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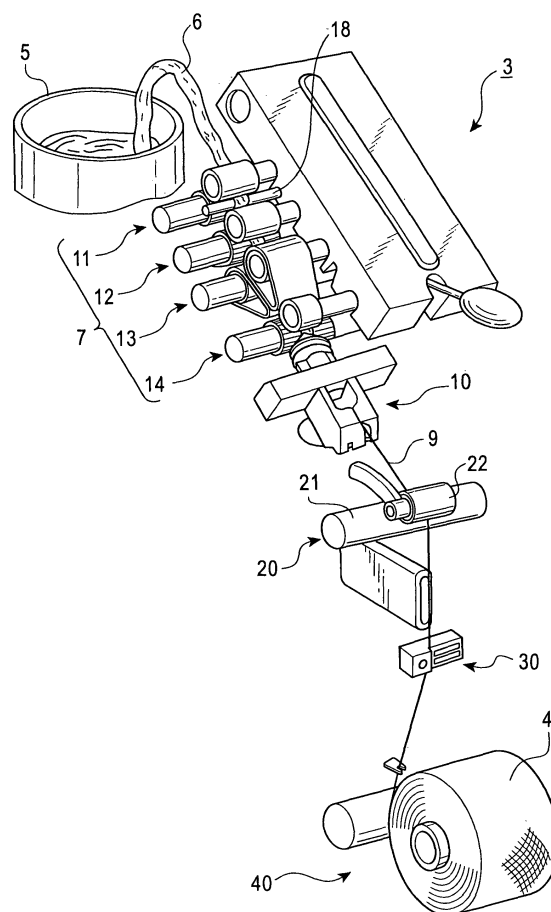
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(54) **Draft device in pneumatic spinning device**

(57) In a pneumatic spinning machine 3, when a too thin sliver 6 is used as a material, the sliver 6 may slip out or its quality may be degraded. However, when a thick sliver 6 is utilized in order to prevent the above problem, the quality may also be degraded owing to the limitation of the drawing magnification of a draft device 7 in the pneumatic spinning machine 3. According to the present invention, a draft device 7 is provided in a pneumatic spinning machine 3 that spins out a spun yarn 9 using a sliver 6 supplied by a drawing frame 2. The draft device 7 includes four pairs of draft rollers, a back roller pair 11, a third roller pair 12, a second roller pair 13, and a front roller pair 14 arranged along a path on which the sliver 6 is conveyed. Further, the conveyance path of the sliver 6 is divided into a first section A, a second section B, and a third section C, each of which sections are enclosed by adjacent draft roller pairs. A fiber running control member 18 is arranged in the first section A to bend the conveyance path of the sliver 6 while the sliver 6 is being conveyed in the first section A (Fig.2).

FIG. 2



## Description

### Field of the Invention

**[0001]** The present invention relates to a draft device in a pneumatic spinning machine that manufactures a spun yarn using a sliver produced by a drawing frame and directly supplied to the pneumatic spinning machine without using a roving frame.

### Background of the Invention

**[0002]** A spinning process mainly includes the following three operations: an operation 1 of drawing fibers straight and arranging them parallel to one another, an operation 2 of converging the parallel fibers into a string (sliver) and sequentially drawing the sliver so as to reduce its thickness while correcting the unevenness of the thickness, and an operation 3 of drawing the sliver to a required thickness and then twisting the sliver into a spun yarn.

**[0003]** A process for spinning a cotton yarn, e.g. ring spinning, includes a carding process (corresponding to the operation 1), a drawing process (corresponding to the operation 2), a roving process (corresponding to the operations 2 and 3), and a spinning process (corresponding to the operations 2 and 3). In contrast, pneumatic spinning includes a carding process (corresponding to the operation 1), a drawing process (corresponding to the operation 2), and a spinning process (corresponding to the operations 2 and 3). In the pneumatic spinning, the roving process, which is present in the ring spinning, is omitted.

**[0004]** A drawing frame that executes the drawing process comprises plural pairs of draft rollers between which a sliver is sandwiched. The sliver is drawn by increasing the rotation speed of a feed-out side than that of a feed-in side.

**[0005]** A roving frame that executes the roving process comprises a draft device that further draws the sliver subjected to the drawing process and a twisting device that slightly twists the sliver. The roving frame generates roving yarn. The draft device provided in the roving frame is, for example, a pair of draft rollers, and the twisting device is, for example, a flyer.

**[0006]** A spinning machine that executes the spinning process comprises a draft device that further draws the roving yarn resulting from the roving process (in the case of ring spinning) or the sliver resulting from the drawing process (in the case of pneumatic spinning), and a twisting device that twists the drawn roving yarn or sliver.

**[0007]** In particular, a well-known draft device in a drawing frame is composed of four pairs of draft rollers. Moreover, as shown in paragraphs 0009 and 0013 in the Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 5-56968, a technique is also known in the prior art in which the draft device composed of the four pairs of draft rollers includes a pressure bar

that controllably presses the sliver. The pressure bar enables the sliver to be further drawn.

**[0008]** The pneumatic spinning machine manufactures a spun yarn by directly spinning a sliver produced by a drawing frame. Thus, the sliver supplied to the pneumatic spinning machine needs to have been subjected to the operation 2 by the drawing frame so as to have a size with which the sliver can be drawn by the spinning machine. That is, the drawing frame must perform the operations of converging the parallel fibers into a string and sequentially drawing the string (sliver) so as to reduce its thickness to a suitable thickness for supply to the pneumatic spinning machine while correcting the unevenness of the thickness.

**[0009]** However, if the sliver generated by the drawing frame is too thin, when the sliver in a can (a sliver container) is supplied to a trumpet (sliver introducing section) of the draft device in the spinning machine, the sliver may slip out. Further, high draft in itself achieved by the drawing frame is limited.

Accordingly, when an attempt is made to force a general-purpose drawing frame to generate a thin sliver, the quality of the sliver may be degraded.

**[0010]** On the other hand, if the sliver produced by the drawing frame is thick, when such a thick sliver is directly supplied to the spinning machine, a draft ratio (drawing magnification) in the spinning machine must be increased. This requires the rotation speed ratio (peripheral speed ratio) between the upstream side draft roller and the downstream side draft roller in the spinning machine to be set at a large value. This in turn lowers a draft force (a force that pulls a group of fibers) exerted on the fibers conveyed between the draft rollers. As a consequence, floating fibers cannot be controlled, resulting in an uneven yarn thickness. Therefore, yarn quality may be degraded.

**[0011]** That is, a problem to be solved is that in the pneumatic spinning machine, when too thin sliver is used as a material, the sliver may slip out or its quality may be degraded, and that when a thick sliver is utilized in order to prevent the above problem, the quality may also be degraded because of the limits to the drawing magnification of the draft device in the pneumatic spinning machine.

### Summary of the Invention

**[0012]** A description has been given of the problems to be solved by the present invention. Now, a description will be given of means for solving the problems.

**[0013]** According to an aspect of the present invention set forth in Claim 1, there is provided a draft device in a pneumatic spinning machine that manufactures a spun yarn using a sliver produced by a drawing frame and then directly supplied to the spinning machine, the draft device being characterized by comprising plural pairs of draft rollers, which draw the sliver and are provided along a path on which the sliver is conveyed, and a fiber running

control member arranged in at least one of a number of sections into which the conveyance path is divided, each of which sections are enclosed by the adjacent pairs of draft rollers, the fiber running control member bending the conveyance path of the sliver while the sliver is being conveyed in that section.

**[0014]** According to an aspect of the present invention set forth in Claim 2, the draft device in the pneumatic spinning machine further comprises a position adjusting device that enables variation of an attachment position of the fiber running control member in a direction orthogonal to the conveyance path.

**[0015]** According to an aspect of the present invention set forth in Claim 3, the fiber running control member and a conveyance guiding member for a sliver are arranged in one or more of the sections, and the section in which the fiber running control member is arranged is different from the section in which the conveyance guiding member is arranged.

**[0016]** The present invention exerts the effects described below.

**[0017]** The aspect of the present invention set forth in Claim 1 can prevent yarn physical properties from being degraded (a decrease in uniformity ratio and defects) owing to the limitation of the drawing magnification of a draft device while using a sliver having a thickness appropriate for preventing the sliver from slipping out of a trumpet arranged in a sliver introducing section of a draft device or from having its quality degraded as a result of an overload imposed in the drawing frame.

**[0018]** The aspect of the present invention set forth in Claim 2 not only exerts the effects of the aspect in Claim 1 but also allows the use of a thicker sliver.

**[0019]** The aspect of the present invention set forth in Claim 3 not only exerts the effect of the aspect in Claim 1 or Claim 2 but also prevents the fibers constituting the sliver from being disturbed in spite of the provision of both the fiber running control member and the conveyance guiding member.

#### Brief Description of the Drawings

##### **[0020]**

Figure 1 is a schematic view of a spinning process in pneumatic spinning after a carding process.

Figure 2 is a perspective view showing a pneumatic spinning machine in accordance with a first embodiment.

Figure 3 is a side view schematically showing the configuration of a draft device in accordance with the first embodiment.

Figure 4 is a plan view schematically showing the configuration of the draft device in accordance with the first embodiment.

Figure 5 is a side view schematically showing the configuration of a draft device in accordance with a second embodiment.

Figure 6 is a plan view schematically showing the configuration of the draft device in accordance with the second embodiment.

#### 5 Detailed Description of the Preferred Embodiments

**[0021]** Embodiments of the present invention will be described with reference to the drawings. Two embodiments of the present invention will be described below.

10 First, a description will be given of the configuration of a draft device 7 that is a first embodiment. Then, a description will be given of the configuration of a draft device 107 that is a second embodiment. The difference between these embodiments is the numbers and arrangements of conveyance guiding members for a sliver (described later) and fiber running control members (described later) provided in the draft device.

15 **[0022]** First, an outline of a spinning process in pneumatic spinning will be described with reference to Figure 1. In case of the pneumatic spinning, in the spun yarn manufacturing process, a carding process is followed by a drawing process and a spinning process. The carding process is executed by a carding machine 1, and the drawing process is executed by a drawing frame 2, and the spinning process is executed by a pneumatic spinning machine 3.

20 **[0023]** A sliver generated by the drawing frame 2 is once accommodated in a can (sliver container) 5. The sliver 6 taken out of the can 5 is supplied to the pneumatic spinning machine 3. The pneumatic spinning machine 3 comprises a draft device 7 (first embodiment) that further draws the sliver 6 supplied from the can 5 and a pneumatic spinning device 10 that spins the sliver 6 drawn by the draft device 7 to generate a spun yarn 9. The pneumatic spinning device 10 spins the spun yarn 9 by using an air current. The spun yarn 9 generated by the pneumatic spinning machine 3 is wound around a bobbin to form a winding package 4.

25 **[0024]** With reference to Figure 2, a description will be given of the pneumatic spinning machine 3 in accordance with the present embodiment. The following are arranged in the following order along a path (hereinafter referred to as a manufacturing path) through which the spun yarn 9 is manufactured from the sliver 6: the can 5 located at the most upstream position on the manufacturing path, the draft device 7, the pneumatic spinning device 10, a yarn feeding device 20, a yarn defect detecting device 30, and a yarn winding device 40. In the specification, an arrangement composed of the draft device 7 and the pneumatic spinning device 10 is called the pneumatic spinning machine 3. However, the pneumatic spinning machine may be an arrangement further including other devices on the manufacturing path.

30 **[0025]** The yarn feeding device 20 feeds the spun yarn 9 manufactured by the pneumatic spinning device 10 to the yarn winding device 40, and the yarn feeding device 20 comprises a delivery roller 21 and a nip roller 22 that nip and feed the spun yarn 9. The yarn defect detecting

device 30 detects a yarn defect in the spun yarn 9 being fed to the yarn winding device 40. On the basis of yarn defect detection information obtained by the yarn defect detecting device 30, a defective yarn is prevented from being wound into the winding package 4. The yarn winding device 40 traverses the spun yarn 9 manufactured by the pneumatic spinning device 10, in an axial direction of the bobbin to wind and form the spun yarn 9 into the winding package 4.

**[0026]** The pneumatic spinning machine 3 manufactures a fasciated spun yarn by causing a whirling current to act on a bundle of fibers in a pneumatic spinning nozzle (contained in the pneumatic spinning device 10). The pneumatic spinning machine 3 in accordance with the present embodiment has a spinning speed of 300 to 400 m/min and can thus achieve high speed spinning approximately 20 times as fast as a ring spinning machine having a spinning speed of 20 to 30 m/min.

**[0027]** With reference to Figures 3 and 4, a description will be given of the configuration of the draft device 7, provided in the pneumatic spinning machine 3. The draft device 7 comprises four pairs of draft rollers between which the sliver 6 is sandwiched. The four pairs of draft rollers are arranged in a direction in which the sliver 6 is conveyed and comprise a pair of back rollers 11, a pair of third rollers 12, a pair of second rollers 13, and a pair of front rollers 14. Each pair of draft rollers sandwiches the sliver 6 in an up-and-down direction (in the direction of the gravity), and the pair of draft rollers comprises a top roller in an upper side and a bottom roller in a lower side. The pair of back rollers 11 comprises a back top roller 11U and a back bottom roller 11D. The pair of third rollers 12 comprises a third top roller 12U and a third bottom roller 12D. The pair of second rollers 13 comprises a second top roller 13U and a second bottom roller 13D. The pair of front rollers 14 comprises a front top roller 14U and a front bottom roller 14D.

**[0028]** To make surface contact with the sliver 6, the pair of second rollers 13 is provided with an apron top belt 15U corresponding to the second top roller 13U and an apron bottom belt 15D corresponding to the second bottom roller 13D. The apron top belt 15U is wound around the second top roller 13U and an apron guide 16U arranged in the downstream side of the second top roller 13U in a direction in which the sliver 6 is conveyed. The apron bottom belt 15D is wound around the second bottom roller 13D and an apron guide 16D arranged in the downstream side of the second bottom roller 13D in the direction in which the sliver 6 is conveyed.

**[0029]** The sliver 6 is drawn by making a difference in peripheral speed between the adjacent draft roller pairs. For example, it is assumed that a pair of back rollers 11 have a peripheral speed of 1, while a pair of third rollers 12 have a peripheral speed of 2. The sliver 6 is drawn between a pair of back rollers 11 and a pair of third rollers 12 so as to double its length. In particular, since the sliver 6 is held between the apron top belt 15U and the apron bottom belt 15D by the surface contact, the peripheral

speed ratio between a pair of second rollers 13 and a pair of front draft rollers 14 is maximized without causing the sliver 6 to slip. Accordingly, the sliver 6 is drawn to the maximum between a pair of second rollers 13 and a pair of front draft rollers 14. Here, the peripheral speed of a pair of draft rollers means the peripheral speed of the top roller and the bottom roller constituting each draft roller pair.

**[0030]** The draft device 7 is provided with various conveyance guiding members for the sliver 6 and fiber running control members in addition to four pairs of draft rollers. A trumpet 17 is provided in an introducing portion where the sliver 6 is introduced into the draft device 7, and the trumpet 17 serves as a conveyance guiding member for the sliver 6. A fiber running control member 18 is provided in the draft device 7 and the fiber running control member 18 serves as means for enhancing the inter-fiber resistance of the sliver 6.

**[0031]** In the draft device 7, a conveyance path of the sliver 6 is divided into the following sections, each of which sections are enclosed by adjacent draft roller pairs: a first section A, a second section B, and a third section C. The first section A extends from a pair of back rollers 11 to a pair of third rollers 12. The second section B extends from a pair of third rollers 12 to a pair of second rollers 13. The third section C extends from a pair of second rollers 13 to a pair of front rollers 14.

**[0032]** The fiber running control member 18 is arranged in the first section A. The fiber running control member 18 is, for example, a bar-like cylindrical member having an axial length larger than the maximum width of the sliver 6. The fiber running control member 18 is brought into contact with the sliver 6 running in the first section A from a side of the conveyance path (from above or below), and the fiber running control member 18 then presses the sliver 6. The sliver 6 pushed from the side of the conveyance path runs in the first section A along a curved path bent by the pressure of the fiber running control member 18 instead of a linear path that is the shortest distance from a pair of back rollers 11 to a pair of third rollers 12.

**[0033]** The conveyance path of the sliver 6 between the draft rollers pairs is thus curved to increase the inter-fiber resistance of the sliver 6 pulled between the draft rollers pairs. That is, a draft force (a force that pulls a group of fibers) is increased. This increases the draft ratio (drawing magnification) between the draft roller pairs arranged adjacent to each other. Consequently, a decrease in draft force is avoided even if the difference in peripheral speed between the adjacent draft roller pairs is increased. The draft force can be increased by gauge adjustment that reduces the pitch (for example, the distance of the first section A in Figure 3) between the adjacent draft roller pairs. A drawing magnification that cannot be increased only by the gauge adjustment can be dealt with by using the fiber running member 18 adapted to increase the inter-fiber resistance of the sliver 6. Therefore, the draft device 7 can draw the sliver 6 more signif-

icantly than a draft device simply comprising four pairs of draft rollers for drawing. Further, by the increase in the inter-fiber resistance of the sliver 6, an appropriate tension applies to floating fibers (fibers not held by the upstream side draft roller pair and the downstream side draft roller pair). This makes it possible to control the behavior of the fibers and prevent the direction of the fibers from varying, achieving stable draft.

**[0034]** The fiber running control member 18 is attached to an attachment portion 19 of a main body frame of the draft device 7. The attachment position of the fiber running control member 18 to the attachment portion 19 is variable in a direction orthogonal to the conveying direction of the sliver 6. In the present embodiment, the fiber running control member 18 is arranged so as to urge the sliver 6 upward. It is possible to continuously or intermittently vary the attachment position of the fiber running control member 18 to the attachment portion 19. The pressing force exerted on the sliver 6 by the fiber running control member 18 can be varied to more flexibly adapt the fiber running control member 18 for a target drawing magnification that cannot be dealt with by the gauge adjustment.

**[0035]** Instead of the direct fixation of the fiber running control member 18 to the attachment portion 19, it is possible to use the indirect fixation of the fiber running control member 18 via a spring. Specifically, for example, the opposite sides of the fiber running control member 18 are supported, via the spring, by a support frame that can be attached to the attachment portion 19 at a variable position, and a support section may use bolts or the like to adjust the length to arbitrarily vary a spring force. In this case, a variable direction of the attachment position of the support frame to the attachment portion 19 and the urging direction of the fiber running control member 18 by the spring are orthogonal to the conveying direction of the sliver 6. When the fiber running control member 18 is urged downward, the weight of the fiber running control member 18 may be varied, and a weight may be hung.

**[0036]** The fiber running control member 18 may be arranged in the second section B or the third section C instead of the first section A. In this case, higher effects are exerted when the fiber running control member 18 is arranged in more upstream side in the conveying direction of the sliver 6. However, the fiber running control member 18 can effectively increase the inter-fiber resistance of the sliver 6 only under a drawing action, and the fiber running control member 18 cannot achieve the increase of the inter-fiber resistance of the sliver 6 in the upstream side to a pair of back rollers 11. That is, the arrangement position of the fiber running control member 18 is limited to within one of the section A, the section B, and the section C.

**[0037]** When the fiber running control member 18 is arranged in the third section C, the possible arrangement position of the fiber running control member 18 lies somewhere between the terminals of the apron top belt 15U

and the apron bottom belt 15D, and a pair of front rollers 14.

**[0038]** Now, with reference to Figures 5 and 6, a description will be given of the draft device 107 as a second embodiment of the present invention. The draft device 107 differs from the above draft device 7 (first embodiment) in the following two points: the arrangement position of the fiber running control member 18 and the provision of a condenser 20 serving as a conveying guiding member for the sliver 6 in addition to the trumpet 17. The other constitutions of the draft device 107 are the same as those of the draft device 7, and further, the draft device 107 constitutes a part of the pneumatic spinning machine 3 similarly to the draft device 7. Therefore, the members shared by the draft device 107 and the draft device 7 are denoted by the same reference numerals with description thereof omitted.

**[0039]** In the draft device 107, the condenser 20 guiding the running of the sliver 6 is arranged in the first section A, and the fiber running control member 18 which is means for increasing the inter-fiber resistance of the sliver 6 is arranged in the second section B. As previously described, the fiber running control member 18 is desirably arranged in one of the sections A, B, C and more upstream side in the conveying direction of the sliver 6. However, it is not desirable that the fiber running control member 18 is arranged in the same section as that in which the condenser 20 is arranged. This is because the condenser 20 adjusts the running of the fibers constituting the sliver 6, and if the influence of the increase of the inter-fiber resistance by the fiber running control member 18 is added to the sliver 6, the fibers may be disturbed.

**[0040]** The other constitutions of the draft device 107 are the same as those of the draft device 7. The attachment position of the fiber running control member 18 arranged in the second section B to the attachment portion 19 of the main body frame is variable in the direction orthogonal to the conveying direction of the sliver 6.

**[0041]** A comprehensive description will be given of the draft devices provided in the pneumatic spinning machine in accordance with the present invention.

**[0042]** The draft device in accordance with the first aspect of the present invention is used in a pneumatic spinning machine that manufactures a spun yarn from a sliver produced by a drawing frame and supplied directly to the spinning machine. Plural pairs of draft rollers that draw the sliver are arranged along a path on which the sliver is conveyed, and a fiber running control member is arranged in at least one of the sections into which the conveyance path is divided, each of which sections are enclosed by adjacent pairs of draft rollers, and the fiber running control member bends the conveyance path of the sliver while the sliver is being conveyed in that section.

**[0043]** Each of the draft device 7 (first embodiment) and the draft device 107 (second embodiment) comprises four pairs of draft rollers that draw the sliver 6. Each of the draft devices 7, 107 is provided with the three sec-

tions, the first section A, second section B, and third section C into which the conveyance path of the sliver 6 is divided, each of which sections are enclosed by the adjacent draft roller pairs. The fiber running control member 18 is arranged in the first section A of the draft device 7, and the fiber running control member 18 is arranged in the second section B of the draft device 107.

[0044] Further, the draft device is not limited to the four-line type (that comprises four draft roller pairs) in accordance with the present embodiment but may be a five-line type. Other draft devices may be used provided that they comprise a plurality of draft roller pairs. In case of a five-line draft device, the fiber running control member is desirably arranged between the fourth and fifth lines (between the draft roller pair (fifth line) closest to the can and the draft roller pair (fourth line) second closest to the can). Of course, in the five-line draft device, the fiber running control member may be arranged between other adjacent draft roller pairs.

[0045] Thus, the above draft device increases the achievable drawing magnification compared to a draft device simply comprising a plurality of draft roller pairs for drawing. Further, by the increase in the inter-fiber resistance of the sliver, an appropriate tension applies to floating fibers (fibers not held by the upstream side draft roller pair and the downstream side draft roller pair). This makes it possible to control behavior of the fibers and prevent the direction of the fibers from varying, achieving stable draft. Therefore, the draft device can prevent yarn physical properties from being degraded (a decrease in uniformity ratio and defects) owing to the limitation of the drawing magnification of a draft device while using a sliver having a thickness appropriate for preventing the sliver from slipping out of a trumpet arranged in a sliver introducing section of a draft device or from having its quality degraded as a result of an overload imposed by the drawing frame.

[0046] The draft device in accordance with the second aspect of the present invention is the first aspect of the present invention having the following configuration. The draft device comprises a position adjusting device that enables variation of the attachment position of the fiber running control member in a direction orthogonal to the conveyance path.

[0047] In the first and second embodiments, the position adjusting device is composed of the attachment portion 19 to which the fiber running control member 18 is attached at a variable position. Since the attachment portion 19 is fixed to the main frame of each of the draft devices 7, 107, a change in the attachment position of the fiber running control member 18 to the attachment portion 19 means a change in the positional relationship between the fiber running control member 18 and the conveyance path of the sliver 6. Further, attachment position adjustment of the fiber running control member 18 by the position adjusting device may include at least the position adjustment in a direction orthogonal to the conveyance path. The position adjustment in a direction par-

allel to the conveyance path may be conducted simultaneously with the position adjustment in the direction orthogonal to the conveyance path.

[0048] Thus, the amount of the increase of the inter-fiber resistance of the sliver 6 by the fiber running control member 18 is variable, and this allows the target drawing magnification to be more appropriately dealt with. Therefore, a thicker sliver is available.

[0049] A draft device in accordance with a third aspect of the present invention is the first or second aspect of the present invention having the following configuration. The fiber running control member and the conveyance guiding member for the sliver are arranged in one or more of the sections, and the section in which the fiber running control member is arranged is different from the section in which the conveyance guiding member is arranged.

[0050] In the draft device 7 in accordance with the first embodiment, the conveyance path of the sliver 6 is divided into the first section A, the second section B, and the third section C, and the fiber running control member 18 is arranged in the first section A. In the draft device 107 in accordance with the second embodiment, the conveyance path of the sliver 6 is divided into the first section A, the second section B, and the third section C, and the condenser 20 is arranged in the first section A, whereas the fiber running control member 18 is arranged in the second section B.

[0051] Thus, a part of the sliver being drawn by the adjacent draft roller pairs is not subjected simultaneously to the regulation of fiber running by the conveyance guiding member (condenser) and to the increase in the inter-fiber resistance by the fiber running control member. This prevents the fibers constituting the sliver from being disturbed in spite of the provision of both the fiber running control member and the conveyance guiding member.

## Claims

1. A draft device in a pneumatic spinning machine that manufactures a spun yarn using a sliver produced by a drawing frame and then directly supplied to the spinning machine, the draft device being **characterized by** comprising plural pairs of draft rollers provided along a path on which the sliver is conveyed, the pair of draft rollers drawing the sliver, and a fiber running control member arranged in at least one of a number of sections into which the conveyance path is divided, each of which sections are enclosed by the adjacent pairs of draft rollers, the fiber running control member bending the conveyance path of the sliver while the sliver is being conveyed in that section.
2. A draft device in a pneumatic spinning machine according to Claim 1, **characterized by** further comprising a position adjusting device that enables variation of an attachment position of the fiber running

control member in a direction orthogonal to the conveyance path.

3. A draft device in a pneumatic spinning machine according to Claim 1 or Claim 2, **characterized in that** the fiber running control member and a conveyance guiding member for a sliver are arranged in one or more of the sections, and the section in which the fiber running control member is arranged is different from the section in which the conveyance guiding member is arranged.

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FIG. 1

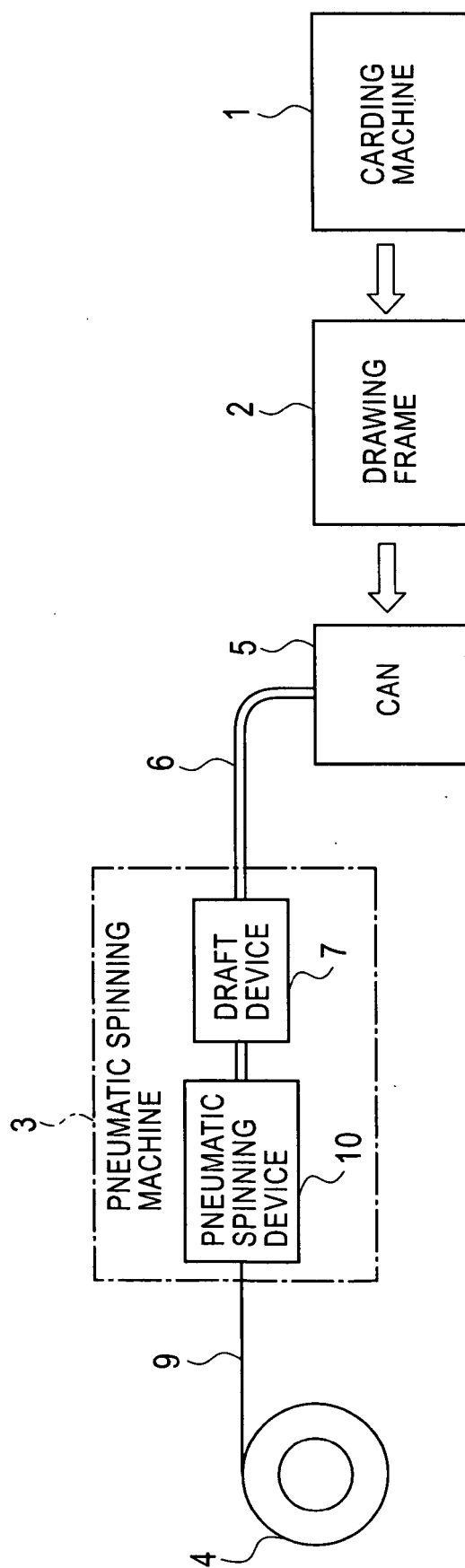


FIG. 2

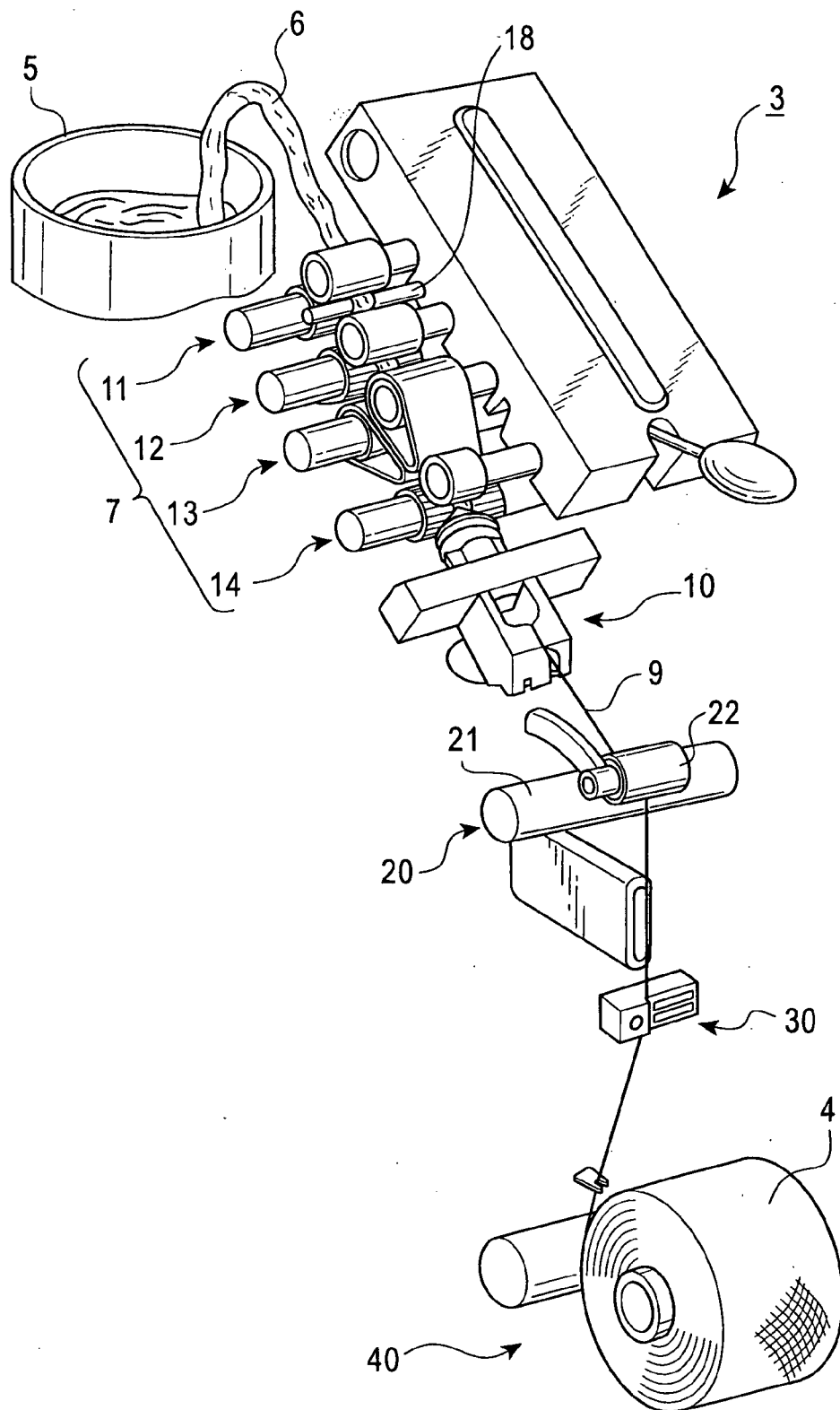


FIG. 3

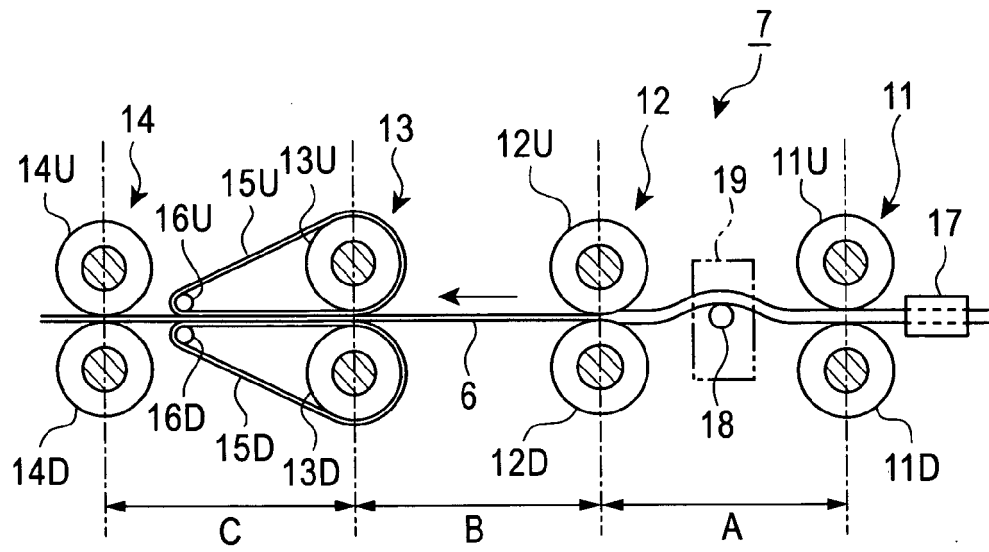


FIG. 4

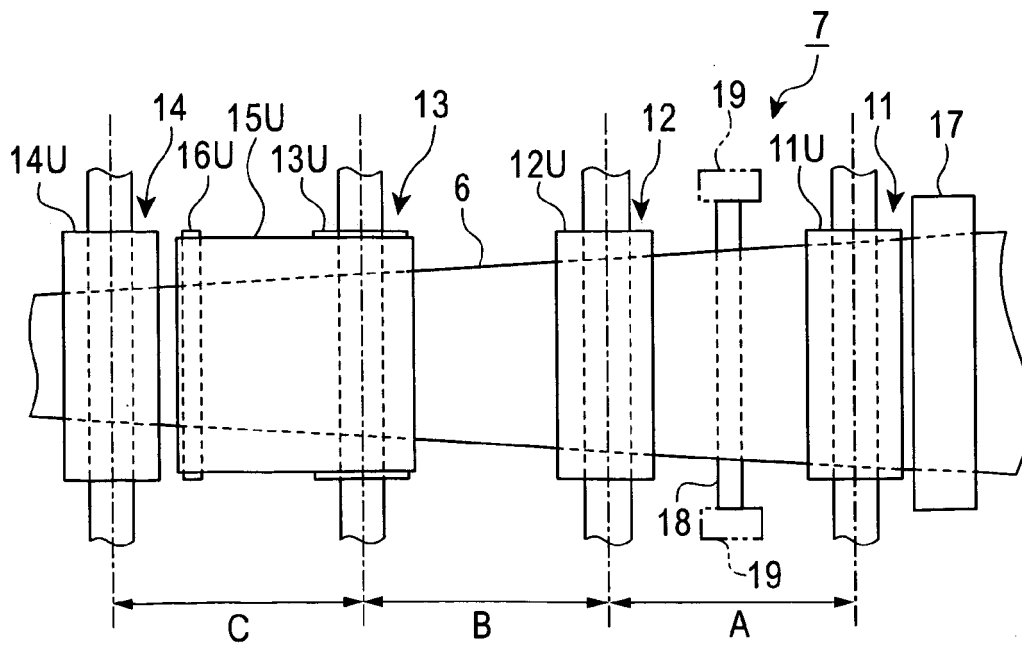


FIG. 5

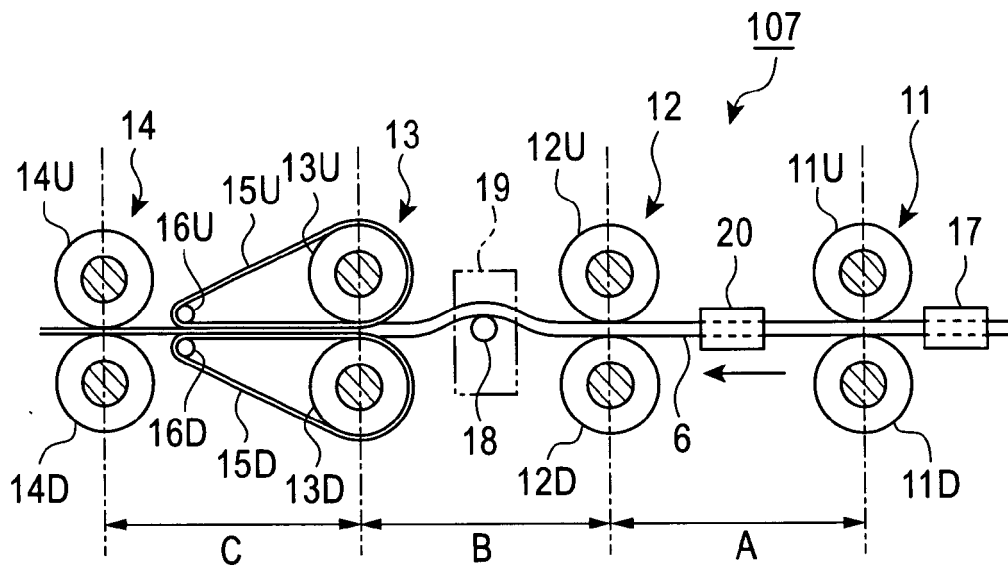


FIG. 6

