Nov. 18, 1952 L. E. KEENE 2,618,023

METHOD AND APPARATUS FOR COMPACTING TEXTILE FIBERS

Filed July 26, 1948 3 Sheets-Sheet 1

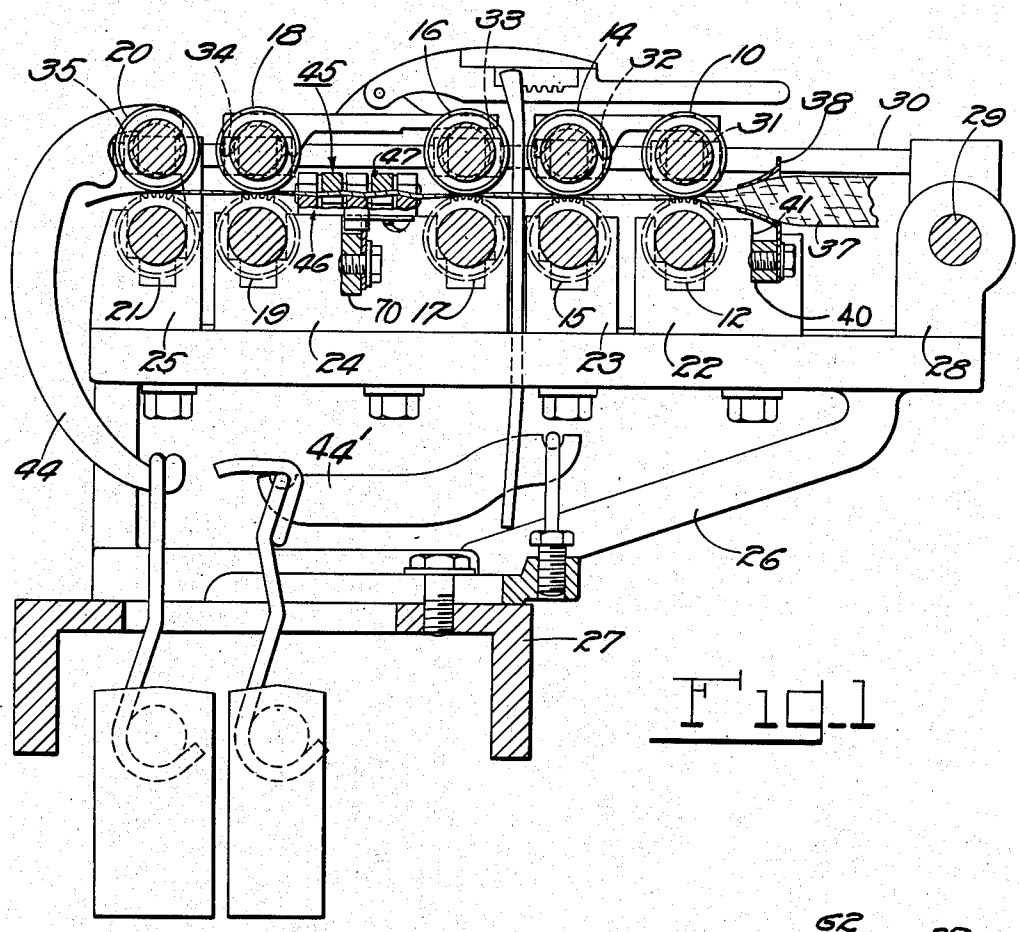


Fig. 1

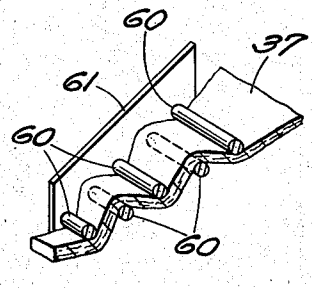


Fig. 8

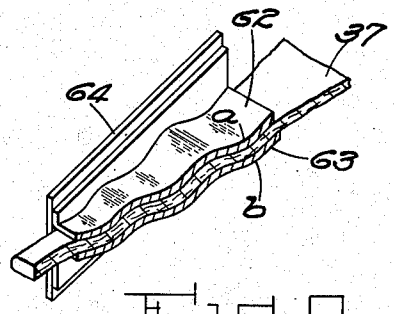


Fig. 9

INVENTOR:
LESTER E. KEENE

by W. Russell Greenwood Atty.

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METHOD AND APPARATUS FOR COMPACTING TEXTILE FIBERS

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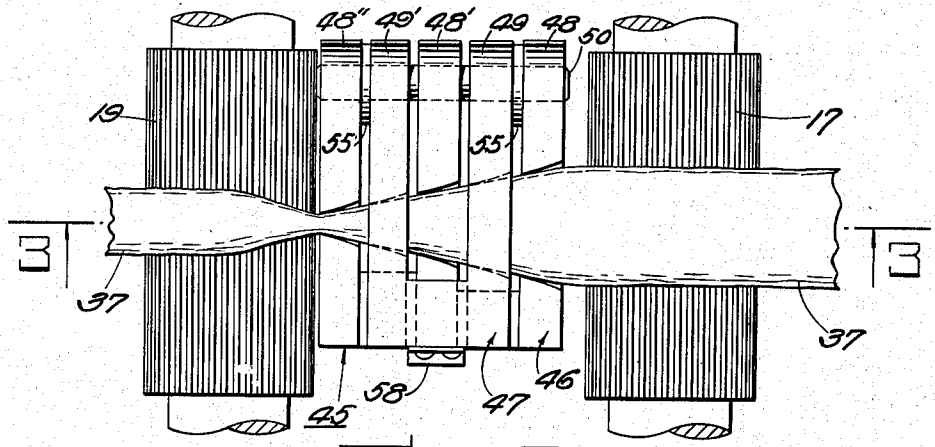


Fig. 2

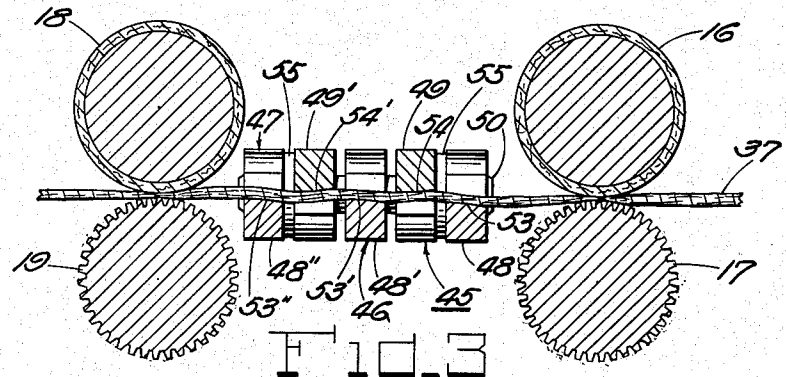


Fig. 3

Fig. 5

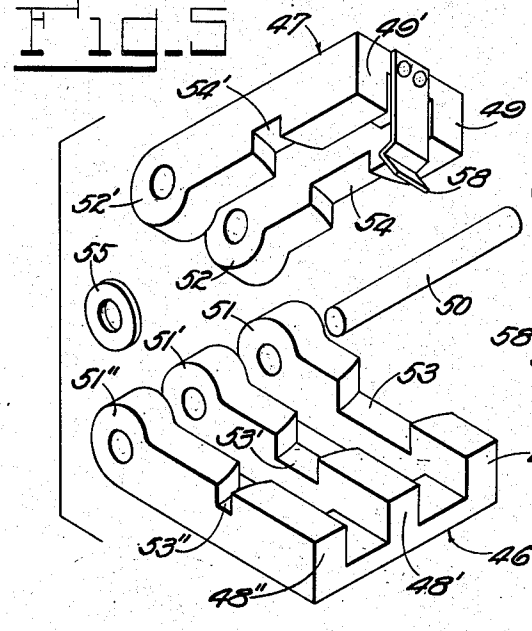
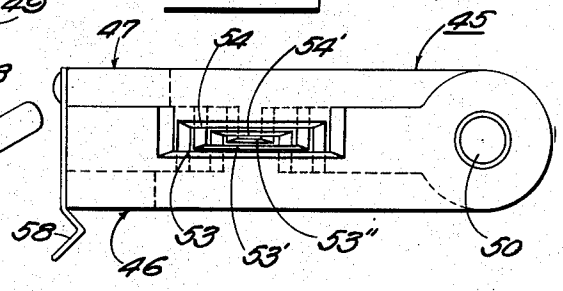


Fig. 4



INVENTOR:
LESTER E. KEENE

by W. Russell Greenwood Atty.

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METHOD AND APPARATUS FOR COMPACTING TEXTILE FIBERS

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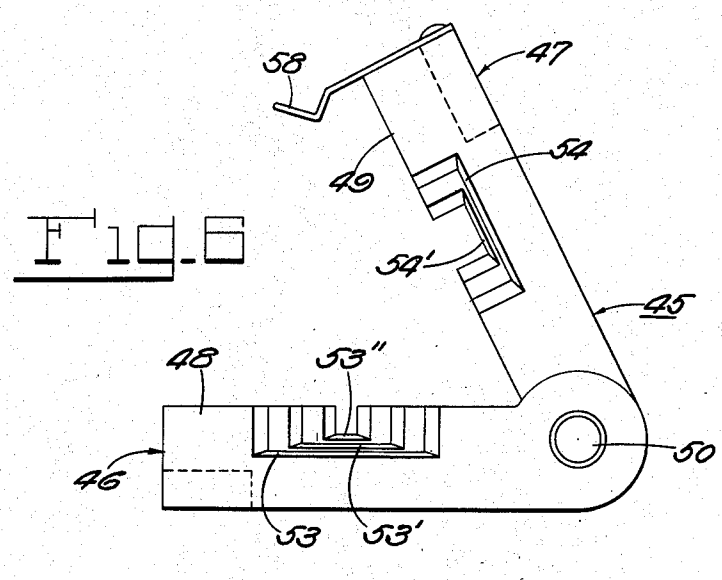


Fig. 6

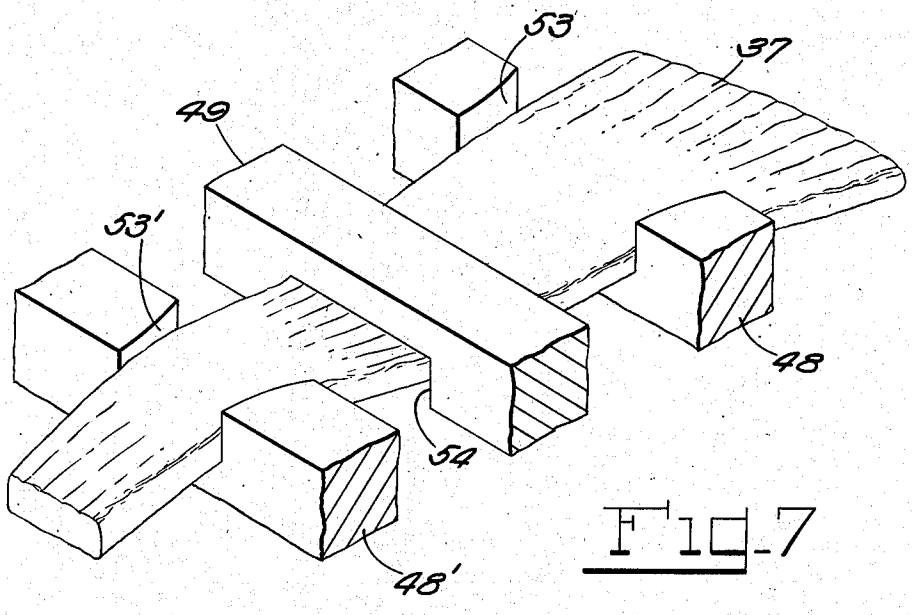


Fig. 7

INVENTOR:
LESTER E. KEENE
by W. Russell Greenwood Atty.

Patented Nov. 18, 1952

2,618,023

UNITED STATES PATENT OFFICE

2,618,023

METHOD AND APPARATUS FOR COMPACTING TEXTILE FIBERS

Lester E. Keene, Newtonville, Mass., assignor, by mesne assignments, to Whitin Machine Works, a corporation of Massachusetts

Application July 26, 1948, Serial No. 40,645

10 Claims. (Cl. 19—130)

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My present invention relates to continuous fiber drafting mechanisms and to a method for converting sliver into roving or for the further drawing of roving.

The object of drawing or drafting sliver or roving is to attenuate it and at the same time, so far as possible, to arrange the fibers parallel with each other. Any departure from ideal perfect parallelism creates irregularities in the drafting which carry through on subsequent operations causing variations in size and breaking strength of the spun yarn. Consequently, the effectiveness of a drafting mechanism of any type is measured by the extent to which it changes the random arrangement of the fibers into a parallel arrangement. No device should be introduced into the processing machinery which will disturb fiber parallelism if anything approaching the ideal condition is to be achieved. A customary procedure has been to put a twist into the sliver after it has been drafted and thus to form a roving, then wind the roving on a bobbin, and then place the bobbin in the next processing machine, the operation being repeated until the roving has been reduced in size and attenuated enough to be ready for the final spinning operation. Many attempts have been made to do a more extensive drafting operation on a single machine and thus do away with the intermediate twisting step or steps. Some machines designed to accomplish this result have operated by folding the sliver longitudinally upon itself and turning in the edges. Such machines have successive drafting stages separated by a zone in which no substantial draft takes place and they lay the edge fibers across other fibers, thus undoing to that extent the work done by previous processes.

I have discovered that it is possible to make a drafting mechanism in which the fibers of the sliver are squeezed together or compacted during drafting without being laid crosswise of each other and the previous parallel arrangement of the fibers is enhanced rather than disturbed. In the machine embodying my invention, the drafting of the sliver proceeds continuously, although at different rates of draft, from the time it enters the machine until it leaves it, and the intermediate twisting of the roving is done away with. This result is obtained by placing between two sets of drawing rollers, a compacting device or condenser of novel form which crowds together the fibers laterally without undoing the parallelism produced by any previous drafting process. In a zone in which such a device is positioned, a substantial draft is entirely practicable.

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Since substantial drafting may take place during the lateral and vertical compacting of the sliver or roving, it is possible to redistribute the amount of drafting which takes place in the several zones of the machine, thus making the draft more gradual and uniform through the machine. As is well known, a drafting mechanism with three pairs of rolls forming two draft zones accomplishes the same total draft better than a machine with two pairs of rolls and a single draft zone. My invention makes it possible to reduce the rate of draft in one or more of the draft zones by the amount of draft which is performed in the zone in which the compacting device or condenser is located, thus if a draft of 1.33 is accomplished in the zone in which the compacting device is located, the draft in the following zone may be reduced from say 4.00 to 3.00.

In practice, I find that a smoother and more uniform roving is produced, and consequently a stronger and better yarn can be made. These results are accomplished by providing, preferably in a drafting zone, a compacting device or condenser of novel shape and construction which has a forwardly converging passage through it, the passage being formed to give to the sliver or roving an up and down sinuous or weaving course, i. e. in a vertical plane, which imparts to the sliver a series of horizontal transverse bends and overcomes the tendency of the fibers to get themselves into crosswise or transverse position. The repeated transverse bending of the sliver or roving while it is subjected to the pull of the rolls at the delivery end of the zone in which the condenser or compacting device is located loosens the fibers in the bundle and tends to release them from their tendency to cling to each other, so that they slide more freely on each other. At the same time the transverse bending flattens the sliver transversely and thus counteracts any tendency of the edge fibers to be laid over onto the center fibers. A notable improvement in smoothness and uniformity of the yarn results.

A machine embodying my invention can be constructed with the successive pairs of drafting rolls having the usual settings and when my novel compacting device or condenser is placed in a drafting zone between two successive drafting stages, the drafting through the machine is continuous although at differing rates.

The foregoing and other objects and advantages of the invention will be best understood from the following particular description of a preferred embodiment thereof taken in connection with the accompanying drawings, this, however,

having been chosen for the purpose of exemplification only, as it will be obvious to those skilled in the art that the invention, as defined by the claims hereunto appended, can be otherwise embodied without departing from its spirit and scope.

In the drawings:

Fig. 1 is a vertical, sectional view, partly in elevation, of a portion of a drafting mechanism for converting sliver into roving according to the method of my invention and also showing in longitudinal vertical section the compacting device or condenser embodying my invention;

Fig. 2 is a plan view, on enlarged scale and somewhat diagrammatic in character, of a portion of the drafting mechanism illustrated in Fig. 1, with the top rolls removed, and showing the changing form of the sliver at different points in its path of travel through the drafting mechanism and the compacting device;

Fig. 3 is a vertical sectional view, taken on the line 3—3 of Fig. 2 of the drafting mechanism there illustrated but with the top rolls in position;

Fig. 4 is a rear elevation of a compacting device or condenser constructed in accordance with the invention and viewed from the feed end;

Fig. 5 is an exploded perspective view of the compacting device or condenser shown in Fig. 4;

Fig. 6 is a rear elevation of the compacting device or condenser illustrated in Fig. 4 and shown in opened position to facilitate insertion of a sliver;

Fig. 7 is a perspective view, on enlarged scale, showing the compressing and condensing action of a plurality of adjoining alternating ridges or notched cross-members relative to a portion of sliver passing thereover as would occur in its forward movement through the compacting device or condenser during a drafting operation;

Fig. 8 shows a modified form of compacting device; and

Fig. 9 shows another modified form of compacting device.

Referring to the drawings and more particularly to Figs. 1 and 2, the invention is there illustrated as embodied in a five-line drawing mechanism of a long draft roving frame, and includes spaced pairs of rolls 10, 12; 14, 15; 16, 17; 18, 19 and 20, 21 arranged in series of which each pair comprises a relatively short covered upper roll and a longitudinally fluted lower roll of considerable length made up of shorter sections joined together end-to-end. The construction and arrangement of these rolls are conventional in that the lower rolls are journalled for rotation in suitable bearing slides 22, 23, 24 and 25 having limited adjustment on the usual roll stands 26, one being shown in the drawing, a series of such stands being secured at spaced locations along the usual roller beam 27 of the machine. Mounted rearwardly of the roll stand 26 is the bracket 28 providing a pivotal support as at 29 for the usual cap bar arm 30 on which is carried the adjustable nebs 31, 32, 33, 34 and 35 which loosely support the adjoining terminal ends of the upper rolls 10, 14, 16, 18 and 20 respectively.

As thus arranged, the lower rolls 12, 15, 17, 19 and 21 are positively driven by suitable gearing, not shown, and they are caused to be rotated at successively greater speeds whereby the several pairs of rolls will rotate with the proper surface velocities to effect the required total draft of the sliver or roving herein designated at 37 passing between them during its travel through the successive draft zones. Thus, in this particular arrangement, the pair of back rolls or feed rolls 10 and 12 respectively, draw the sliver or roving 37 of textile fibers from a can (not shown) or other source of supply, and feed it forward to the next or first pair of intermediate rolls, indicated at 14 and 15. In front of these are the second and third pairs of intermediate rolls 16, 17 and 18, 19, respectively, the rolls 18 and 19 being located immediately behind the pair of front or delivery rolls 20 and 21. Preferably the sliver or roving 37 is drawn through a trumpet 38 before entering the bite of the back rolls 10 and 12. The trumpet 38 may have a circular aperture and is of well known construction in the art. Traverse of the trumpet 38 is provided by the usual traverse rod 40 which supports the trumpet and is arranged for reciprocable movement in the slot 41 in the back roll slide 22 when actuated by suitable traversing mechanism (not shown), as is a common practice in this art.

The five pairs of rolls shown in Fig. 1 of the drawings provide four drafting stages, the first being between the first pair of rolls 10 and 12 and the second pair of rolls 14 and 15, the second being between this pair of rolls and the third pair 16, 17. The third drafting stage is between the pair of rolls 16, 17 and the fourth pair 18, 19. The compacting device or condenser is placed in the third drafting zone so that as the sliver 37 is being drawn it is also being compacted laterally. The amount of draft in the compacting stage is from 1.25 upward. The final drafting stage is between the roll pair 18, 19 and the delivery rolls 20 and 21.

The upper rolls of each pair are pressed against their associated lower rolls by means of any suitable weighting mechanism, one representative arrangement being generally designated by the numerals 44 and 44', whereby the array of fibers passing between the pairs of drafting rolls will be firmly gripped thereby and carried forward in succession between each pair of rolls and the desired drafting effected if the settings of the pairs of drafting rolls are properly adjusted and the relative surface velocities and speeds of the rolls is provided. While the top roll saddle and weighting mechanism shown in Fig. 1 forms no feature of the present invention, mention is made that this weighting and top roll pressure applying mechanism embodies structure disclosed in Patents Nos. 2,203,419 and 2,203,424, both of said patents being granted June 4, 1940.

In the third drafting zone, that is, between the second and third pairs of intermediate rolls 16, 17 and 18, 19, respectively, I place my novel compacting device or condenser 45 presently to be described.

One form of compacting device or condenser of the present invention is illustrated in Figs. 4, 5 and 6 and comprises two cooperating separable members 46 and 47 each including a series of cross-members or parallel bars 48, 48', 48'' and 49, 49', respectively, arranged in two groups, the cross members of each group being widely spaced relative to each other on their associated supporting member. In the form depicted in Figs. 4 and 6 the members 46 and 47 are shown hinged together by means of a pin 50 which passes through suitable enlarged portions 51, 51', 51'' and 52, 52' terminating the free ends of the respective cross-members, and also through the circular spacing elements 55. In this instance, the members 46 and 47 have pivotal movement about a horizontal axis, the

member 46 thus forming the lower or stationary member while the member 47 forms the upper or movable member of the device. The cross-members 49 and 49' of the top member 47 lie, when in operative position, in the spaces between the cross-members 48, 48' and 48'' of the lower member 46, and vice versa. Notches 53, 53' and 53'' are provided in the top faces of the cross-members 48, 48' and 48'' while the cross-members 49 and 49', in turn, have notches 54, 54' provided in their bottom faces. Each of these notches is formed with converging vertical side walls and they are progressively graduated in size whereby they provide, when in operative position, a forwardly converging passageway through the device and the alternating upper and lower faces of the cross-members form an up-and-down or vertically sinuous path for the sliver or roving. Thus, the notched sections provide through the device a sectional passageway which presents a series of substantially flat forwardly inclined guiding surfaces alternately in contact with the opposite sides of a sliver or roving as it passes through the device. The size of this passageway decreases substantially uniformly laterally from the entering to the delivery ends of the device. The notches preferably are provided with outwardly flaring or curved entrance ends to make sure that all of the fibers, particularly those at the edges, will be carried forward with the sliver.

It will thus be seen that the notches and their respective cross-members, when in operative position as shown in Figs. 2 and 3, provide a series of ridges arranged transversely of the sliver 37 and over and under which it passes in going through the compacting device combined with vertical confining walls which converge in the horizontal plane towards the delivery end. In accordance with this arrangement, it will be observed also that the tops and bottoms of alternating ridges and the vertical confining walls of the notches are at right angles to each other.

In practice, the device is mounted on a traverse bar 70 so that it may be traversed to reduce uneven wear of the top rolls. The members 46 and 47 may be formed as individual die castings from any of the well known die casting metals or they may be formed as rigid molded plastic bodies of thermosetting phenolic resins such as, for example, Bakelite phenolic resin formed under heat and pressure into a hard infusible final product, or of any other suitable thermosetting phenolic molding material.

Suitable detent means, such as a spring latch element 58, may be provided to hold the top member 47 secured in its operative position with respect to the lower member 46, and also to prevent accidental separation of these members when the device is in use. This arrangement permits the upper and lower groups of cross-members to be separated when it is desired to thread or clean the device.

Fig. 8 shows a modified form of compacting device or condenser which differs from the structure of Fig. 4 in that the ridges are formed by a series of spaced rods 60 which have their opposite ends fixed to a pair of wall members 61, one of which is shown in Fig. 8. These wall members are vertical and converge toward the forward or delivery end of the device and with the rods 60 provide a converging vertical sinuous passageway.

Fig. 9 shows another modified form of the compacting device or condenser. In this construction the sinuous passageway is afforded by two cooperating upper and lower corrugated members 62 and 63 secured to converging vertical members 64, one of which is shown in Fig. 9. The corrugated members 62 and 63 are so placed that the ridges *a* of the upper member are over the depressions *b* of the lower member.

As the sliver goes through the compacting or condensing device it passes alternately over and under the surfaces of the ridges, i. e., cross-members, notched bars or corrugations, thereby being given an up and down sinuous movement, in a vertical plane, and the vertical walls of the passage through the compacting device crowd the fibers of the sliver or roving inwardly toward each other. This progressive inward crowding movement caused by the converging vertical walls of the passageway might make the edges of the sliver or roving curl up so that when viewed transversely in cross section the sliver would be slightly concave were not this tendency counteracted, and the fibers at the edges of the sliver would then be laid over onto the edges of the body of the sliver and lie crosswise of them. However, each time that the sliver passes over or under one of the ridges, it is bent in the direction which counteracts the tendency to curl and is thus flattened. The upward and downward bending of the sliver also tends to loosen the contact or grip of the fibers on each other, rendering them freer to be pulled out by any drafting action of the rolls. The result is that the parallelism of the fibers does not decrease but rather is increased by the passage of the sliver through the compacting device and a smoother, stronger and more uniform yarn is produced. The device also makes it possible to do more or even all of the drafting in a single machine and to make the several stages of drafting in this machine more nearly uniform than has heretofore been possible.

While I have shown the compacting device or condenser 45 in Figs. 1, 2 and 3 as spanning and filling in a substantial portion of the space between the consecutive pairs of rolls associated with my device, it will be readily understood that, in practice, the various forms of the compacting device or condenser shown and described may be constructed to have any appropriate or convenient size and dimensions. For example, the compacting device 45 may have the form and structure illustrated in Figs. 4, 5 and 6 but its length longitudinally may be made much shorter than that in the form depicted in Figs. 1, 2 and 3, and, in certain instances, its length, in the direction of draft, may be as short as one-half of the entire distance between the nip points of the pairs of rolls at either end of the condenser, with good performance and efficiency resulting when in use.

I claim:

1. A compacting device for a sliver or roving having notched sections which provide a passageway therethrough which converges in the horizontal plane and is sinuous in the vertical plane, the notched sections which provide said passageway being inverted alternately and disposed for contact in succession with opposite sides of a moving sliver or roving for bending it up and down as it passes through the device.

2. A compacting device for a sliver or roving having a series of ridges arranged transversely of the sliver and formed with substantially flat forwardly inclined surfaces for bending the sliver

up and down as it passes over and under alternate ridges in going through the device combined with confining walls converging toward the delivery end, the whole providing a converging and vertically sinuous passageway.

3. A compacting device for a sliver or roving comprising a series of cross-members arranged in two groups, the cross-members of one group being located in spaces between those of the other group, the upper faces of the cross-members of one group and the lower faces of those of the other group having therein notches with converging vertical sides and providing a forwardly converging passageway through the device and the alternating upper and lower faces forming a vertically sinuous path for the sliver or roving.

4. A drafting mechanism having spaced pairs of rolls forming a succession of drafting zones and having between two adjoining pairs of rolls a compacting device having notched sections which provide a passageway therethrough which converges in a horizontal plane toward the delivery end and is sinuous in the vertical plane, the notched sections which provide said passageway being inverted alternately and disposed for contact with opposite sides of a sliver or roving for bending it up and down as it passes through the device.

5. A compacting device for a sliver or roving comprising two separable cooperating members each including a series of cross-members arranged transversely of the sliver with each cross-member spaced relatively to its neighbor; the cross-members of one member being located in the spaces between the cross-members of the other member, the upper faces of the cross-members of one member and the lower faces of those of the other member having therein notches with converging vertical sides, the whole providing a forwardly converging and vertically sinuous passageway through the device.

6. A compacting device for a sliver or roving comprising a series of cross members arranged in two groups, the cross members of one group being located in spaces between those of the other group, the upper faces of the cross members of one group and the lower faces of those of the other group being formed with substantially flat forwardly inclined surfaces for deflecting the sliver or roving laterally to one side and the other while it moves across the said surfaces over and under alternating cross members in passing through the device, there being side walls converging toward the delivery end of the device and associated with said cross members, the upper and lower sliver deflecting surfaces of alternating cross members and the converging side walls providing a converging and vertically sinuous passageway for the sliver or roving.

7. A compacting device for a sliver or roving comprising two separable cooperating members each including a series of cross members arranged transversely of the sliver or roving with each cross member spaced relatively to its neighbor; the cross members of one member being located in the spaces between the cross members of the other member, the upper faces of the cross members of one member and the lower faces of those of the other member being substantially flat and forwardly inclined and disposed in the path of travel of the sliver or roving to present thereto a series of ridges alternately in contact with the top and bottom sides of the sliver or roving for bending it up and down as it passes through the device over and under the said alternating ridges, there being vertical confining walls converging toward the delivery end of the device, and the whole providing a forwardly converging and vertically sinuous passageway through the device for the sliver or roving.

8. The method of compacting a sliver or roving which comprises progressively compressing it laterally and alternately bending it up and down by subjecting it to a succession of deflecting forces applied by a series of flat forwardly inclined supporting surfaces alternately in contact with opposite sides of the said sliver or roving while moving it in an axial direction across said surfaces and simultaneously drafting it.

9. A drafting mechanism having spaced pairs of drawing rolls forming at least one drafting zone and including in said drafting zone a compacting device having a series of notched sections one behind the other which provide a constricted notched passageway therethrough, the notched portions of alternate sections being inverted and each having substantially flat forwardly inclined guiding surfaces disposed to come alternately in contact with the opposite sides of a sliver or roving as it passes through the device, the passageway formed by said notched sections converging in a horizontal plane toward the delivery end and being sinuous in the vertical plane.

10. A compacting device for a sliver or roving having a plurality of notched members spaced apart and arranged one behind the other providing a constricted notched passageway therethrough, the notched portions of said members being inverted alternately and each having substantially flat forwardly inclined guiding surfaces disposed to come alternately in contact with the opposite sides of a moving sliver or roving as it passes through the device, the passageway formed by said notched members converging in a horizontal plane toward the delivery end and being sinuous into the vertical plane.

LESTER E. KEENE.

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