machine because of the pressure applied while the continuous layer is being compacted, and this compact unit may be handled and conditioned, in the case of the long soft fibre, in a minimum of factory space as compared with the floor space utilized in the other known methods.

The initial step of the process eliminates the use of special batching trucks and the use of large conditioning rooms in treating the long soft fibre.

When applied to the manufacture of yarns for cordage, where the long hard fibre is used, the initial step of the present invention has the advantage over current practice, in that the raw material does not require accurate piecing when the feed is controlled by the precision feed practiced herein; the softening emulsion permeates the mass of raw material because of the pressure applied when the sliver is collected into large compact units; the large compact units of the intermediate material may be handled and stored economically in the minimum of factory floor space; and the compact unit does not become ravelled and roughened in handling and will not break and slough so readily in subsequent operations.

It is another of the objects of the present invention to apply a vigorous combing and stretching pressure along the axis of the fibre as a softening measure, at the same time the fibres are being drawn or spread and arranged in parallel relation, and in the treatment of soft fibre this will eliminate the customary preliminary crushing and opening of the fibre by a series of softening rolls under pressure applied at right angles to the axis of the fibre. Hard fibre is not customarily given the preliminary treatment by passage through softening rolls.

Another feature of the present invention resides in the creation of a process which permits the long fibre, both hard and soft, to be collected in a compact unit, such as a roll, under pressure, and to feed the fibre directly from the compact units to machines that perform certain

subsequent steps in the method of treatment.

Another feature of the present invention is to devise a roll former to be combined with Good's machine that performs the combing, spreading, and stretching operation for both the hard and soft, long fibre, which roll former compacts the roll under considerable pressure and does not interfere with the conditioning treatment applied in the treatment of the long soft fibre.

Another feature of the present invention involves the combination of a creel with a breaker card for supporting the rolls of soft fibre sliver being fed to a breaker card, whereby the sliver may be fed directly from the rolls to the feed belt or apron of the breaker card.

Another object of the invention resides in the construction which enables a precision feeding device to be combined with a Good's machine by which the weight of the fibre may be controlled to produce a finished yarn of the desired size.

Another object of the present invention is to provide a method of manufacturing yarn from hard and soft, long fibre, that admits of delivering rolls of sliver compacted under pressure, from the initial step through immediately succeeding steps up to, but not including the step where the soft and hard fibre is subjected to the first drawing operation.

Another object of the present invention is to provide a method of manufacturing yarn from hard and soft, long fibre which enables the sliver from a compact roll of fibre from the initial step to be fed directly from the roll in the second step of the treatment, and likewise through all immediately succeeding steps, up to, and including the feeding to the machine subjecting the fibre to the first drawing operation.

A further advantage of the present invention is the utilization of a separator strip to be wound between the convolutions of the roll of hard fibre sliver to prevent one layer from sticking to the underlying layer and sloughing off when the layer is unwound from the rolls and fed to the machine in the next succeeding step in the method, thereby avoiding tangles in the feed that cause delays in operation.

A still further advantage of the present invention, in the treatment of the soft fibre, is the utilization of a separator strip that provides space between the convolutions of the roll of sliver so as to promote uniform conditioning of the soft fibre roll in the conditioning step in the method, and at the same time, as in the case of the use of the separator strip with the hard fibre, this strip prevents one layer from sticking to the underlying layer and sloughing off when the layer is unwound from the roll and fed into the breaker card thereby avoiding tangles in the feed that cause delays in operation.

With the foregoing objects in view, the invention consists of a novel combination of process steps and apparatus capable of carrying these steps to accomplishment but it is to be understood that the invention is not to be limited to its scope beyond the claims subjoined, inasmuch as the disclosure reveals only the preferred embodiment of the invention.

In the drawings, wherein the preferred embodiment of the invention is illustrated:

Figure 1 is a side elevation in the nature of a diagram showing the precision feeding device, coupled with the Good's machine combining the combing and spreading action, and a roll former coupled with the combined comber and spreader,

which mechanism is the initial step in the treatment of both the hard and soft, long fibre.

Figure 2 is a diagrammatic section of a conditioning room wherein the rolls of long soft fibre are subjected to a conditioning treatment, and the steps illustrated in Figures 2 to 9, inclusive, are only used in connection with manufacturing yarns from the long soft fibre.

Figure 3 is a diagrammatic elevation of the breaker card for the treatment of soft fibre.

Figure 4 is a diagrammatic view of the finishing card for the soft fibre.

Figures 5, 6, 7 and 8 are diagrammatic representations of the four drawing machines used on the soft fibre which apply the necessary stages of drawing and doubling to the sliver.

Figure 9 is a diagrammatic representation of the spinning operation for the soft fibre which completes the method of the one form of present invention and delivers a spun yarn in bobbins or cheeses ready for the use in the industry.

Figure 10 is an enlarged vertical sectional view of a portion of a roll of sliver of hard or soft fibre being formed on the delivery end of the combined comber and spreader illustrating the incorporation of the separator strip between the convolutions of the roll of sliver.

Figure 2A is a diagrammatic elevation of a Good's machine consisting of a combined comber and spreader which illustrates the second step in the treatment of hard fibre after the hard fibre has been subjected to the treatment illustrated and described in connection with Figure 1.

Figure 3A is a diagrammatic side elevation of a Good's machine shown in Figure 2A illustrating the third step in the treatment of the long hard fibre.

Figure 4A is a diagrammatic side elevation of a Good's machine shown in Figure 2A, illustrating the fourth step in the treatment of the long hard fibre.

Figure 5A is a diagrammatic side elevation of a Good's machine shown in Figure 2A of the drawings, illustrating the fifth step in the treatment of the long hard fibre.

Figure 6A is a diagrammatic side elevation of a chain type gill drawing machine for the long hard fibre which illustrates the sixth step in the treatment of the hard fibre and the first of two drawing operations.

Figure 7A is a view similar to Figure 6A illustrating the seventh step in the treatment of long hard fibre and the second of two drawing operations.

Figure 8A is a diagrammatic side elevation of a horizontal gill spinner for cordage yarns of hard fibre of the dual bobbin type, illustrating the last step in the treatment of the hard fibres.

Figures 11 is a front elevation of a register with which is combined the precision feeding device parts.

Figure 12 is a side elevation of Figure 11.

Figure 13 is a fragmentary rear elevation of Figures 11 and 12.

Figure 14 is a top plan view of the feed end of the combined comber and spreader.

Figure 15 is a side elevation of Figure 14.

Figures 15A and 15B are respectively, a fragmentary top plan and side elevation of the combined comber and spreader showing the drive for the slow chain taken from the fast chain.

Figure 16 is a vertical section on the plane of line 16—16 of Figure 14 and looking in the direction of the arrows.

Figure 17 is a top plan view of the delivery end

of the combined comber and spreader showing the roll former and separator strip feeding device combined therewith.

Figure 18 is a side elevation of Figure 17.

Figure 19 is a perspective view of the ram and actuating cables removed from the cylinder and the combined comber and spreader, whereby the tension on the rolls is applied.

Figure 20 is a fragmentary side elevation of the combined comber and spreader in the area of the feed table, showing the gear train for driving the speed-indicating hand of the precision feeding device, and the demountable feature of one of the gears for changing the speed ratio between the feed table and the speed-indicating hand.

Figure 21 is a detailed section through the supporting bracket or plate on the plane of line 21—21, in Figure 20, showing the mounting for the change speed gears.

Figure 22 is a fragmentary side elevation of a breaker card showing in side elevation, a creel for supporting the rolls of fibre combined therewith.

Figure 23 is a vertical section through the creel taken substantially on the plane of line 23—23 of Figure 24 looking in the direction of the arrows.

Figure 24 is a rear elevation of the creel on the side next to the breaker card.

Figure 25 is a horizontal section taken on the plane of line 25—25 of Figure 24, and looking in the direction of the arrows.

Figure 26 is a fragmentary vertical section through the bottom frame of the separator roll housing on the plane of line 26—26 of Figure 24.

It will be understood that the method illustrated in the drawings, from Figure 1 to Figure 9, inclusive, illustrates a method of manufacturing yarn from long soft fibre such as flax, ramie, jute, etc., where the heads or raw-stock, run from 5 to 12 feet long. The extremely vigorous combing action, together with the spreading, or drawing action, and the stretching and straightening action performed by the Good's machine of the character revealed in the Patent 95,462, is not followed primarily to break the fibre into shorter lengths. Although the machine does split some of the fibre in the direction of its length, and also does break the fibre into shorter lengths to some extent, the major portion of the breaking into shorter lengths is preferred to be accomplished in the breaker card, and in the case of the soft fibre, the ideal condition sought is to reduce the breaking into shorter lengths to a minimum in the Good's machine, and do all of the breaking in a breaker card.

In the form of the method of manufacturing yarn from the hard fibre for the cordage industry, illustrated in Figure 1 as the initial step, and continuing from Fig. 2A to 8A, inclusive, it is the aim to obtain an ultimate fibre length equal to the length of the fibre of the raw stock. It follows then, that by treating the hard fibre according to the invention herein, there is very little breakage into shorter lengths, that occurs in the five steps of the combined action of combing, spreading or drawing, and stretching. In both forms of the methods of the invention, i. e. manufacturing yarn from both hard and soft, long fibre, the initial step illustrated in Figure 1 of the drawings is used.

Referring to the drawings where the method and apparatus are disclosed, an operator breaks the bales 20 of raw fibre and loads the loose fibres in parallel relation on a wheeled barrow, or box 21, from where the box is moved onto the platform 22 of the weighing register of the precision feeding device, indicated generally at A. In order to obtain a desired weight in the finished yarn, it is one of the essential features of the present invention to control and regulate the feeding of the raw stock to the Good's machine, indicated generally at B. To accomplish this purpose, the operator is provided with a precision feeding device which eliminates the feeding of the machine B, by the skill of the operator alone, based on his experience developed by long periods of trial and error, commonly referred to as a rule of thumb.

The machine B is formed of spaced vertical side frames 23, 24. The feed table 25 for the machine consists of an endless conveyor trained about sprockets on the respective shafts 26, 27 and these shafts are journalled in the side frames. On one side, shaft 27 (Figs. 14 and 20) extends outwardly from the frame 23, and has a gear 28 keyed thereto, which drives the gear 29 through the intermediate gears 30, 31. Gears 30 and 31 are both splined on a sleeve 30a and the sleeve rotates on a stud 32 which is anchored in a bracket or plate 33. This plate is adjustably secured to the side frame 23 by means of a bolt 34, the inner end of which is anchored in the frame 23. To adjust the plate, the bolt 34 is loosened and the plate is moved on the bolt as a pivot to accommodate a change in the size of the gears 30 and 31. It will be seen that gear 30 may be changed to a larger or smaller gear to alter the ratio of speed of the shaft 27 of the feed table 25, with respect to movement of the indicator hand on the register to be presently described, when it is desired to change from the manufacture of one size yarn to another.

The gear 29 is keyed to a sleeve on sprocket wheel 37, and the sprocket and gear are rotatable on a stud 38 anchored to the frame 23. A shaft 39 and a shaft 40 are rotatably supported on a suitable frame 39a. By these shafts 39 and 40, motion is transmitted from the feed table 25 to the weighing register A. For this purpose, a chain 41 is trained about a sprocket 42 on shaft 39 and sprocket 37 on stud 38. A miter gear 43 on the other end of shaft 39 meshes with a miter gear 44 on one end of shaft 40, and a miter gear 45 on the other end of shaft 40, meshes with a miter gear 46 at the upper end of a shaft 47. Shaft 47 is journalled in a bracket 48 supported by a frame 50 that is secured to the stand 51 of the weighing register A. The weighing register A is of the regulation type having a dial 52 on the upper portion of the stand 51 and a tare beam 53 extending from the stand.

A register is initially selected to provide the necessary weighing facilities required for the present invention. In the present instance, the design may utilize anything less than one complete circumference of the dial 52. The weight indicating hand 54 cooperates with the dial to register the actual weight of the fibre in the wheeled box 21 on weighing platform 22, after the tare beam 53 is set to counterbalance the weight of the empty box in the customary manner well known in the industry. A shaft 55 is journaled in bearings on frame 50, and this shaft has a gear 56 at the outer end meshing with gear 57 on shaft 47. Adjacent the inner end, the shaft 55 has a wheel fixed thereto formed with a peripheral V-shaped groove 58. The inner end of the shaft 55 supports a collar 59 that is freely rotatable around the shaft. The collar 59 carries an indicating hand 60 which is disposed to overhang the margin of dial 52 adjacent the scale markings

61 and follows a path conforming to the weight indicating hand 54 when it is coupled to move with the motion of the feed table 25. A spring-pressed detent rod 62 is mounted for sliding movement on the inner reaches of indicating hand 60, and has a segmental head 63 normally engageable with the groove 58 in the wheel on shaft 55. When it is desired to release the engagement of the rod 62 with shaft 55, a lever 64, pivoted at 65 to hand 60, is pressed, and by a rocking connection 66 with rod 62, the head 63 is retracted free of the groove 58, whereupon the indicating hand 60 may be moved to the desired position on dial 52 independent of shaft 55. Upon release of lever 64, the head 63 grips the wheel on shaft 55, and the indicating hand 60 moves with shaft 55 at a speed proportional to the speed of the feed table 25.

When a box 21 of raw fibre is placed on platform 22, and the weight-indicating hand 54 moves to the position on scale markings 61 commensurate with the actual weight of the contained fibre, after the tare has been deducted by the usual manipulation of tare beam 53, then the feed table speed-indicating hand 60 is moved, as previously described, to a position coinciding with the position of hand 54, illustrated in dotted lines in Figure 11, and released into engagement with shaft 55. As hand 60 moves counterclockwise, the operator removes raw fibre from the box 21 and supplies it to the feed table 25, so as to keep the weight-indicating hand 54, moving in response to the loss of weight in box 21, in substantial alignment with the movement of the speed-indicating hand 60. It will, therefore, be seen that the method of treating fibre herein, utilizes a regulated amount of fibre at a certain stage, preferably at the initial step where the fibre is fed to the Good's machine B, through the instrumentality of the precision feeding device as described in the foregoing.

In addition to the feed table 25, the machine B is equipped with a pair of spring loaded fluted feed rolls 69 and 70, journalled in standards 71, where adequate pressure may be applied by hand wheels 72 regulating the tension on springs 73, mounted in standards 71, which springs 73 bear on the journals 74 for the upper roll 69. It is pointed out that there is no crushing or breaking pressure applied to the traveling fibre by the feed rolls 69, 70, the pressure being adjusted to a tension only necessary to grip the ends of the fibres and pull them free of the feed table 25, and pass then into contact with the slow combing chain 75 of the machine B.

As disinguished from the customary preliminary crushing and opening of the fibre, it will be seen that this invention applies a combination combing, spreading or drawing, stretching, and parallelizing action where all tension is administered in a direction of the axis of the fibre. This step is accomplished by the slow combing chain 75 operating on the traveling fibre in conjunction with the fast combing chain 76. These chains not only comb, draw, and stretch the traveling fibre but simultaneously align all the fibre in parallel relation with respect to the axis of the fibre on the Good's principle in Patent 95,462. The speed of the slow combing chain 75 is such as to move faster than the peripheral speed of the feed rolls 69, 70 and consequently there is a drawing, stretching, combing and parallelizing action on the fibre between the slow combing chain 75 and the feed rolls. The fast combing chain 76 moves in the same plane and in the same direction as the slow chain 75, but it moves at a rate of speed ten times faster than the slow chain. The combing is then performed in a horizontal plane different from tangential combing and breaking on the cylinder of a breaker card. To facilitate adherence of the fibre to the combing pins, to be presently described, on the slow combing chain 75, a pair of lantern rolls 78, 78 are provided, one near one end of the chain, and the other at the opposite end. Each of these rolls consists of a plurality of spaced bars 79, which are arranged to revolve with the roll and press the fibre downwardly between the combing pins and hold the fibre securely to the slow chain 75, so that greater combing and stretching action ensues when the fast chain 76 pulls the fibre free of the slow chain. While the fibre is passing along the slow chain 75, a regulation softening emulsion 80 is sprayed in a fine mist by a spray head 81 connected to a supply tank having a suitable pressure applied, not shown, by means of the pipe 82.

The slow combing chain 75 consists of a pair of endless chains trained over sprockets 83, 84, on shafts that are journaled in the side frames 23, 24. The fast combing chain 76 is constructed like the slow chain 75 and its pair of chains are trained over sprockets 85, 86 likewise mounted on shafts journaled in the side frames 23, 24. Each of the chains 75, 76 have cross bars 87, 88 respectively, spanning their width, and each cross bar has a series of combing or hackle pins 89 anchored therein and extending outwardly of the bar. These pins are sharp on their outer ends and have the usual rake, and as the traveling fibre is pulled through the pins on slow chain 75 by the tension of the increased speed of the fast moving combing chain 76, the fibre is drawn, stretched, combed, and parallelized in a direction of the horizontal path of travel, and along the axis of the fibre.

The slow chain 75 and fast chain 76 move in a direction from left to right in Figure 1, of the drawings. As the fibre is fed by the feed rollers 69, 70 to the slow moving chain 75, it is carried forward by the slow chain to the path of the combing or hackle pins 89 on the fast chain 76, where these pins comb through the forward ends of the fibre in a stretching action until sufficient of the fibre is being clawed and combed to pull it free of the pins 89 on the slow moving chain 75, whereupon the fibre is carried by the fast chain 76 to the delivery rolls 90, 91, which strip the fibre free of the hackle pins on fast chain 76. The fibre then passes from the set of delivery rolls 90, 91 into a lateral condensing trough 92, which progressively narrows the width of the web of fibre, and has a tendency to thicken the web. The fibre then passes through the first set of condensing rolls 93, 94 where the thickness of the web is reduced. After passing through rolls 93, 94, the web of fibre is again laterally reduced as it passes through condensing trough 95, and its thickness is then reduced by the second set of condensing rolls 96, 97 from where the web emerges as a sliver, which is unmatted and unfelted by any extraneous means except for the cohesion produced in the two stages of lateral and vertical compressing, or condensing, above described. From the second set of condensing rolls 96, 97, the web, now reduced to a sliver, is fed to the roll former, indicated generally at C, which is combined in a novel manner with the delivery mechanism of the machine B.

The mechanical features of the roll former C,

consist of a support composed of a pair of side frames consisting of plates 100, 101 secured to the floor. The support further consists of a pair of inverted U-shaped frames 102, 103 rearward of the frames 100, 101, and in these latter frames are journalled the shafts 104, 105 which drive the traction supplying rolls 106, 107 respectively, that wind the sliver on the core, as will presently appear. Although the support is shown and described as two pairs of frames, one pair 100, 101 for rotatably supporting the core, and the other 102, 103, for supporting the shafts, it is within the contemplation of the invention to combine the functions and use by a single pair of frames such as a continuation of the side frames 23, 24 of the machine B.

Opening at the upper edge, and extending vertically to the approximate centers of the side frames 100, 101 are aligned slots, one in each frame, which form guideways 108 that receive portions adjacent the ends of a spindle 109 that supports a wooden core 110 on which the sliver of fibre is wound. The driving rolls are arranged to provide a space between the upper segments of their peripheries which forms a cradle 111 that initially supports the core 110, and the roll 112 of sliver as the roll is wound on the core. Adjacent the outer traction roll 107 are a pair of posts 113 with aligned bearing slots 114 which form bearings for a pin 115 that rotatably supports a core or drum 116 carrying a roll of the separator strip 117. The foraminous strip 117 is made of non-corrosive metal such as alloys of high nickel content, and the like, which when woven into screen wire will not appreciably compress under the pressures utilized in this process. It is to be noted that the outer periphery 110*a* of the core 110 is tapered slightly so the core may be easily removed from the roll when the core is struck with a hammer.

In order to provide for mounting and demounting the rolls of sliver 112, there are a pair of flat connector plates 118, one on each side, formed with a banjo slot 119 to receive the heads 109*a* on the spindle 109. At the lower part, each connector plate has a stud 120 with which the loops 121 on the end of the pair of pressure-applying cables 122 engage. The pair of cables 122 are trained about pulleys 123, 124 mounted conveniently on the machine, and are secured, one to each end of a cross piece 125 on the end of an air ram 126.

The ram is connected to the piston 127 which operates in an air cylinder 128 mounted under the machine B. The air ram 126 supplies a constant pressure of 60 lbs. which acts as a compression force on the roll of sliver 112, as it is wound on the core 110. This pressure is supplied from an air reservoir 130, maintained under 60 lbs. pressure, through a pipe 131 which connects with the control valve 132, having a rotary core 133, operated by a handle, not shown, with a passage 134, which, when in the position shown in Figure 18, connects with one end of the cylinder 128, through pipe 135. In this position, there is a pressure of 60 lbs. on ram 126. To release the ram 126 and change rolls, the core 133 is turned counter-clockwise about 90 degrees from the position shown in Figure 18, and the core passage 134 connects pipe 135 with the opposite end of cylinder 128 by pipe 136, where the pressure is relieved through an opening 137 in the cylinder head. With the pressure on the ram released, cables 122 are slack, then the connector plates 118 may be lifted free of the spindle 109, and a crane may be used to lift the wound pressure compacted roll out of the frames 100, 101, and an empty core is placed in the cradle 111 with a new spindle 109 inserted therein. Then the connector plates, and the cables, are assembled ready to wind another roll of sliver.

In winding the roll of sliver 112, the separator strip 117 is wound on the core also, this strip being utilized for separating the layers in the roll as shown in Figure 10 of the drawings. The separator strip 117 forms a non-compressible foraminous partition between the layers of sliver on the roll 112 that permits the sliver to be unwound on the breaker card without sluffing or tangling, and in addition, allows the conditioning heat and humidity presently to be explained, to permeate the interstices in the woven wire and act quickly and thoroughly on the interior of the roll of fibre.

The rolls 112 are wound on the core under the pressure of the cables 122 from the ram 126 pulling downwardly on the connector plates 118, and this maintains the periphery of the increasing roll of sliver in contact with the peripheries of rolls 106 and 107. The rolls 106, 107 are driven by chain and sprocket connection 140, shaft 106, chain and sprocket connection 141, with shaft 142 of the lower condenser roll 94, thence by chain and sprocket connection 143, to the main drive shaft 144, which carries the pulley 145 and idle pulley 145*a* that are connected by a shiftable belt to the prime mover, not shown. The drive for the condenser rolls 96, 97, is taken from chain 141 by a sprocket on shaft 150*b* which carries lower roll 97. The drive for upper roll 96 is taken from shaft 150*b*, gears 150, 149 to idle shaft 146, thence by chain and sprocket connections 147 to shaft 148 which carries roll 96. The lower roll 91 only, of the delivery rolls 90, 91 is driven by the main shaft 144, the upper roll 90 being spring-pressed against the lower roll like shown and described in connection with the feed rolls 69, 70 in Figure 15, appearing hereafter. The fast combing chain 76 is driven from the main drive shaft 144, and gear train 151, and shaft 152, where power is transmitted through the chain 76 to the sprockets 86 on shaft 86*a* (Fig. 15A and Fig. 15B). A transmission of power from shaft 86*a* to the slow chain is effected through the gear train 154*a* (Fig. 15A and Fig. 15B). The transmission of power from the slow chain 75 to the feed table 25, shown in Figure 14, consists of the shaft 153 carrying sprockets 84 being extended to accommodate the chain and sprocket connection 154 to the shaft 26. It will be understood that the variation in speed of the several shafts produced by the gear trains and chain and sprocket connections is accomplished by changing gears and increasing the size of one sprocket and reducing the other, as desired. The drive for the rolls 69, 70 is taken from sprocket shaft 153, through a gear train 155 to shaft 156 of the lower roll 70. Only the lower feed roll 70 is driven. The journals 74 for the upper feed roll 69 ride in standards 71, and pressure regulated by hand wheel 72 on springs 73 retains the upper roll in peripheral abutment with the lower roll 70. Only the lower roll 94 of the front pair of condensing rolls 93, 94 is driven by the chain and sprocket connection 143 which drives the shaft 142 that carries the lower roll 94. The upper roll 93 is spring loaded like the upper rolls of the feed and delivery rolls, heretofore described and illustrated, so that said upper roll will bear against the lower roll 94 under a regulated tension.

The creel W is combined with the breaker card

D in a novel manner so that several rolls 112 containing the separator strip 117 may present the several slivers in doubled relation to the feed apron or belt of the breaker card for the usual breaking treatment provided by the regulation breaker cards of the cylinder type.

The breaker card shown includes upright side frames 301 and an inclined endless feed belt or apron 302 driven by the usual method, not shown. The feed belt receives the several slivers from the creel W and feeds them to feed rolls (not shown) of the breaker card D which rolls are mounted on shaft 303 and driven thereby. The shaft 303 is journaled in the side frames 301 and has a sprocket 304 fixed thereto on the outside of the breaker card, and power for driving the traction drive rolls of the creel W, as will presently appear, is taken from the sprocket 304.

In the form of the creel W shown, there is a cage-like body for housing the rolls of sliver, with a cage-like body for housing the roll of separator strip mounted on top of the roll housing. The roll housing is formed of a substantially rectangular open bottom frame which rests on a platform 306 on the floor 307. The bottom frame is made with a pair of spaced parallel end pieces 308, 309 formed of steel channel bars, and parallel cross-pieces, preferably three in number, formed of steel angle bars 310, 311, 312. The cross-pieces are secured at their opposite ends to the end pieces 308, 309 in any suitable manner.

The sides of the roll housing are defined by four upright corner posts 313 formed of steel angle bars, the lower end of two of which are secured in any suitable manner to one of the outer cross-pieces 310, and the other two being likewise secured to the cross-piece 312. The tops of the corner posts 313, are secured to the horizontal substantially rectangular angle iron frame consisting of end pieces 314 and side pieces 315, suitably secured together, and this frame defines an open top of the roll housing through which the separator strip 117a passes.

The separator strip roll housing is made with an open horizontal bottom frame having steel angle bar end pieces 316, and steel angle bar side pieces 317 suitably secured together, and the side pieces 317 of the frame are suitably secured to the end pieces 314 of the top frame of the sliver roll housing. The separator strip roll housing further includes four upright corner posts 318 secured at their lower ends in any suitable manner to the end pieces 314. The corner posts are riveted to the rectangular top frame 319 and this top frame is supported by the posts 318.

Spaced vertical partition posts 320 are arranged at each side of the separator roll housing and are welded as at 320a, to side pieces 317 of the bottom frame and are riveted to the top frame 319 thereof to define stalls or compartments 321 open at each side in which separate separator strips are wound into a roll on a core 116a as the roll of sliver 112a is unwound and fed to the conveyor 302. There are also spaced vertical partition posts 322 extending from the bottom frame of the sliver roll housing to the top frame thereof, and these posts are secured at their opposite ends respectively, as at 323, 324. Secured to the partition posts, as by welding 325, are spaced vertical plates 326 which define sliver roll winding stalls 327 that open on each side, the one side facing the breaker card D and the other side for loading and unloading the rolls of sliver.

A pair of separator strip roll driving shafts 328, 329 are journalled on the end pieces 316 of the separator strip roll housing and these shafts span the width of the housing and extend outwardly of the corner posts 318. One shaft is driven from the other by chain and sprocket connection 330. On these shafts are secured the traction drive rolls 331 in the cradle formed by the upper peripheries of which the separator strip 117a is wound on the individual cores 116a from which the spindles have been removed, as the sliver from the sliver roll is fed to the breaker card to be presently described. One separator strip is wound in each stall 321 on a separate core 116a.

A pair of traction drive rolls 332 for the roll of sliver 112a are mounted, one on each drive shaft 333, 334. The ends of these shafts are journalled in bearings 335 on the end channel bars 308 and 309. An idle roll 336 has its shaft 337 journalled in bearings 338 on the end bars 308 and 309 and this roll lies between the drive rolls 332 and the feed belt 302 of the breaker. The idle roll 336 runs slightly faster than the drive rolls to prevent any slack in the sliver being fed to the feed belt 302.

The drive shaft 334 receives its power from any shaft on the breaker card, preferably from the most convenient point which is the feed roll shaft 303. The shaft 303 is connected to a transmission train of gears 340 mounted on the side frame 301 by the chain drive 341, thence to a double pulley 342 by chain 343. The pulley 342 is connected to one pulley 344 on shaft 334 by chain 345. The other traction drive roll 332 is driven by the chain and sprocket connection 346, while the idle roll 336 is driven from shaft 334 by the chain and sprocket connection 347. The shaft 328 is driven by the second pulley 348 on shaft 334 by means of the chain 349 which is connected to pulley 350 on shaft 328.

Extending across the side of the sliver roll housing are a pair of bars 351 having their ends anchored to the end channel bars 308, 309 by clamps 352. When the roll of sliver 112a is to be taken directly from the Good's machine, in the case of hard fibre, or from the conditioning room, in the case of soft fibre, it is lifted by a crane from the transporting truck, not shown, and deposited on the bars 351, where the operator rolls it onto the cradle of the drive rolls 332. The separator strip 117a is trained upwardly through the open top and bottom of the two housings and lapped on core 116a on the traction drive rolls 331. The sliver from roll 112a is then passed to the feed belt 302 of the breaker card over idle roll 336. It will be understood that the number of rolls of sliver unwound by the creel and fed to the breaker card depends upon the number of stalls 327 that are provided, the amount of doubling of the sliver being dependent upon the capacity of the breaker card being used.

While the creel has been illustrated and described in combination with a housing for the separator strip, it is not essential to the functioning of the creel that the separator strip housing be used in every operation of the creel inasmuch as the purpose of the creel may be accomplished with, or without this separator strip housing. It is the aim of the method of treating hard and soft fibre to utilize a creel of the foregoing principle on every intermediate step from the combing operation to and including the first drawing operation in both the hard and soft fibre methods, all of which will be apparent from the disclosure of the methods, described and illustrated herein.

It is here pointed out that the method and apparatus described in the foregoing comprising the regulation by the precision feeding device of the raw fibre to the Good's machine B, wherein the stock is combed, spread or drawn, stretched and parallelized, and thereafter rolled under pressure into compact units with a separator strip between the layers constitute the first step in the manufacture of yarn, whether the stock be hard or soft fibre of the long variety. It is only in the subsequent steps of the manufacture that the methods deviate, the one form being calculated to treat the long soft fibre, and the other being directed toward the treatment of the hard fibre terminating in a spun yarn for cordage. In both method·, it will be found that the usual step of reducing the sliver to a roving before spinning or twisting is entirely eliminated.

Only the long soft fibre is treated in the conditioning room and subjected to a breaker card. As the compacted units, such as the rolls 112, are removed from the roll former C containing the softening emulsion 80, and the separator strip 117, they are confined in a closed chamber, or conditioning room 160, at atmospheric pressure. The temperature in the room 160 is kept at no less than room temperature, and preferably ranging from 85 to 100 degrees Fahrenheit, and at a humidity less than the saturation point. The relative humidity is maintained within the range of from 80 to 90 in the conditioning chamber 160. The rolls of long soft fibre are preferably placed upright as shown in Figure 2, and subjected to this conditioning treatment for a period of from 12 to 24 hours, at which time the rolls are removed and placed on the creel W of the breaker card indicated generally at D in Figure 3. The structure involved in combining the creel W with the breaker card D has been particularly described heretofore.

Several slivers of soft fibre from the conditioned rolls 112*a* are then fed to the breaker card D where the fibre is broken into shorter lengths, which operation customarily applies in the regulation breaker cards. The separator strips 117*a* are unwound from the rolls 112*a* onto the core 116*a* as the slivers are fed to the breaker card, in which condition the separator strips may be used again on the roll former C. After the slivers of soft fibre are treated in the breaker card, the resulting single sliver is again rolled under pressure of 40 lbs. at 162 in an operation similar in all respects to the described application of the roll former C, at the delivery mechanism of the machine B. While it has been found that it is unnecessary to use a separator strip in winding the rolls on the breaker card, it is within the purview to use them on the soft fibre if the sliver sticks.

The rolls 162 wrapped under pressure are then placed directly on the creel 164 of the finishing card E, shown in Fig. 4 of the drawings, where the fibre is subjected to the customary finishing card operation. The treated sliver of soft fibre is again wound in a roll former 165, under 40 lbs. pressure, as it comes from the finishing card. The roll 165 is then transferred to the first drawing frame F, shown in Figure 5, and placed on the creel 166, where the sliver is passed through the drawing frame F and collected in a usual can 167. It is preferred to subject the sliver of the present method to three additional drawing operations shown respectively at G in Fig. 6, H in Fig. 7, and I in Fig. 8. It is pointed out that after the first stage of drawing, the sliver is collected in, and fed from, the regulation cans 167. The last step in the method is the regulation spinning operation J shown in Fig. 9, where the spinning operation furnishes the twist in the yarn 168 which is collected on the regulation cheese 169 because these cheeses hold so much more yarn in bulk than do the regulation bobbins.

It will be seen that the present method of making yarn from the long soft fibre dispenses with the roving operation, inasmuch as the yarn is spun directly from the attenuated sliver from the drawing operations without subjecting the sliver to an intermediate roving treatment. Moreover, while it is preferred to use four stages of drawing operations in connection with soft fibre, it is to be understood that the number of drawing operations may be reduced, or increased as the requirements of the finished soft fibre yarn demand.

After long hard fibre has been subjected to the combing, drawing or spreading, stretching, and straightening operations and has been formed under pressure of 60 lbs. into rolls 112 containing a separator strip 117, instead of conditioning the hard fibre, it is conveyed on a suitable vehicle to a creel indicated generally at 201 similar to the creel W combined with the breaker card D. A plurality of these rolls 112 are supported upright in the creel 201, where the power driven traction rolls 202 unwind the several slivers 203 which are fed into the Good's machine K, shown in Figure 2A, which is the same as the Good's machine B used in the first step of the operation, except that no softening emulsion is sprayed on the sliver as it passes through the machine K. As the rolls 112 are unwound, the separator strips 117 are wound on a core on the traction drive rolls 210 like in the creel W heretofore explained. In the machine K, the slivers of hard fibre, now doubled, are again subjected to a combined combing, drawing or spreading, stretching, and straightening or parallelizing operation, and the resulting condensed sliver is collected on the roll former 204, in a single condensed sliver by condensing rolls 205, 206, and the condensing trough 207 intermediate the condensing rolls. As the sliver is wound into roll 208 under 60 lb. pressure by the air ram 209 pulling on the core by means of cables similar to the operation of the air ram described in connection with the machine B, a separator strip like 117 (Figure 10) is unwound from the core 209*a* and wound between the layers of sliver on the roll.

The next step in the method, as shown in Figure 3A, is a repetition of the previous step shown and described in connection with the Figure 2A of the drawings where the Good's machine L performs the third combing, spreading or drawing, stretching and parallelizing action on the doubled sliver, and the plurality of slivers are fed to the machine from a creel and collected on a roll former under 60 lb. pressure with a separator strip between the layers.

The next succeeding steps in the method, illustrated respectively in Figures 4A and 5A, are performed under identical conditions with Good's machines indicated at M and P. In these steps, the plurality of slivers, now forming a doubled sliver, is fed from a plurality of rolls mounted on a creel, like the creel W, attached to the breaker card D, and the doubled sliver is fed to the Good's machine where it is subjected to a combined combing, spreading or drawing, stretching, and parallelizing action. After the combined action,

in the machines M and P, the sliver is again collected in rolls under 60 lb. pressure supplied by an air ram like 209, in the step illustrated in Figure 2A, wherein a separator strip like 117 (Figure 10) is applied between the layers of the rolls to prevent breaking and sloughing of the fibre in handling in the subsequent operations.

The next step, or sixth step, in the treatment of the hard fibre is a drawing operation solely, performed by a regulation drawing machine R, and is illustrated in Figure 6A. It is pointed out that the sliver is utilized in the roll form from the previous step shown in Figure 5A. It will thus be seen that the roll delivered by the first step in the treatment of hard fibre is placed in a creel and utilized in the second step, then wound in a roll under pressure, which treatment is followed in the succeeding three steps. The sliver is fed in the sixth step, or the first operation devoted solely to drawing, from a roll, but is collected in a can of the regulation type, from which point the sliver is fed and delivered to cans and finally collected as cordage yarn on bobbins.

Returning now to the sixth step, it will be seen that a plurality of rolls 212 are supported in upright position on a creel 213 like in the creel W. The separator strips 214 are wound on the drums 215 as the slivers are fed from the creel, and the now doubled hard fibre sliver 216 is fed from the delivery rolls 217 into the path of the drawing chain 218 which runs at the desired speed to provide the predetermined draft to the fibre. The sliver is then picked up by the first set of delivery rolls 219 and here the sliver is condensed. From the delivery rolls, the sliver passes through a second set of rolls 220 which further condense the sliver, and after the sliver leaves these latter rolls, it is collected in a regulation can 221.

It is customary to use two stages of drawing in the hard fibre industry, and next step, or seventh step, performed by the drawing machine S in Figure 7A of the drawings, is identical with the first drawing machine R, except the sliver is fed from the can 221, which latter, full of sliver, has been transferred to the feed end of the machine. The sliver from this second drawing operation is collected in a can 222.

The last step, or eighth step in the treatment of hard fibre, is performed on a regulation horizontal gill spinner of the dual bobbin type indicated at T in Figure 8A. In this machine, the sliver is fed from the can 222, from the drawing machine S, through the trumpet rolls 223 onto a gill chain 224. From the gill chain, the sliver is fed into the proper mechanism, well known in the trade, where the sliver is condensed and twisted, and finally wound on the bobbins 225 in which form the yarn is made into cordage.

What is claimed is:

1. A method of making yarn from long hard raw fibre selected from a group consisting of natural and synthetic vegetable origin comprising regulating the weight of travelling fibre, subjecting the travelling fibre to a horizontal combing tension, condensing the fibre to a sliver, collecting the sliver in a roll under pressure greater than its own weight, operating upon the fibre subsequently with at least three independent treatments one of which includes horizontal combing, collecting the fibre at the end of each of the three treatments in a roll of sliver under pressure greater than its own weight, feeding the sliver from the roll in each of the succeeding three treatments, then after the three independent treatments subjecting the fibre to at least one drawing operation, and finally spinning the fibre into yarn.

2. A method of making yarn from long hard raw fibre selected from a group consisting of natural and synthetic vegetable origin comprising regulating the weight of travelling fibre, subjecting the travelling fibre to a combing tension, collecting the combed travelling fibre in a roll under pressure greater than its own weight, operating upon the fibre subsequently with at least four independent treatments involving a combing action, collecting the fibre at the end of each of the four treatments in a roll of sliver under pressure greater than its own weight, feeding the sliver from the roll in each succeeding treatment of the said four treatments, then after the four independent treatments subjecting the fibre to a drawing operation, and finally spinning the fibre into yarn.

3. A method of making yarn from discontinuous lengths selected from a group consisting of long hard fibre of natural and synthetic vegetable origin comprising predetermining the rate of feed of fibre and feeding the fibre in accordance with said predetermined rate in a manner to form a length of fibres of substantially uniform weight per unit length as the initial step, subjecting the traveling fibre immediately following the initial step to a combing tension administered in the direction of the axis of the fibre without any appreciable mechanical softening other than the combing action, treating the travelling fibre with a softening liquid during the combing action, condensing the treated travelling fibre relative to its width, collecting the condensed travelling fibre in a roll under applied pressure greater than the weight of the collected fibre, operating upon the fibre subsequently with at least four independent treatments involving combing action, collecting the fibre at the end of each of the four combing treatments in a roll of sliver under applied pressure greater than the weight of the roll of sliver, feeding the sliver from the roll in each succeeding treatment of the said four treatments, then after the said four treatments subjecting the fibre to a drawing operation, and finally spinning the fibre into yarn without an intermediate production of roving.

4. In a method of making yarn from successive supplies of long fibre having a minimum length of three feet comprising weighing an initial supply of raw fibre to be fed in making the yarn, causing the weight of said supply to actuate an indicator hand movable along recording means, causing a second indicator hand to move continuously along recording means at a rate proportional to the speed of a feed mechanism for said fibre, feeding the fibre to said feed mechanism to deplete the initial supply in such a manner that the weight-registering hand and speed indicator hand move simultaneously along their respective recording means at a rate to indicate by their relationship uniform feed of fibre, weighing successive supplies of fibre when required as indicated by the weight indicator hand, manually setting the second indicator hand to be in register with the weight indicator hand after each weighing of successive supplies, whereby maintaining of the position of the indicator hands in register may be accomplished for the purpose of proper continuous fibre feed and whereby a continuous length of fibre having substantially uniform weight per unit length is formed, subjecting the traveling fibre to a combing tension applied in the direction of its path of travel, col-

lecting the combed traveling fibre in a roll of continuous layers under pressure greater than its own weight, utilizing the fibre of the roll in at least two subsequent independent treatments, and finally spinning the fibre whereby a yarn is formed having substantially uniform size and weight.

5. That step in the making of yarn from a series of supplies of raw stock of long fibre having a minimum length of three feet comprising weighing each supply of raw fibre to be fed in making the yarn, causing the weight of said supply to actuate an indicator hand movable along recording means, causing a second indicator hand to move continuously along recording means at a rate proportional to the speed of a feed mechanism for said fibre, feeding the fibre of one supply to said mechanism to deplete the supply in such a manner that the weight-registering and speed indicators move simultaneously along their respective recording means at a rate to indicate by their relationship substantially uniform feed of fibre, weighing successive supplies of fibre when required as indicated by the weight indicator hand, manually setting the second indicator hand to be in register with the weight indicator hand after each weighing of successive supplies, whereby maintaining of the position of the indicator hands in register may be accomplished for the purpose of proper continuous fibre feed and whereby the continuous length of fibre so formed has substantially uniform weight per unit length at the initial operation.

6. In a method of making yarn from successive supplies of long fibre having a minimum length of three feet comprising weighing an initial supply of raw fibre to be fed in making the yarn, causing the weight of said supply to actuate an indicator hand movable along a scale, causing a second indicator hand to move continuously along said scale at a rate proportional to the speed of a feed mechanism for said fibre, feeding the fibre to said mechanism to deplete the initial supply in such a manner that the weight-registering hand and speed indicator hand move simultaneously along the scale at substantially the same rate to form a continuous length of travelling fibres of substantially uniform weight per unit length, weighing successive supplies of fibre when required as indicated by the weight indicator hand, manually setting the second indicator hand to be in register with the weight indicator hand after each weighing of successive supplies, whereby maintaining of the position of the indicator hands in register may be accomplished for the purpose of proper continuous fibre feed and treating the continuous length of traveling fibres with a conditioning liquid, subjecting the traveling fibre to a combing tension applied in the direction of its axis, whereby the fibres are arranged in parallel relation, collecting the traveling fibre in a roll of continuous layers under pressure substantially greater than its own weight, confining the roll in an atmosphere of a regulated amount of heat and humidity, unwinding the roll, and feeding the fibre of the layer unwound successively through a breaker card, a finishing card, a drawing operation, and a spinning operation.

7. In a method of making yarn from successive supplies of raw stock of long fibre having a minimum length of three feet comprising weighing an initial supply of raw fibre to be fed in making

the yarn, causing the weight of said supply to actuate an indicator hand movable along a scale, causing a second indicator hand to move continuously along said scale, at a rate proportional to the speed of a feed mechanism for said fibre, feeding the fibre to said feed mechanism to deplete the initial supply in such a manner that the weight-registering and speed indicators move simultaneously along the scale at substantially the same rate to form a continuous length of traveling fibres of substantially uniform weight per unit length, weighing successive supplies of fibre when required as indicated by the weight indicator hand, manually setting the second indicator hand to be in register with the weight indicator hand after each weighing of successive supplies, whereby maintaining of the position of the indicator hands in register may be accomplished for the purpose of proper continuous fibre feed and treating the continuous length of traveling fibres with a conditioning liquid, combing the fibre under a tension applied in a direction of its path of travel whereby the fibres are arranged in substantially parallel relation, collecting the fibre in a roll of continuous layers under pressure greater than its own weight, confining the roll at no less than room temperature and in a relative humidity of less than the saturation point, unwinding the roll and feeding the fibre of the unwound layer successively through a breaker card, a finishing card, a drawing operation and a spinning operation without resorting to an intermediate treatment by a roving operation.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,926,288	Koch	Sept. 12, 1933
361,266	Coe	Apr. 19, 1887
1,994,313	Jacobs	Mar. 12, 1935
1,472,815	Schimek	Nov. 6, 1923
1,080,205	Fisher	Dec. 2, 1913
1,331,333	Etrich	Feb. 17, 1920
1,048,526	Good	Dec. 31, 1912
2,067,497	McCardle et al.	Jan. 12, 1937
2,167,332	Emery	July 25, 1939
1,506,936	Lea	Sept. 2, 1924
1,706,928	Lea	Mar. 26, 1929
1,181,678	Macintyre	May 2, 1916
1,599,597	Sunderland	Sept. 14, 1926
335,870	Winterwerber	Feb. 9, 1886
1,703,358	Oxley	Feb. 26, 1929
1,637,139	Clow et al.	July 26, 1927
357,486	Klein	Feb. 8, 1887
1,480,471	Sandeman	Jan. 8, 1924
1,939,525	Schmitt	Dec. 12, 1933
1,994,313	Jacobs	Mar. 12, 1935
1,573,709	Horman	Feb. 16, 1926
1,899,260	Clements	Feb. 28, 1933
2,221,396	Evoy	Nov. 12, 1940
240,980	Dunn	May 3, 1881
1,080,700	Kranebiel	Dec. 9, 1913

FOREIGN PATENTS

Number	Country	Date
1,256	British	1886