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PROCESS AND MECHANISM FOR THE MANUFACTURE OF ROVING OR YARN

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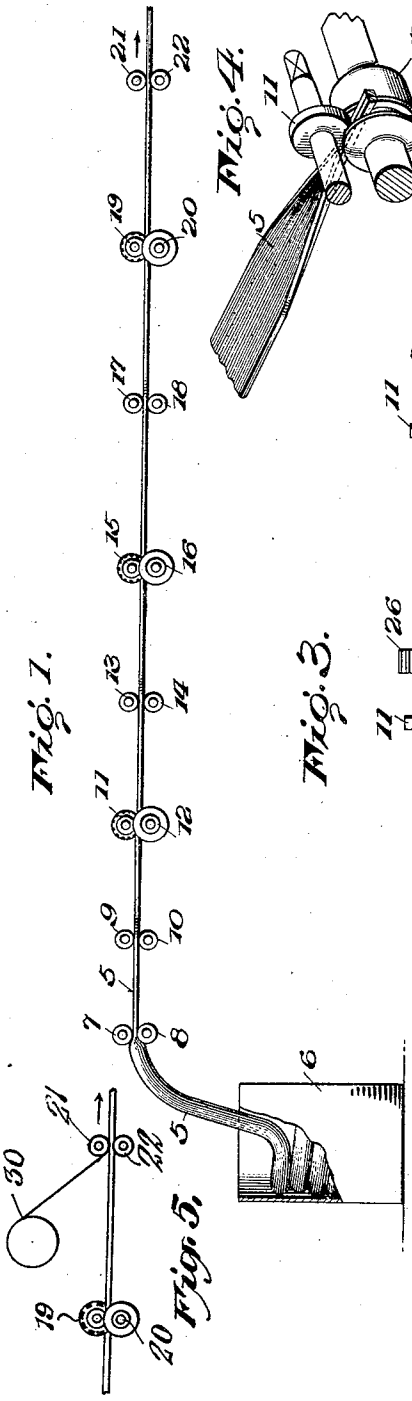


Fig. 1.

Fig. 4.

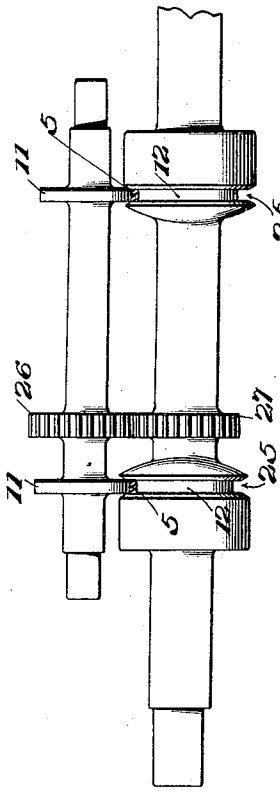


Fig. 3.

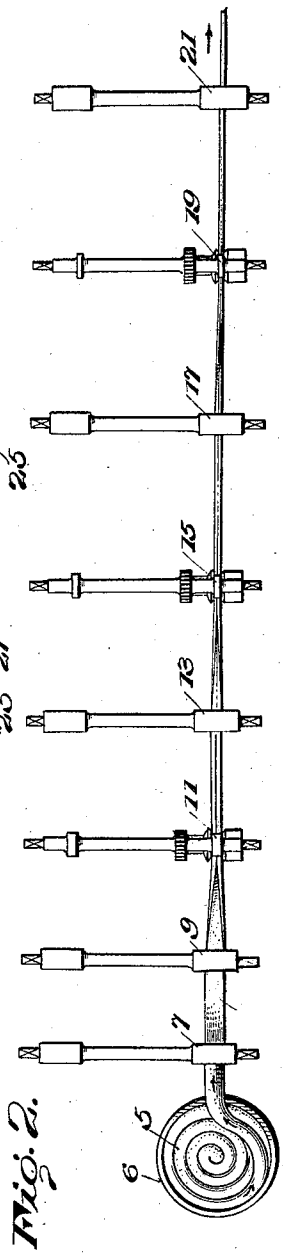


Fig. 2.

Fig. 5.

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UNITED STATES PATENT OFFICE

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PROCESS AND MECHANISM FOR THE MANUFACTURE OF ROVING OR YARN

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This invention has reference to the production of yarn of cotton or other fiber, and particularly to that part of the general process which is known as "roving", and by means of which the sliver is brought to the state of yarn.

One object of the present invention is to accomplish the drawing of the strand or sliver to the required degree of fineness, whatever it may be, by a continuous process, capable of being carried on to completion by a single organization of mechanical elements which act upon the strand successively and simultaneously, bringing it eventually to the required degree of fineness without interrupting the travel thereof.

According to the preferred manner of practicing the said invention, the strand of fiber, after having been subjected to the first drafting operation, either with or without a preliminary compression of the strand (in which first drafting operation ordinary drawing rollers may be employed) is forthwith, and without interruption of its travel, folded upon itself and condensed; which operations may be accomplished by the yielding pressure of elements—preferably power-driven rolls—whose contacting surfaces move in the same direction and at the same rate of travel as the strand. The latter, after having been thus folded and condensed, undergoes another drawing; and the above described alternations of folding and condensing and drawing are repeated as often as is necessary for bringing the strand to the requisite degree of fineness, all without a break in the continuity of the process.

Said process is characterized by the following distinguishing features, amongst others:

1. The condensing and drafting operations are accomplished by means of elements whose contacting surfaces travel with the strand.

2. The strand is acted upon, in the course of its uninterrupted travel, by a series of condensing and drafting elements, each successive drafting element acting upon an already condensed strand.

3. Between each successive drafting operation the strand is folded upon itself, the line of fold being lengthwise of the strand. This operation is to be clearly distinguished from the doubling of one strand upon another, which has been heretofore proposed.

4. The condensing (or folding and condensing) elements are positively driven. Hence, instead of putting a drag upon the strand, they serve to carry it forward in a positive manner; while at the same time the said condensing elements serve to hold the strand against the pull of the next succeeding drafting elements.

Further, according to the preferred method of carrying out the invention, the folding and condensing operations are accomplished by means of a pair of power-driven rolls, whereof one has a groove formed with bevelled faces at the lips thereof, and the other has a peripheral rib or tongue fitting said groove; the rolls being geared to rotate in such wise that the contacting surfaces between which the strand is condensed travel at the same speed. These tongued and grooved rolls serve the several purposes of folding, condensing, holding, and carrying the fiber.

The folding of the strand upon itself as it issues from the drawing rolls results in a better product than is obtained by the uniting of two strands together (as is now commonly practiced); and other advantages are secured thereby, particularly in that this folding of the strand upon itself makes possible the successful drawing of the fiber to any desired degree of fineness in a single continuous process.

In some cases it is desirable to use two or even more drawing operations to one condensing operation.

All the operations described above can be carried out uninterruptedly in one simple mechanical organization. Moreover, it is possible by means of this invention to produce a strand of yarn or roving with a theoretically correct and practical draft, or in other words, a balanced draft; which it is not always practical to attain by means of the processes now in use.

It is possible also to unite a strand of rayon or similar material with the cotton roving by running the two together through the final drawing rolls. Inasmuch as cotton is strong-

est when wet and rayon weakest, the composite strand thus produced has durability as well as beauty.

Other objects and advantages are secured by this invention, and other modifications thereof may be made, as will be apparent from the following detailed description, reference being had to the accompanying drawings, wherein—

Fig. 1 is a diagrammatic illustration in side elevation, showing the successive steps of condensing and drawing;

Fig. 2 is a similar view from above;

Fig. 3 is a front (or rear) elevation of part of a pair of condensing rolls, showing two pairs of condensing elements;

Fig. 4 is an enlarged detail in perspective, illustrating how the strand is doubled upon itself and compressed in passing through the condensing rolls; and

Fig. 5 is a diagrammatic detail in side elevation, showing how a strand of rayon or like material may be united with the cotton strand.

In carrying out the said continuous process of alternate drawing and condensing of the sliver 5, the latter is led out of its container 6 and carried through a series of rolls, of which eight pairs are shown in Figs. 1 and 2. In practice, the roll shafts would be long enough to carry each a considerable number of rolls. In Fig. 2, a sufficient length of the shafts is shown to indicate the location of two rolls on each shaft.

In the arrangement illustrated in the drawings, the first pair of rolls 7, 8 are holding rolls, and the second pair 9, 10 are drawing rolls, the speed of which, relative to that of rolls 7, 8, will be such as to draw out the sliver to the desired extent at this first step of the process, the extent of the elongation of the strand being a matter of judgment, and dependent upon various considerations.

Next to these is shown a pair of rolls 11, 12, by means of which the strand is folded upon itself, and is also condensed or compacted, and thereby made ready for a further drawing operation by the next pair of rolls 13, 14.

The preferred construction of these condensing elements is illlustrated in Fig. 3, and the operation thereof in Fig. 4.

As shown, roller 12 is formed with a peripheral groove 25, the edges 29 therof being slightly bevelled for a short distance from the surface of the roll, which gives to the groove a flaring mouth, whereby the guiding of the strand into the aperture through which it is to pass is facilitated.

This construction of the groove with bevelled edges is of much importance, not only because it facilitates the folding operation, but also because, if the walls of the groove were vertical all the way to the top thereof, the rib on the companion roll would act as a shear, and would destroy the strand.

The width of groove 25 and the pressure of the upper roll 11, which is of just the proper thickness to fit closely in groove 25, determine the extent to which the strand is compressed at this point; and the manner in which the compression or condensation takes place is shown in Fig. 4. The edges of the web 5, as it enters the groove 25 are turned up by the action of the bevelled surfaces at the mouth thereof, and the folded strand then comes under the pressure of roll 11, which is so journalled as to rest freely with its full weight upon the strand of fiber. In other words, the roll 11 is automatically adjustable vertically, so that the size of the aperture is automatically adjustable, its height being determined by the volume of stock passing through it.

The aperture between rolls 11 and 12 answers in function to the orifice of a cone tube or trumpet, and the curved peripheries of the respective rolls answer to the flaring walls of the tube or trumpet. The all important difference, however, is that the opposing walls in this instance move with the strand and at approximately the same rate of travel.

It is further to be observed that the several pairs of condensing rolls (11, 12, 15, 16, etc.) perform four distinct functions. First, they fold the strand upon itself; second, they condense the strand preparatory to another drawing; third, they carry the strand forward; and fourth, they act as holding rolls against the contiguous pair of drawing rolls.

I have stated that, in the arrangement shown in the drawings, the first pair of rolls (7 and 8) are holding rolls, though, of course, they perform also the functions of condensing the strand and of carrying it forward; and it is obvious that a pair of rolls such as 11, 12, might be used in place of the smooth surfaced rolls 7, 8; in which case the condensing effect at that point will be better. But in the arrangement of rolls illustrated in the drawings, the distinct novelty of the process in its departure from present practice begins with the folding, condensing, and holding action of rolls 11, 12.

The driving gear of the roll shafts is not shown in the drawings, as the same is of ordinary construction and forms no part of the present invention. It is enough to say that the under one of each pair of drawing rolls is postively driven by any suitable means, and the upper member of the pair receives its motion by contact with the lower. As shown, however, in Fig. 3, it has been found desirable, in the case of the condensing rolls, to gear the upper roll shaft to the lower, as by the spur gears 26, 27, the teeth of which have sufficient length to permit the necessary vertical play of the rolls 11, etc.

The manner in which the upper roll shafts are weighted, and the amount of weight to be applied, are matters well understood by

those skilled in the art and concerning which no specifications are needed.

As shown in Fig. 5, a spool or bobbin 30 containing a thread of rayon or similar undrawn fiber, may be suitably supported at a convenient distance above the level of the travelling strand of cotton, and in such position that the thread 31 may be run through the last pair of drawing rolls 21, 22, and thus be united to the cotton strand, forming a composite yarn.

As indicated in Fig. 2 the width of the strand 5 is reduced successively at each condensing operation to approximately one-half of its previous width; but obviously the precise amount of reduction will be more or less according to variable conditions. The corresponding progressive narrowing of the grooves of the grooved rolls, and of the presser rolls, is clearly apparent in Fig. 2 of the drawings.

From the last pair of drawing rolls, 21, 22, the strand is wound directly upon a bobbin or other receptacle, by the usual means, receiving in the operation of winding the necessary twist to make it a finished strand of roving or yarn.

By the above described process and mechanism, as much draft is accomplished in one continuous operation as in three or more distinct and separate operations by the processes now in general use.

It is specially to be observed that a pair of condensing rolls, constructed as described above, performs the function of a cone tube in compacting or compressing the travelling strand of fiber, but without tearing it apart or putting a harmful strain thereon.

What is claimed is:—

1. A continuous process for the production of a composite strand of drawn fibrous material and undrawn material, which process consists in drawing out a strand or sliver of cotton or other fibers, then condensing the same by folding it upon itself and passing it between moving compression elements under yielding pressure, then drawing the strand further and repeating these operations continuously until the desired state of fineness is attained, and at the final drawing operation running and uniting a strand of undrawn material such as rayon with the strand of fiber.

2. Mechanism for preparing fibrous material for spinning, comprising, in combination with a plurality of groups of drawing rolls by which a fibrous ribbon is attenuated through successive stages, a series of sets of devices alternating with the said groups, namely at a plurality of the intervals between the groups, to act in connection with the progressively attenuated ribbon at successive stages, each set consisting of driven compression elements, yieldingly pressed together, moving in the same direction as the fibrous ribbon at the predetermined rate of feed, and cooperating in their movement to fold the spread-out ribbon transversely upon itself, subject it in its transversely infolded state to yielding compression between them, feed the infolded partially-drawn ribbon to the succeeding pair of rolls so that extension of the sliver shall take place between the said set and the said succeeding pair of rolls.

3. Mechanism for preparing fibrous material for spinning, comprising, in combination with a plurality of groups of drawing rolls by which a fibrous ribbon is attenuated through successive stages, a series of grooved rolls alternating with the said groups, namely at a plurality of the intervals between the groups, to act in connection with the progressively attenuated ribbon at successive stages, and yielding presser rolls co-acting with said grooved rolls, each presser roll having a narrow working portion occupying the groove of the companion roll, and each grooved roll and its companion presser roll cooperating in their movement to fold the spread-out ribbon transversely upon itself, subject it in its transversely infolded state to yielding compression, feed the infolded partially-drawn ribbon to the succeeding pair of rolls, so that extension of the sliver shall take place between the said set and the said succeeding pair of rolls.

4. Mechanism for preparing fibrous material for spinning, comprising, in combination with a plurality of groups of drawing rolls by which a ribbon of fiber is attenuated through successive stages, a series of sets of condensing devices alternated with the said groups, namely at a plurality of the intervals between the groups, to act in connection with the progressively attenuated ribbon at successive stages, the condensing devices intermediate two successive groups of the drawing rolls consisting of driven compression elements, yieldingly pressed together, and in their movement cooperating to fold the attenuated and flattened ribbon transversely inward upon itself, subject it in its transversely infolded state to yielding compression between them, advance the condensed partially-drawn ribbon at the predetermined rate to the succeeding pair of rolls so that extension of the sliver shall take place between the said set and the said succeeding pair of rolls.

5. The combination with a train of groups of drawing rolls, of a series of sets of sliver condensing and carrying devices located at successive intervals in the said train, forming a sequence effecting, at each of a plurality of stages of the progressive attenuation of the fibrous ribbon, recondensation thereof by a set of the said devices, each set consisting of driven compression elements, yieldingly pressed together, moving in the same direction as the travel of the ribbon and at substantially the same speed as the latter, and

the coacting elements cooperating to shift the margins of the partially attenuated ribbon transversely inward, as well as to subject the thus narrowed ribbon to yielding compression between them, advance the thus-conditioned ribbon to the action of the succeeding group of rolls so that extension of the sliver shall take place between the said set and the said succeeding pair of rolls.

6. Mechanism according to claim 3, characterized by the grooves and presser rolls of the successive groups thereof being progressively narrower.

7. Mechanism according to claim 3, characterized by the edges of the side-walls of a groove being slightly beveled, forming a flaring mouth whereby entrance of the said ribbon is facilitated, inward folding of the margins of the ribbon is promoted, and shearing action is avoided.

8. Mechanism for preparing fibrous material for spinning, comprising, in combination with a plurality of groups of drawing rolls by which a fibrous ribbon is attenuated through successive stages, a series of grooved rolls alternating with the said groups, namely at a plurality of the intervals between the groups, to act in connection with the progressively attenuated ribbon at successive stages, and yielding presser rolls coacting with said grooved rolls, each presser roll having a narrow working portion occupying the groove of the companion grooved roll, and each set comprising a grooved roll and its companion presser roll cooperating in their movement to fold the spread out ribbon transversely upon itself, subject it in its transversely infolded state to yielding compression, feed the infolded partially-drawn ribbon to the succeeding pair of rolls, and hold it against the draft by the latter so that extension of the sliver shall take place between the said set and the said succeeding pair of rolls, with the grooves and presser rolls of the successive sets progressively narrower, and with the side-walls of a groove slightly beveled, forming a flaring mouth whereby entrance of the said ribbon is facilitated, inward folding of the margins of the ribbon is promoted, and shearing action is avoided.

9. Drawing-roll mechanism comprising, in combination, successive pairs of drawing rolls, and an intermediately-located pair of sliver-advancing and holding rolls comprising driven compression elements consisting of a grooved roll and a yielding presser roll having a narrow working portion occupying the groove of the companion rolls, the said grooved rolls operating to shift the margins of the spread-out ribbon transversely inward, and the two rolls cooperating to subject the narrowed ribbon to yielding compression, feed the narrowed partially-drawn ribbon to the succeeding pair of rolls, and hold it against draft by the latter, so that extension of the sliver shall take place between the said intermediately located rolls and the said succeeding pair of rolls.

In testimony whereof I have signed this specification.

WILLIAM G. REYNOLDS.