

April 6, 1965

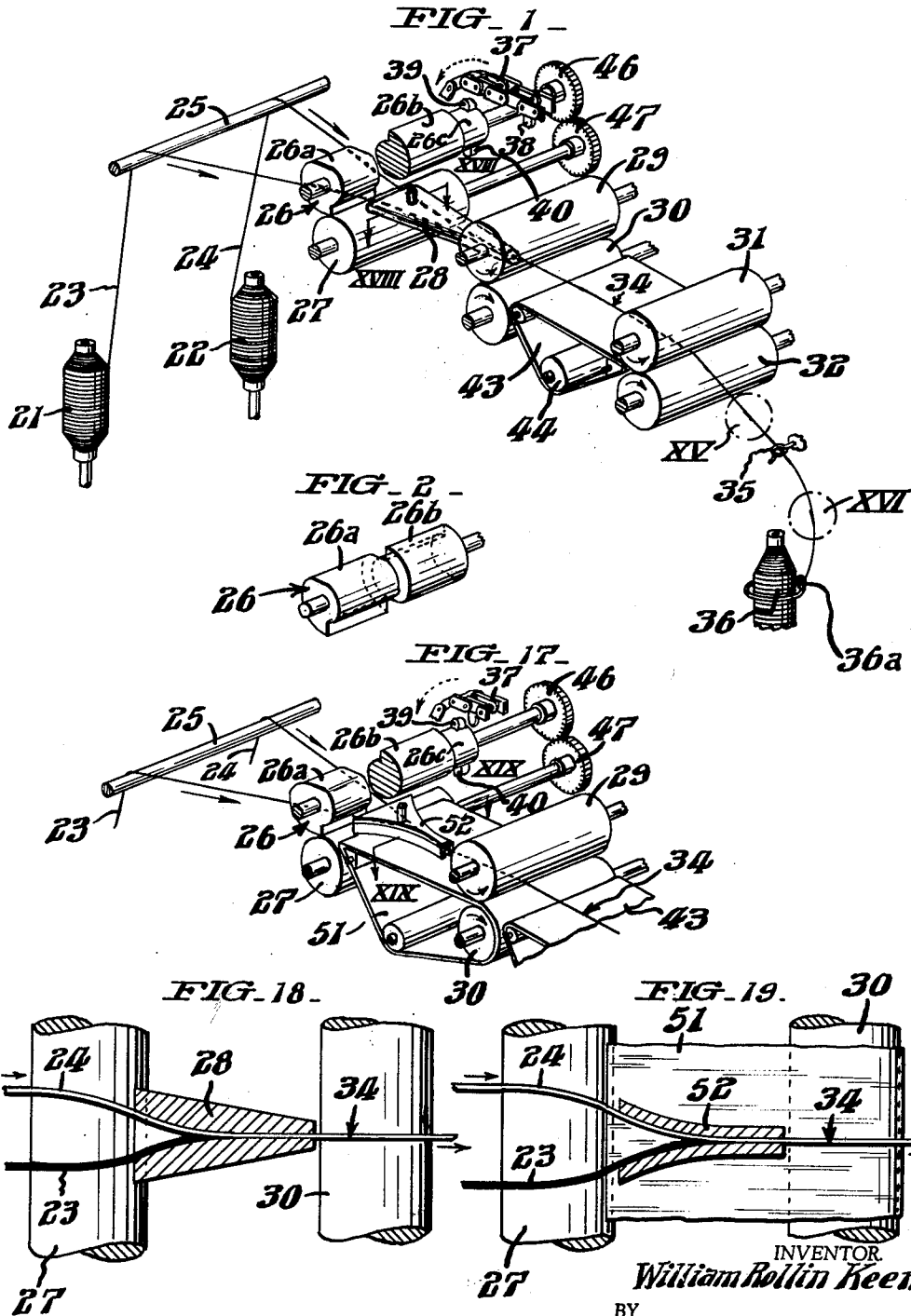
W. R. KEEN

3,176,351

APPARATUS FOR PRODUCING COMPOSITE YARN

Filed Sept. 6, 1963

3 Sheets-Sheet 1



April 6, 1965

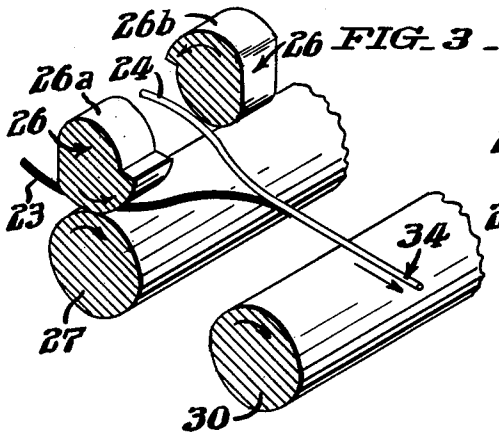
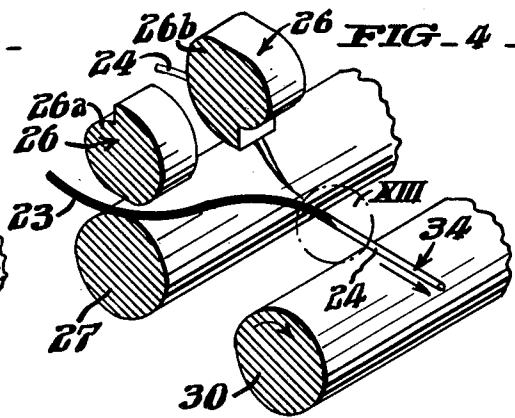
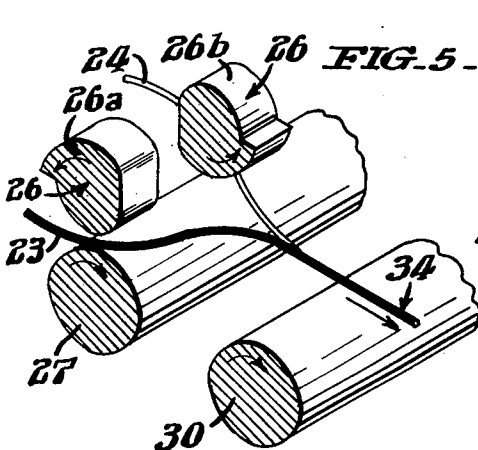
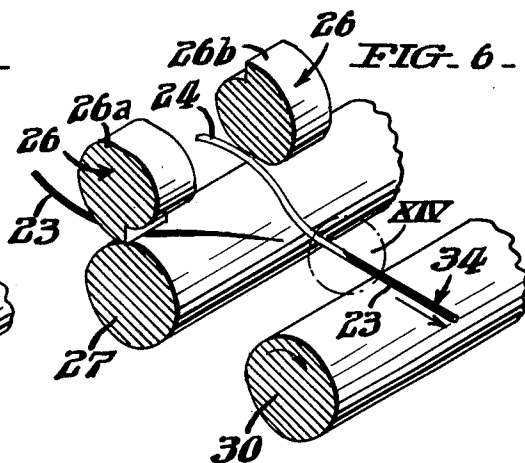
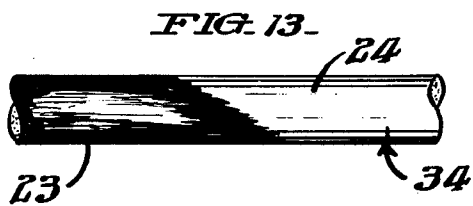
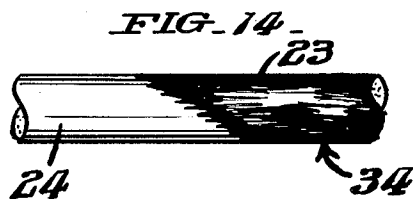
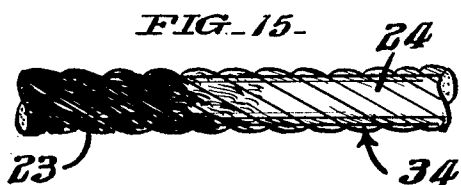
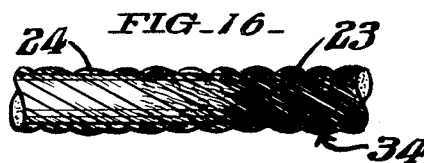
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APPARATUS FOR PRODUCING COMPOSITE YARN

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3 Sheets-Sheet 2



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APPARATUS FOR PRODUCING COMPOSITE YARN

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3 Sheets-Sheet 3

FIG. 7 -

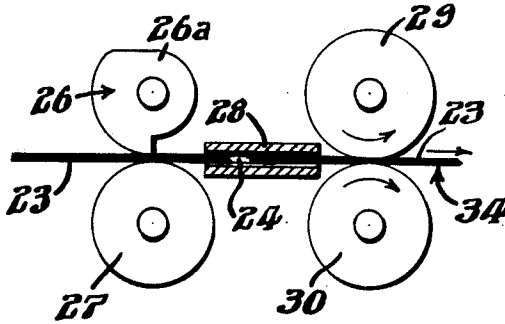


FIG. 8 -

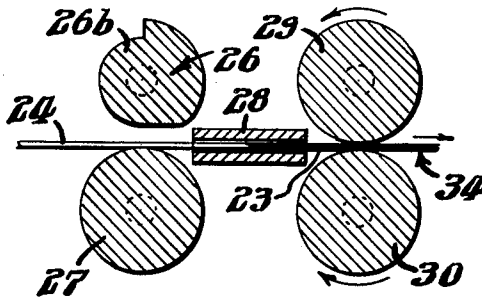


FIG. 9 -

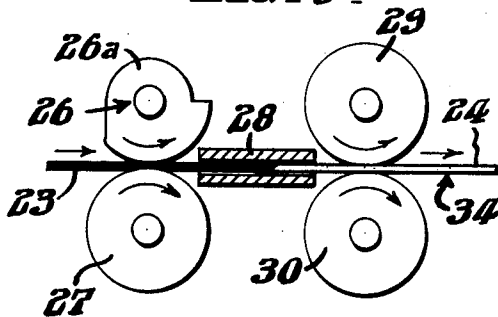


FIG. 10 -

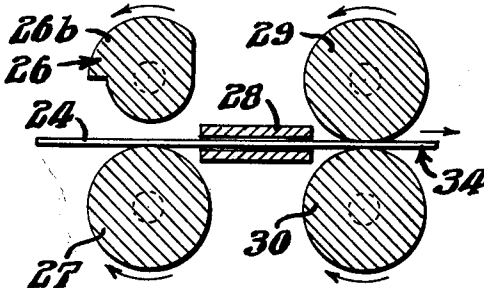


FIG. 11 -

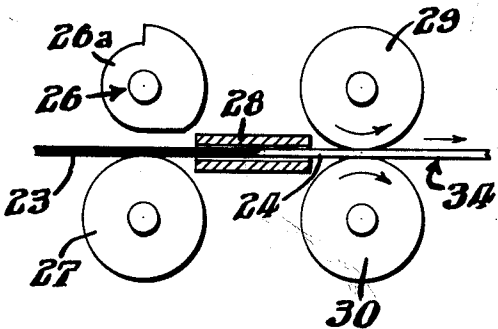
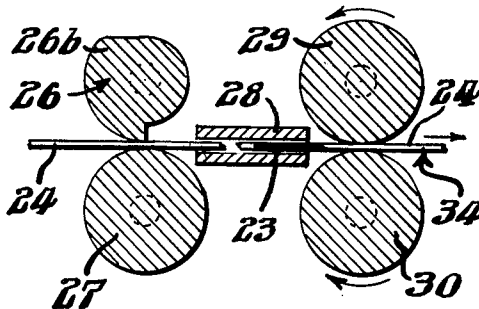


FIG. 12 -



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1

3,176,351

APPARATUS FOR PRODUCING COMPOSITE
YARN

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Filed Sept. 6, 1963, Ser. No. 397,202

7 Claims. (Cl. 19—236)

This invention relates to apparatus for producing a
composite yarn.

A principal object of the present invention is to provide means for producing a composite yarn in which alternate lengthwise sections of the yarn consist of fibers having different characteristics from those of the other alternate sections.

Another object of my invention is to provide apparatus for producing a continuous yarn of which a first section includes fibers having a first characteristic followed by a section of yarn which includes fibers having a second characteristic, followed in turn by a section of yarn which includes fibers of the first type, and so on alternately. At the junctions of the sections, an overlap condition exists and the yarn includes fibers of both characteristics.

The fibers of the successive sections of the composite yarn may be different in their natural characteristics, or they may be merely different in that they have been pre-dyed to different colors or to different shades of the same color. The fibers of one series of alternate sections may, for example, be natural, such as cotton, and the fibers of the other alternate sections may be synthetic, such as cut or broken acetate rayon staple. Or, the fibers of both series of sections may be synthetic. For example, one series of alternate sections may be nylon staple and the succeeding series of alternate sections may be Orlon staple. Or, the different sections may be different blends of fibers. In brief, the present invention is not limited by any specific fibers or combination of fibers normally used in making spun yarn.

My invention will be clear from a consideration of the following detailed description, taken together with the drawings, in which:

FIG. 1 is a diagrammatic perspective illustration of apparatus according to the present invention;

FIG. 2 is a diagrammatic perspective view of the gate rollers employed in the apparatus of the present invention;

FIGS. 3-6 are diagrammatic perspective illustrations, partly broken away, showing successive actions of the gate rollers;

FIGS. 7-12 are diagrammatic side elevations showing successive actions of the gate rollers;

FIGS. 13 and 14 are greatly enlarged diagrammatic illustrations of the junction points identified in FIGS. 4 and 6, respectively, by the circles XIII and XIV;

FIGS. 15 and 16 are greatly enlarged diagrams to illustrate the merging of the fibers at the junction points identified in FIG. 1 by the circles XV and XVI, respectively;

FIG. 17 is a perspective illustration of a modification of the apparatus of FIG. 1, and;

FIGS. 18 and 19 are diagrammatic top views looking down along the lines XVIII and XIX of FIGS. 1 and 17, respectively.

Referring now to FIG. 1, the reference numerals 21 and 22 identify two supply bobbins of twisted roving or sliver the fibers of which differ from each other in some way. For convenience in explaining the present invention, the fibers of bobbin 21 will be assumed to have been pre-dyed black and the fibers of bobbin 22 will be

2

assumed to be white. In actual practice, in many instances, the fibers of bobbin 21 will be of one type, such as cotton, while the fibers of bobbin 22 will be of another type, for example, cut or broken synthetic staple, such as acetate or nylon or Dacron. It will be understood that, so far as the present invention is concerned, the only requirement is that the fibers of the two bobbins 21 and 22 be different in some significant characteristic.

In FIG. 1, the black sliver 23 and the white sliver 24 are shown to be passed over a guide bar 25 and then in converging manner between upper and lower gate rollers 26 and 27 into a converging device represented in FIG. 1 as a trumpet 28. The output of the trumpet 28 is a composite sliver 34 which is fed to a conventional drafting stage comprising a pair of feed-in rolls 29 and 30 followed by a pair of delivery rolls 31 and 32. A conventional apron 43 and tension roller 44 may be provided in the drafting stage between the feed-in rolls 29, 30 and the delivery rolls 31, 32. The drafted composite sliver 34 delivered from the delivery rolls 31, 32 is passed through an eye 35 and thence to a roving frame, or a drafting frame, or to a spinning frame as represented in FIG. 1 by the bobbin 36.

The rollers 26 and 27 are referred to herein as "gate rollers" since these rollers function as a gate in that they determine whether or not the slivers 23, 24 presented thereto pass therethrough. The lower roller 27 is a conventional one-piece cylindrical roller, but the upper roller 26 is a two-part roller having complementary parts 26a and 26b which form, with lower roller 27, a dual gate, the one gate being open when the other is closed, and vice versa. For additional clarity, the two-part upper roller 26 is shown by itself in perspective in FIG. 2.

Each of the roller parts 26a and 26b of roller 26 has an angular sector which is of full diameter; the remainder of each roller part 26a and 26b is of reduced diameter. The full-diameter sector may occupy about 140° of the total periphery. As already indicated, the full-diameter sectors of the two parts 26a and 26b are complementary. This is seen clearly in FIGS. 7-12 where FIGS. 7, 9 and 11 are diagrammatic elevational views showing roller part 26a in three angular positions, and FIGS. 8, 10 and 12 are corresponding views of roller part 26b. For example, when part 26a is in the angular position shown in FIG. 7, part 26b is in the angular position shown in FIG. 8. The same relationship applies to FIGS. 9 and 10; also to FIGS. 11 and 12.

As clearly illustrated in FIGS. 7-12, the two-part upper gate roller 26 is so spaced above the lower roller 27 that when the roller 26 is driven rotationally to the angular position shown in FIGS. 7 and 8, the full diameter portion of part 26a will engage the peripheral surface of the lower roller 27, whereas the reduced diameter portion of part 26b will be above and will clear the peripheral surface of the roller 27, leaving a space therebetween. Similarly, when the upper roller 26 is in the angular position shown in FIGS. 11 and 12, the full diameter portion of part 26b will engage the lower roller 27 while the reduced diameter portion of part 26a will clear roller 27.

The distance between the nip of the gate rollers 26 and 27 and the nip of the feed-in rolls 29 and 30 may be varied, similar to the manner in which the ratch between the feed-in rolls and delivery rolls may be varied, as is well known in the art. Although not essential to the present invention, the distance between the nip of the gate rolls and the nip of the feed-in rolls may preferably be adjusted to be slightly greater than the expected maximum fiber length of the fibers in the sliver. For example, if the fibers in the slivers 23 and 24 have an expected maximum length of two inches, then the distance between the nip of the gate rolls and the nip of

the feed rolls may preferably be made slightly greater than two inches. This allows the sliver 23 or 24 to be pulled apart, as will be described, without actually breaking the individual fibers, or at least breaking only those relatively few fibers which exceed the expected maximum length.

The upper two-part gate roller 26 is driven intermittently by any suitable means, at intervals which are controlled according to the section lengths desired for the successive sections of the composite continuous yarn to be made.

Solely for the purpose of illustrating one form of suitable intermittent drive, the shafts of the gate rollers 26 and 27 are shown to be connected together by the meshed spur gears 46 and 47, and the upper roller 26 is shown to be driven intermittently by a chain drive 37 having depending lugs 38 at spaced-apart intervals. Upper roller 26 is provided with a portion 26c having upstanding lugs 39, 40 at 180° spacing. When the depending lug 38 of chain drive 37 engages one of the upstanding lugs 39 or 40, the upper gate roller 26 is driven rotationally through an angular distance. It will be assumed that the chain drive follows an arcuate path and is so arranged that the lug 38 drives the upper roller 26 through 180°.

In FIG. 1, the chain lug 38 is shown to be approaching, but not in driving engagement with, the lug 39, and, accordingly, the gate rollers 26 and 27 are stationary. The angular position of the upper roller 26 at this moment is shown in perspective, partly broken away, in FIG. 6, and is shown in elevation in FIGS. 7 and 8 in which FIG. 7 shows the roller part 26a and FIG. 8 shows the roller part 26b. As seen in FIGS. 6 and 7, the full diameter portion of the upper roller part 26a is in engagement with the peripheral surface of the lower roller 27. Since the rollers 26 and 27 are not rotating, the black sliver 23 is pinched between the roller part 26a and the roller 27, and as the feed-in rolls 29, 30 continue to rotate, the pinched black sliver 23 becomes stretched and strained, and then severs or parts completely between the pinch point and the feed-in rollers 29, 30, with theoretically one-half of the fibers extending forwardly of the pinch point for varying lengths, forming a terminal portion which tapers from full size at the pinch point to but a few fibers at the extreme end.

At the instant now being described, the other part 26b of upper roller 26 is in the angular position illustrated in FIG. 8 in which its reduced diameter portion is opposite the lower roller 27. Accordingly, there is a space between the roller part 26b and the lower roller 27 through which the white sliver 24 is drawn by the feed-in rolls 29, 30.

Referring again to FIG. 1, when the depending lug 38 of chain 37 contacts the upstanding lug 39 of roller part 26c, the upper roller 26 is driven counterclockwise, as viewed in the drawing, and the lower roller 27 is driven clockwise, through the meshed gears 46, 47. When this occurs, the black sliver 23, which had been stop-pinchd as described above, is now pushed forwardly by the pressure applied thereto by the rotating roller part 26a and roller 27, as illustrated in FIGS. 3 and 9. This pushing forward of the black sliver 23 continues during the 180° angular rotation of the roller 26, and as a result, the tapered forward end of the black sliver 23, which had protruded forwardly of the pinch point, is now pushed into the forward part or apex of the trumpet 28 which may preferably extend forward almost to the nip of the feed-in rolls 29, 30 as indicated in FIGS. 7-12, and 18, 19. These fibers of the black sliver are carried along through the apex of the trumpet into the nip of the feed-in rolls 29, 30 by the fibers of the white sliver 24 which is being drawn through the confining aperture. In the embodiment shown in FIG. 1, the peripheral dimension of the full diameter sector of roller part 26a should be of sufficient length to accomplish the desired pushing of the tapered forward end of the black sliver into the nip of the

feed-in rolls 29, 30, or at least sufficiently into the trumpet so that the fibers at the trailing tapered end of the white sliver will carry the black fibers into the nip of the feed-in rolls.

At the conclusion of 180° of counter-clockwise rotation of rollers 26, 27, from the position indicated in FIGS. 6 and 7, the lug 38 of drive chain 37 discontinues its engagement with the lug 39 of roller 26, and the rotation of the gate rollers 26 and 27 then terminates leaving the roller parts 26a and 26b in the angular positions shown in FIGS. 4, 11 and 12. The white sliver 24 is now pinched by the pressure of the stopped rollers 26b and 27. As the feed-in rolls 29 and 30 continue to rotate, they continue to draw the white sliver forward, and this sliver, being stop-pinchd at the nip of the gate rollers, becomes so stretched and strained that it severs between the pinch point and the nip of the rolls 29, 30, as indicated in FIG. 4. As already mentioned, this desired result may be facilitated by locating the gate rollers 26 and 27 ahead of the feed-in rolls 29 and 30 by such distance that the sliver distance between the nips of these two pairs of rolls 26, 27 and 29, 30 is slightly greater than the maximum expected length of the fibers in the sliver. Thus, while the strained sliver becomes completely severed, few if any of the fibers of the sliver are actually broken. The longitudinal tension on the sliver merely pulls the sliver apart. Those fibers whose forward end is caught in the nip of the feed-in rolls 29, 30 but whose trailing end is beyond the nip of the gate rollers 26, 27 are pulled away from the other fibers of the sliver whose forward end has not yet reached the nip of the feed-in rolls but whose rearward portion is caught in the nip of the now stopped gate rollers. Thus, the total number of fibers in the cross section of the trailing portion of the severed sliver decreases from the full number at the nip of the rolls 29, 30, to but a very few fibers at the extreme end, and the trailing portion may be said to be tapered. Similarly, the leading end portion of the severed sliver, which is now pinched by the pressure of the now stopped gate rollers, has a decreasing number of fibers in its cross section, and may also be said to be tapered from the pinch point forward.

In the present discussion, as the feed-in rolls 29, 30 draw the now severed white sliver 24 forward through the confining aperture at the apex of the trumpet 28, the white fibers at the tapered trailing end of sliver 24 tend to carry along into the nip of the rolls 29, 30, the black fibers of the tapered forward end of sliver 23 which have been pushed into the apex region of the trumpet by the 180° rotation of the gate rollers. The aperture of the trumpet is so sized as to merge the tapered portion of the trailing end of the severed white sliver 23 with the tapered forward end of the black sliver 24.

The black sliver 23 now is exclusively drawn by the feed-in rolls 29, 30 until such time as the next lug 38 of drive chain 37 encounters the now upstanding lug 40 of the gate roller part 26c. When this occurs, the gate rollers 26 and 27 are again driven through 180° of rotation, as indicated in FIG. 5, and the tapered end of the white sliver 24, which had been pinch-stopped by the part 26b, is now pushed forwardly into the apertured apex region of the trumpet 28. At the conclusion of 180° of rotation, the upper gate roller 26 is in the angular position depicted in FIGS. 6, 7 and 8, and the roller drive ceases. The black sliver 23 is now stop-pinchd by the part 26a, and as the feed-in rolls 29, 30 continue to rotate and to draw the black sliver, the black sliver 23 comes apart between the pinch point and the rolls 29, 30, as indicated in FIGS. 6 and 7. As the feed-in rolls 29, 30 continue to draw the now severed black sliver 23 through the confining aperture of the trumpet 28, the white fibers at the tapered forward end of the white sliver 24 are carried along with the black fibers at the trailing end of the black sliver 23 into the nip of the rolls 29, 30, and a merger takes place in the confining aper-

ture of the trumpet between the tapered trailing end portion of the black sliver 23 and the tapered forward end portion of the white sliver 24. The actions described above are repeated and a composite sliver 34 is formed having alternate black and white sections. This sliver may be passed through the nip of the delivery rolls 31, 32, then through the fixed guide eye 35, and then through the rotating eye 36a of a spinning frame and wound on to the bobbin 36. As the sliver or yarn is wound about the bobbin 36 by the rotating eye 36a, a slight twist is imparted to the yarn, which is reflected back to the nip of the delivery rolls 31, 32. This twist is indicated diagrammatically in FIGS. 15 and 16 of the drawing, which depict the junctions of the black and white sections at the points indicated in FIG. 1 by the dot-and-dash circles XV and XVI.

While I have shown the composite sliver 34 as being fed to a spinning frame, it will be understood that the composite sliver could be fed to a drafting or a roving frame for further drafting or blending operations before being spun into a final yarn.

It will be seen that by the means disclosed, a continuous yarn may be produced in which for a preselected length the fibers are exclusively of one type, as provided by one supply package, followed by a section of preselected length in which all of the fibers in the yarn are exclusively of another type as supplied by a second supply package, and so on alternately. Of course, at the junction of the sections, fibers from both supply packages overlap.

The technique employed may be expanded to include three (or more) different supplies to form a composite sliver having three (or more) series of repeating sections of fibers of different characteristics. In such case, the upper gate roller 26 would be required to have three (or more) parts each adapted to establish a pinching relation with the lower gate roller for a different 120° of peripheral surface.

In FIG. 1, the merging device for bringing the fibers of one sliver into merging relationship with the fibers of the second sliver is represented as being the trumpet 28 having a confining aperture at the apex thereof. In lieu of a trumpet, the merging device could, as illustrated in FIG. 17, preferably be formed from a moving endless belt or apron 51 having mounted thereabove, in proximity thereto, an open bottom V-shaped channel member 52, having a confining throat at the forward end thereof. The apron 51 may be driven by the delivery rolls 29, 30. In this form of merging device, the fibers at the forward end of the sliver which had previously been pinch-stopped by the gate rollers 26, 27, and which are now pushed forward by the rotation of the gate rollers, are carried into the merging device, into the throat at the forward end thereof, and into the nip of the rolls 29, 30, by the forward movement of the apron. Thus, in this form, the peripheral dimensions of the full-diameter sectors of the gate-roller parts 26a and 26b need only be long enough to push the tapered forward end of the sliver on to the apron 51.

The use of an adjustable intermittent form of drive for the gate rollers permits the section lengths of the composite yarn being formed to be selected and varied as desired. It is not essential to the concept of the present invention that the alternating sections of yarn be of equal length. The intermittent drive may be arranged to provide sections of different lengths.

While the preferred embodiment of this invention has been described in some detail, it will be obvious to one skilled in the art that various modifications may be made

without departing from the invention as hereinafter claimed.

Having described my invention, I claim:

1. Apparatus for producing continuous composite textile yarn comprised of a repeating pattern of successive sections of fibers having different characteristics, said apparatus comprising: means for supplying a first sliver of fibers having a first characteristic; means for supplying a second sliver of fibers having a second characteristic; a drafting stage including a pair of back nip rolls; first and second complementary pressure roller gate means disposed rearward of said back nip rolls and forward of said first and second supply means for applying pressure selectively to one or the other of said first and second slivers for controlling the forward movement of said slivers toward said back nip rolls; merging means disposed between said gate means and said back nip rolls and into which the output of said gate means is convergently fed, said merging means including a confining aperture sized to merge said slivers; and intermittent means for operating said complementary pressure roller gate means at selected intervals to control selectively the feed of said first and second slivers into said merging means; said complementary pressure roller gate means including an upper and a lower roller, the upper one having first and second coaxial portions adjacent to each other, each of said adjacent portions having a full diameter sector and a reduced diameter sector, the full diameter sectors of said adjacent portions being disposed at different angular positions relative to each other, the full diameter sector of each portion being of a dimension to engage with the peripheral surface of the lower of the pressure gate rollers.

2. Apparatus according to claim 1 characterized in that the full diameter sector of each of said adjacent portions is less than 180°.

3. Apparatus according to claim 2 characterized in that the means for operating the pressure roller gate means comprises intermittent drive means for rotating the pressure rollers through 180° at selected intervals.

4. Apparatus according to claim 3 characterized in that said merging means comprises a V-shaped structure having its wide end facing the pressure gate rollers and having a confining aperture at its apex through which the sliver is drawn by said back nip rolls.

5. Apparatus according to claim 4 further characterized in that the gate rollers are so disposed in front of the back nip rolls that the sliver distance between the nip of the gate rollers and the nip of the back nip rolls is greater than the maximum length of most of the fibers in the sliver.

6. Apparatus according to claim 5 further characterized in that said V-shaped structure has an open bottom, and in that an endless conveyor belt is mounted just below said V-shaped structure for carrying the sliver toward said confining aperture.

7. Apparatus according to claim 6 further characterized in that the peripheral length of the full diameter sector of each of the complementary gate roller portions is at least as long as the distance between the nip of the gate rollers and said endless belt.

References Cited by the Examiner

UNITED STATES PATENTS

320,344	6/85	Fuyat et al.	57—38.3
928,830	7/09	Wood	57—38.3
928,831	7/09	Wood	57—139
3,082,593	3/63	Rhyne	57—139

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