



(11) **EP 3 045 576 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
20.07.2016 Bulletin 2016/29

(51) Int Cl.:
D01H 5/26 (2006.01) D01H 5/36 (2006.01)

(21) Application number: **14842527.5**

(86) International application number:
PCT/JP2014/072116

(22) Date of filing: **25.08.2014**

(87) International publication number:
WO 2015/033811 (12.03.2015 Gazette 2015/10)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Kabushiki Kaisha Toyota Jidoshokki Kariya-shi, Aichi 448-8671 (JP)**

(72) Inventor: **TSUCHIDA, Daisuke Kariya-shi Aichi 448-8671 (JP)**

(30) Priority: **09.09.2013 JP 2013186272**

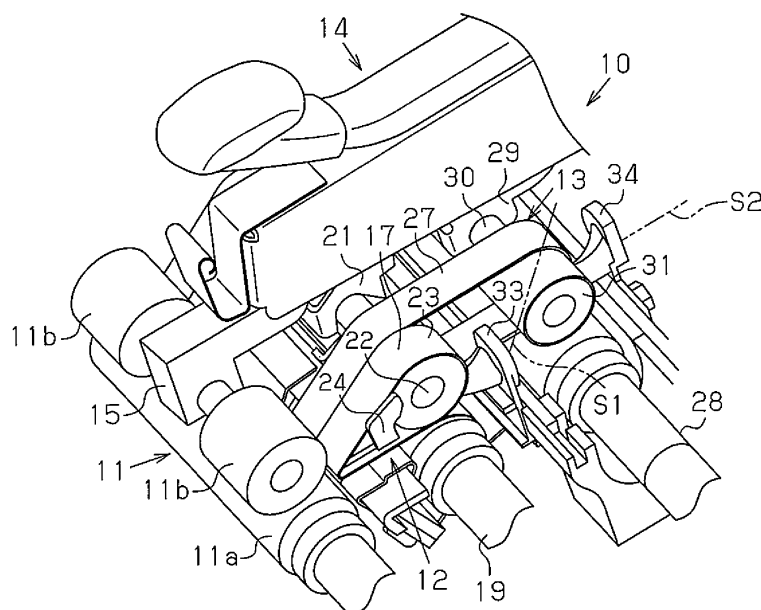
(74) Representative: **TBK Bavariaring 4-6 80336 München (DE)**

(54) **DRAFTING DEVICE IN SPINNING MACHINE**

(57) A draft device for a spinning machine that spins a yarn while changing the blending ratio of two different types of rovings has a middle bottom roller and a middle top roller, a back bottom roller and a back top roller, a middle apron pair, and a back apron pair. The middle apron pair is supplied with a first roving and has a middle bottom apron wrapped around the middle bottom roller and a middle top apron wrapped around the middle top

roller. The middle top apron is driven by the middle bottom roller in a state pressed by the middle bottom apron. The back apron pair is supplied with a second roving and has a back bottom apron wrapped around the back bottom roller and a back top apron wrapped around the back top roller. The back apron pair is driven by the back bottom roller in a state pressed by the back bottom apron.

Fig.1



Description

TECHNICAL FIELD

[0001] The present invention relates to a draft device for a spinning machine and, more particularly, to a draft device for a spinning machine that spins a yarn while changing the blending ratio of two different types of rovings.

BACKGROUND ART

[0002] Referring to FIGS. 6 and 7, Patent Document 1 discloses a draft device that includes two rows of apron devices 62, 63 for supplying a front roller 61 with rovings 71, 72 and drives the apron devices 62, 63 to change the roving for supply. The apron device 62 located on the left in FIG. 6 is driven by a second roller 64. The apron device 63 on the right is driven by a third roller 65 located behind the second roller 64. The apron device 63 has an apron 66. For the apron 66 not to be pressed and driven by the second roller 64, the apron 66 is spaced from the second roller 64 by providing a top roller having a small diameter above the second roller 64. The reason why the apron 66 is spaced from the second roller 64 not to be pressed by the second roller 64 is to prevent the apron 66 from being brought into contact with a bottom apron that is wrapped around the second roller 64 and may be driven to travel at a circumferential speed that is different from that of the apron 66 in the case that the second roller 64 and the third roller 65 are driven to travel at respective different speeds. The rovings 71, 72 are supplied to the apron devices 62, 63 by different back roller 67, 68, respectively. That is, in the draft device of the prior art, the front roller 61 is provided for drafting both rovings 71, 72, while the second and third rollers 64, 65 are driven independently for drafting the rovings 71, 72, respectively.

[0003] Patent Document 2 discloses a three-roller draft device that includes a middle top roller, a middle bottom roller, and an apron pair, which is wrapped around the rollers. The middle top roller, the middle bottom roller, and the apron pair are split into right and left halves. A drive source that is separate from the drive source for a regular middle bottom roller is coupled to one of the split halves of the middle bottom roller.

[0004] Patent Document 3 discloses a draft device that supplies one of two types of rovings is supplied to a back roller pair and supplies the other type of roving to a middle roller pair. This draft device converge the roving supplied from the back roller pair with the other roving before the rovings reach the middle roller and holds the converged rovings with a middle apron pair.

PRIOR ART DOCUMENTS

Patent Documents

[0005]

Patent Document 1: Chinese Patent Publication No. 1587469

Patent Document 2: International Patent Publication No. WO2011018685

Patent Document 3: International Patent Publication No. WO2013041565

SUMMARY OF THE INVENTION

10 Problems that the Invention is to Solve

[0006] However, in the structure of the draft device according to Patent Document 1, except for the front roller 61, independent draft rollers need to be provided for the respective rovings 71, 72. That is, two draft rollers need to be added to a standard three-roller draft device, which complicates the structure of the draft device.

[0007] In the structure of the draft device according to Patent Document 2, the middle top roller and the middle bottom roller need to be split into the right and left halves, and a drive source that is separate from the drive source for a regular middle bottom roller needs to be coupled to one of the split halves of the middle bottom roller. This complicates the structure of the draft device.

[0008] The structure of Patent Document 3 does not complicate the structure like Patent Document 1 and Patent Document 2. However, one of the rovings supplied from the back roller pair needs to be converged with the other roving before the rovings reach the middle roller, and the converged two types of rovings need to be gripped with the middle apron pair. Thus, spinning cannot be executed with only one of the rovings supplied from the back roller pair.

[0009] The present invention is directed to providing a draft device for a spinning machine that spins a yarn by changing the blending ratio of two different types of rovings. More specifically, the present invention is directed to providing a draft device that is capable of performing spinning of either one of two types of rovings without complicating the structure.

Means for Solving the Problems

[0010] In accordance with an aspect of the present invention, a draft device for a spinning machine that spins a yarn while changing the blending ratio of two different types of rovings is provided. The draft device includes a middle bottom roller and a middle top roller, a back bottom roller and a back top roller, a middle apron pair, to which a first roving is supplied, and a back apron pair, to which a second roving is supplied. The middle apron pair includes a middle bottom apron wrapped around the middle bottom roller and a middle top apron wrapped around the middle top roller. The middle top apron is driven by the middle bottom roller in a state pressed by the middle bottom apron. The back apron pair includes a back bottom apron wrapped around the back bottom roller and a back top apron wrapped around the back top roller. The back

apron pair is driven by the back bottom roller in a state pressed by the back bottom apron.

[0011] In the present description, "the blending ratio of two different types of rovings" is applicable not only the case in which two different types of rovings are supplied, but also the case in which ratio of the first roving is 0% and the ratio of the second roving is 100% or the case in which the ratio of the first roving is 100% and the ratio of the second roving is 0%.

[0012] The middle apron pair and the back apron pair are controlled for the start and stop thereof during spinning by controlling the operation of the middle bottom roller and the back bottom roller. Thus, without complicating the structure of the draft device, the blending ratio of two different types of rovings, or the first and second rovings can be changed within a range including the case in which the ratio of either one of the rovings is 0%, and a desired yarn can be spun continuously.

[0013] The thickness of at least one of the back top apron and the back bottom apron is preferably smaller than that of adjacent one of the middle top apron and the middle bottom apron. When the middle top roller is arranged at the pressing position, the distance between the middle top roller and the middle bottom roller agrees with the sum of the thickness of the middle top apron and the thickness of the middle bottom apron. The back top apron and the back bottom apron are never pressed hard by the middle top roller and the middle bottom roller. Thus, even when the lateral sides of the apron pairs are overlapped by displacement of the weighting arm, the top apron of either one of the apron pairs and the bottom apron of the other of the apron pairs are not brought into sliding contact with each other while being firmly gripped by the middle top roller and the middle bottom roller. This prevents rotation failure of the aprons.

[0014] The relationship among the thickness T1 of the middle top apron, the thickness B1 of the middle bottom apron, the thickness T2 of the back top apron, and the thickness B2 of the back bottom apron is preferably expressed by $T1 + B1 > T2 + B2$. This structure restricts rotation failure of the aprons even when the lateral sides of the apron pairs are overlapped by displacement of the weighting arm. Therefore, the draft device needs no a special working such as making a recess in the middle top roller or the middle bottom roller at a position that corresponds to the back top apron or the back bottom apron forming the back apron pair.

[0015] The middle top apron, the middle bottom apron, the back top apron, and the back bottom apron preferably each have a tensioner. The middle apron pair and the back apron pair may use a common tensioner. However, since the length of the apron of the middle apron pair is different from that of the back apron pair, provision of tensioners for the respective apron pairs permits easy and proper adjustment of the tension of the aprons.

EFFECTS OF THE INVENTION

[0016] The present invention allows a draft device for a spinning machine that spins a yarn by changing the blending ratio of two different types of rovings to perform spinning of either one of two types of rovings without complicating the structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a schematic perspective view of a draft device;

FIG. 2 is a partially omitted side view of the draft device of FIG. 1;

FIG. 3 is a schematic diagram showing the relationship among a middle top roller, a middle bottom roller, and an apron of the draft device of FIG. 1;

FIGS. 4A and 4B are schematic diagrams showing the relationship among the aprons of the draft device of FIG. 1;

FIG. 5 is a schematic side view showing a tensioner of a bottom apron according to another embodiment; FIG. 6 is a plan view of a draft device according to a background art; and

FIG. 7 is a side view of the draft device of FIG. 6.

MODES FOR CARRYING OUT THE INVENTION

First embodiment

[0018] Referring to FIGS. 1 through 4, a first embodiment according to the present invention will be described.

[0019] A draft device according to the first embodiment basically has the same structure as a known three-roller draft device for a spinning machine including a bottom roller, a top roller, a weighting arm, and a cradle. However, the draft device according to the first embodiment differs from the above known draft device in that two rows of apron pairs are provided for supplying a common front roller with two types of rovings.

[0020] As shown in FIGS. 1 and 2, a draft device 10 includes front rollers 11, a middle apron pair 12, which is disposed behind the front rollers 11 and supplies a first roving S1 to the front rollers 11, and a back apron pair 13, which is disposed behind the front rollers 11 and supplies a second roving S2 to the front rollers 11. That is, the draft device 10 includes two rows of apron pairs located behind the front rollers 11.

[0021] The front rollers 11 include a front bottom roller 11 a and a front top roller 11 b. The front bottom roller 11 a is supported by a roller stand (not shown). The front top roller 11 b is supported by a weighting arm 14 provided above the front bottom roller 11 a via a support arm 15. Each draft device 10 is used for two spinning stations and has top rollers such as the front top rollers 11 b disposed on the opposite sides of the weighting arm 14.

Two rows of apron pairs are provided to correspond to each front top roller 11 b.

[0022] The middle apron pair 12 includes a middle bottom apron 16 and a middle top apron 17. The middle bottom apron 16 is wrapped around a tensor bar 18, a middle bottom roller 19, and a tensioner 20. The middle top apron 17 is wrapped around and between a middle top roller 23, which is rotationally supported by a support shaft 22 at one end thereof, and an apron cradle 24 supported by the support shaft 22. The support shaft 22 is supported by a support arm 21, which is fixed to the weighting arm 14. The apron cradle 24 has a tensioner 25.

[0023] The back apron pair 13 includes a back bottom apron 26 and a back top apron 27. The back bottom apron 26 is wrapped around the tensor bar 18, a back bottom roller 28, and the tensioner 20. That is, the back bottom apron 26 and the middle bottom apron 16 use the tensor bar 18 and the tensioner 20 commonly. The back bottom apron 26 is wrapped around the back bottom roller 28 in a state that the back bottom apron 26 passes the outer periphery of the middle bottom roller 19.

[0024] The back top apron 27 is wrapped around and between a back top roller 31 that is rotationally supported by a support shaft 30 at one end thereof, and a tensioner 25 provided in the apron cradle 24 of the middle top roller 23. The support shaft 30 is supported by a support arm 29, which is fixed to the weighting arm 14. That is, the back top apron 27 and the middle top apron 17 use the tensioner 25 commonly. The back top apron 27 is wrapped around the back top roller 31 in a state that the back top apron 27 passes the outer periphery of the middle top roller 23.

[0025] When the thicknesses of the middle top apron 17 forming a part of the middle apron pair 12, the middle bottom apron 16, the back top apron 27 forming a part of the back apron pair 13, and the back bottom apron 26 are represented by T1, B1, T2 and B2, respectively, the relationship among these thicknesses T1, T2, B1, B2 is expressed by $T1 > T2$ and $B1 > B2$.

[0026] As shown in FIG. 2, a support bar 32 extends along the back bottom roller 28 behind the back bottom roller 28. The support bar 32 supports a first trumpet 33 guiding the first roving S1 and a second trumpet 34 guiding a second roving S2 through a bracket 35.

[0027] The outlet of the first trumpet 33 is provided behind the middle apron pair 12 so that the outlet of the first trumpet 33 faces the inlet of the middle apron pair 12. The second trumpet 34 is provided so that the outlet of the second trumpet 34 faces the inlet of the back apron pair 13. Since the back bottom apron 26 and the back top apron 27 are disposed on one lateral side of the first trumpet 33, the use of a trumpet in a spinning machine for spinning an ordinary yarn instead of the first trumpet 33 would cause interference of the trumpet with the back apron pair 13. Therefore, the width of the first trumpet 33 needs to be formed narrower than that of the above trumpet in a spinning machine for spinning an ordinary yarn.

In the first embodiment according to the present invention, the flange part of the first trumpet 33 on the left side as viewed from the middle apron pair 12, that is, the flange part that faces the back apron pair 13 is formed in a narrow shape, as shown in FIG. 1.

[0028] A trumpet in a spinning machine for spinning an ordinary yarn may be used for the second trumpet 34 because no middle apron pair such as the pair 12 is present on lateral side of the second trumpet 34. However, in the present embodiment according to the present invention, the second trumpet 34 is of the same configuration as the first trumpet 33, which has a narrower flange part on a lateral side.

[0029] The following will describe the operation of the draft device 10 of the above-described structure.

The first roving S1 unwound from a first roving bobbin supported on a creel (not shown in the drawing) is supplied through the first trumpet 33 to the middle apron pair 12. The second roving S2 unwound from a second roving bobbin supported on a creel (not shown in the drawing) is supplied through the second trumpet 34 to the back apron pair 13.

[0030] The first roving S1 supplied to the middle apron pair 12 is drafted between the front rollers 11 and the middle apron pair 12 into a fleece. Then, the fleece is wound around a bobbin through a snail wire and a traveler (not shown in the drawing). The second roving S2 supplied to the back apron pair 13 is drafted between the front rollers 11 and the back apron pair 13 into a fleece. Then, the fleece is wound around a bobbin through a snail wire and a traveler (not shown in the drawing).

[0031] While the first roving S1 and the second roving S2 are being supplied simultaneously, the front bottom roller 11 a, the middle bottom roller 19, and the back bottom roller 28 are all driven to rotate. The first roving S1 supplied through the first trumpet 33 is drafted by the middle apron pair 12 and the front rollers 11 into a first fleece. The second roving S2 supplied through the second trumpet 34 is drafted by the back apron pair 13 and the front rollers 11 into a second fleece. The first fleece and the second fleece thus produced and coming out from the front rollers 11 are then spun into a strand of yarn while being twisted.

[0032] To change the spinning condition in which the first and second rovings S1, S2 are supplied simultaneously to the spinning condition in which either of the first roving S1 and the second roving S2 is supplied, the apron pair for the roving the supply of which is to be stopped is stopped to be driven. For example, when the supply of the first roving S1 is to be stopped, the middle bottom roller 19 is stopped, so that the middle bottom apron 16 is stopped and simultaneously the middle top apron 17 and the middle apron pair 12 are stopped. When the middle apron pair 12 is stopped, the first roving S1 is cut between the nip point of the middle apron pair 12 and the nip point of the front rollers 11. To start the supply of the first roving S1 again, the middle bottom roller 19 is started, so that the middle apron pair 12 is started and

the first roving S1 is drafted by the front rollers 11 and the middle apron pair 12.

[0033] To stop the supply of the second roving S2, the back bottom roller 28 is stopped, so that the back bottom apron 26, the back top apron 27, and the back apron pair 13 are stopped simultaneously. After the stop of the back apron pair 13, the second roving S2 is cut between the nip point of the back apron pair 13 and the nip point of the front rollers 11. After the back bottom roller 28 is started to be driven thereby to allow the second roving S2 to be supplied again, the back apron pair 13 is started to be driven so that the second roving S2 is drafted by the front rollers 11 and the back apron pair 13.

[0034] According to the configuration described above, the middle apron pair 12 and the back apron pair 13 are controlled for the start and stop thereof during spinning, so that the blending ratio of two different types of the rovings, or the first and second roving S1, S2 can be changed and a desired yarn can be spun continuously by controlling the operation of the middle apron pair 12 and the back apron pair 13.

[0035] For example, to spin a slub yarn, the operation of the middle apron pair 12 and the back apron pair 13 is so controlled that either of the first roving S1 and the second roving S2 is supplied continuously and the other of the rovings S1 and S2 is supplied intermittently. Controlling the operation of the middle apron pair 12 and the back apron pair 13 in such a way that the first and second rovings S1, S2 having different colors are supplied alternately allows a yarn having two different colors to be spun. The thickness, length, spaced interval, and color of slub portions in a slub yarn may be changed as required by controlling the operation of the middle bottom roller and the back bottom roller appropriately.

[0036] The back bottom apron 26 is wrapped around the back bottom roller 28 in such a way that the back bottom apron 26 passes the outer periphery of the middle bottom roller 19. The back top apron 27 is wrapped around the back top roller 31 in such a way that the back top apron 27 passes the outer periphery of the middle top roller 23. If the sum of the thickness T1 of the middle top apron 17 and the thickness B1 of the middle bottom apron 16, or (T1 + B1) is less than or equal to the sum of the thickness T2 of the back top apron 27 and the thickness B2 of the back bottom apron 26, or (T2+B2), there will occur a problem that the back top apron 27 and the back bottom apron 26, when passing between the middle bottom roller 19 and the middle top roller 23, are pressed by the middle bottom roller 19 and the middle top roller 23. However, in the draft device according to the present embodiment, in which the thickness of at least either of the back top apron 27 and the back bottom apron 26 is smaller than that of the middle top apron 17 or the middle bottom apron 16 that are located adjacent to the back top apron 27 and the back bottom apron 26, the middle bottom apron 16, the middle top apron 17, and the first roving S1 held between the middle bottom apron 16 and the middle top apron 17, as shown in FIG. 3, move

at a surface speed of the middle bottom roller 19 and the middle top roller 23. Since the back bottom apron 26 and the back top apron 27 are not pressed by the middle bottom roller 19 and the middle top roller 23, the second roving S2 can pass smoothly between the back bottom apron 26 and the back top apron 27.

[0037] Even when the lateral sides of apron pairs 12, 13 are overlapped by displacement of the weighting arm 14, the top apron of either one of the apron pairs 12, 13 and the bottom apron of the other of the apron pairs 12, 13 are not brought into sliding contact with each other while being firmly gripped by the middle top roller 23 and the middle bottom roller 19.

[0038] When the relationship among the thickness T1 of the middle top apron 17, thickness B1 of the middle bottom apron 16, the thickness T2 of the back top apron 27 and the thickness B2 of the back bottom apron is such that $T1 + B1 > T2 + B2$, no problem due to the displacement of the weighting arm 14 occurs without making additional recess in the middle top roller 23 and the middle bottom roller 19 at a part that corresponds to the back top apron 27 or the back bottom apron 26. Therefore, a top roller and a cradle that are used in a draft device in a spinning machine for spinning an ordinary yarn can be used.

[0039] The aprons that are disposed one above the other may be displaced in lateral direction during the operation of the draft device 10. In this case, if $T2 > T1$ and $B2 < B1$, the back top apron 27 may be in contact with the outer peripheral surface of the middle bottom apron 16, as shown in FIG. 4A, which increases the contact resistance is large and causes rotation failure of the apron.

[0040] However, in the first embodiment, in which the relationship among the thickness T1 of the middle top apron 17, thickness B1 of the middle bottom apron 16, the thickness T2 of the back top apron 27 and the thickness B2 of the back bottom apron 26 is $T1 > T2$ and $B1 > B2$, the back top apron 27 is prevented from being brought into contact with the outer peripheral surface of the middle bottom apron 16 even if the back top apron 27 is displaced laterally, as shown in FIG. 4B, so that no rotation failure occurs.

[0041] The first embodiment offers the following advantageous effects.

- (1) The draft device 10 includes the middle apron pair 12, which supplies the first roving S1 to the front rollers 11, and the back apron pair 13, which supplies the second roving S2 to the front rollers 11. The middle apron pair 12 and the back apron pair 13 are controlled for the start and stop thereof during spinning by controlling the operation of the middle bottom roller 19 and the back bottom roller 28. Thus, without complicating the structure of the draft device 10, the blending ratio of two different types of rovings, or the first and second rovings S1, S2 can be changed within a range including the case in which the ratio of

either one of the rovings is 0%, and a desired yarn can be spun continuously.

(2) The thickness of at least one of the back top apron 27 and the back bottom apron 26 is smaller than that of the middle top apron 17 or the middle bottom apron 16. Therefore, even when the lateral sides of the apron pairs 12, 13 are overlapped by displacement of the weighting arm 14, the top apron of one of the apron pairs 12, 13 and the bottom apron of the other of the apron pairs 12, 13 are not brought into sliding contact with each other while being firmly gripped by the middle top roller 23 and the middle bottom roller 19. Thus, rotation failure of the aprons is prevented.

(3) The relationship among the thickness T1 of the middle top apron 17, thickness B1 of the middle bottom apron 16, the thickness T2 of the back top apron 27, and the thickness B2 of the back bottom apron 26 is such that $T1 + B1 > T2 + B2$. Thus, even when the lateral sides of the apron pairs 12, 13 are overlapped by displacement of the weighting arm 14, rotation failure of the aprons is prevented. Therefore, the draft device 10 needs no a special working such as making a recess in the middle top roller 23 or the middle bottom roller 19 at a part that corresponds to the back top apron 27 and the back bottom apron 26, which form the back apron pair 13. Therefore, a top roller and a cradle that are used in a draft device in a spinning machine for spinning an ordinary yarn can be used, which helps to reduce the costs of the device.

[0042] The above-described embodiment may be modified in various ways as exemplified below.

The middle top apron, the middle bottom apron, the back top apron, and the back bottom apron may all have the same thickness, and the middle top roller or the middle bottom roller may have a recess. That is, a part of the middle top roller that corresponds to the back top apron may have a diameter smaller than that of the other parts. Alternatively, a part of the middle bottom roller that corresponds to the back bottom apron may have a diameter smaller than that of the other parts.

[0043] The thickness of at least one of the back top apron 27 and the back bottom apron 26 may be smaller than that of the middle top apron 17 or the middle bottom apron 16 that is located adjacent to the back top apron 27 and the back bottom apron 26. For example, when a recess is formed in a part of the middle top roller 23 that corresponds to the back top apron 27 as in the case of Patent Document 1, the thickness B1 of the middle bottom apron 16 may be larger than the thickness B2 of the back bottom apron 26 and the thickness T1 of the middle top apron 17 may be the same as the thickness T2 of the back top apron 27.

[0044] When no recess is formed in the middle top roller 23 and a recess is formed in the middle bottom roller 19, the thickness T1 of the middle top apron 17 may be larger than the thickness T2 of the back top apron 27 and

the thickness B1 of the middle bottom apron 16 may be the same as the thickness B2 of the back bottom apron 26.

[0045] In the case that the lateral sides of the apron pairs 12, 13 are overlapped by displacement of the weighting arm 14 and that a recess corresponding to the back top apron 27 is provided in the middle top roller 23, if the thickness T2 of the back top apron 27 is the same as the thickness T1 of the middle top apron 17, the recess prevents the back top apron 27 and the middle bottom apron 16 from being firmly gripped. In this case, the thickness of the back bottom apron 26 only needs to be smaller than that of the middle bottom apron 16.

[0046] If the lateral sides of the apron pairs 12, 13 are overlapped by displacement of the weighting arm 14 and that a recess corresponding to the back top apron 27 is provided in the middle bottom roller 19, if the thickness B2 of the back bottom apron 26 is the same as the thickness B1 of the middle bottom apron 16, the recess prevents the back bottom apron 26 and the middle top apron 17 from being firmly gripped. In this case, the thickness of the back top apron 27 only needs to be smaller than that of the middle top apron 17.

[0047] The middle top apron 17, the middle bottom apron 16, the back top apron 27, and the back bottom apron 26 may have tensioners, respectively. The middle apron pair 12 and the back apron pair 13 may use a common tensioner. However, since the length of the apron of the middle apron pair 12 is different from that of the back apron pair 13, provision of tensioners for the respective apron pairs permits easy and proper adjustment of the tension of the aprons.

[0048] The draft device 10 may have such a structure that an additional tensioner is provided for each apron of the back apron pair 13 in addition to the common tensioners 20, 25 for the middle apron pair 12 and the back apron pair 13, respectively, instead of providing a tensioner for each apron of the middle apron pair 12 and the back apron pair 13. For example, as shown in FIG. 5, a tensioner 36 for the back bottom apron 26 may be provided at a position between the back bottom roller 28 and the tensioner 20.

Similarly, a tensioner for the back top apron 27 may be provided at a position between the middle top roller 23 and the back top roller 31.

[0049] An apron guide may be provided for each apron of the middle apron pair 12 and the back apron pair 13. The apron guide regulates the movement of the apron in the direction of a roller axis.

Separators may be provided between the middle top apron 17 and the back top apron 27 and between the middle bottom apron 16 and the back bottom apron 26, respectively. The separators prevent the contact between the middle top apron 17 and the back top apron 27 and between the middle bottom apron 16 and the back bottom apron 26 in the direction of the axis of the roller. The separator should preferably be provided in the cradle.

[0050] The draft device is not limited to the three-roller draft device 10 but it may be of four-roller type. In this case, a second back roller may be provided behind the back roller around which the back bottom apron 26 is wrapped, so that the middle apron pair 12 and the back apron pair 13 may perform drafting of the roving between the back roller and the second back roller.

[0051] In a four-roller draft device, sliver may be supplied for spinning instead of roving. The draft device according to the present invention is applicable to a fly frame.

3. The draft device according to claim 2, wherein the relationship among a thickness T1 of the middle top apron, a thickness B1 of the middle bottom apron, a thickness T2 of the back top apron, and a thickness B2 of the back bottom apron is expressed by $T1 + B1 > T2 + B2$.

4. The draft device according to any one of claims 1 to 3, wherein the middle top apron, the middle bottom apron, the back top apron, and the back bottom apron each have a tensioner.

DESCRIPTION OF THE REFERENCE NUMERALS

[0052] S1...First Roving, S2...Second Roving, 10...Draft Device, 12...Middle Apron Pair, 13...Back Apron Pair, 16...Middle Bottom Apron, 17...Middle Top Apron, 19...Middle Bottom Roller, 20, 25, 36...Tensioners, 23...Middle Top Roller, 26...Back Bottom Apron, 27...Back Top Apron, 28...Back Bottom Roller, 31...Back Top Roller

Claims

1. A draft device for a spinning machine that spins a yarn while changing a blending ratio of two different types of rovings, the draft device comprising:

a middle bottom roller and a middle top roller;
a back bottom roller and a back top roller;
a middle apron pair to which a first roving is supplied, wherein

the middle apron pair includes a middle bottom apron wrapped around the middle bottom roller and a middle top apron wrapped around the middle top roller, and
the middle top apron is driven by the middle bottom roller in a state pressed by the middle bottom apron; and

a back apron pair to which a second roving is supplied, wherein

the back apron pair includes a back bottom apron wrapped around the back bottom roller and a back top apron wrapped around the back top roller, and
the back apron pair is driven by the back bottom roller in a state pressed by the back bottom apron.

2. The draft device according to claim 1, wherein the thickness of at least one of the back top apron and the back bottom apron is smaller than that of adjacent one of the middle top apron and the middle bottom apron.

Fig.1

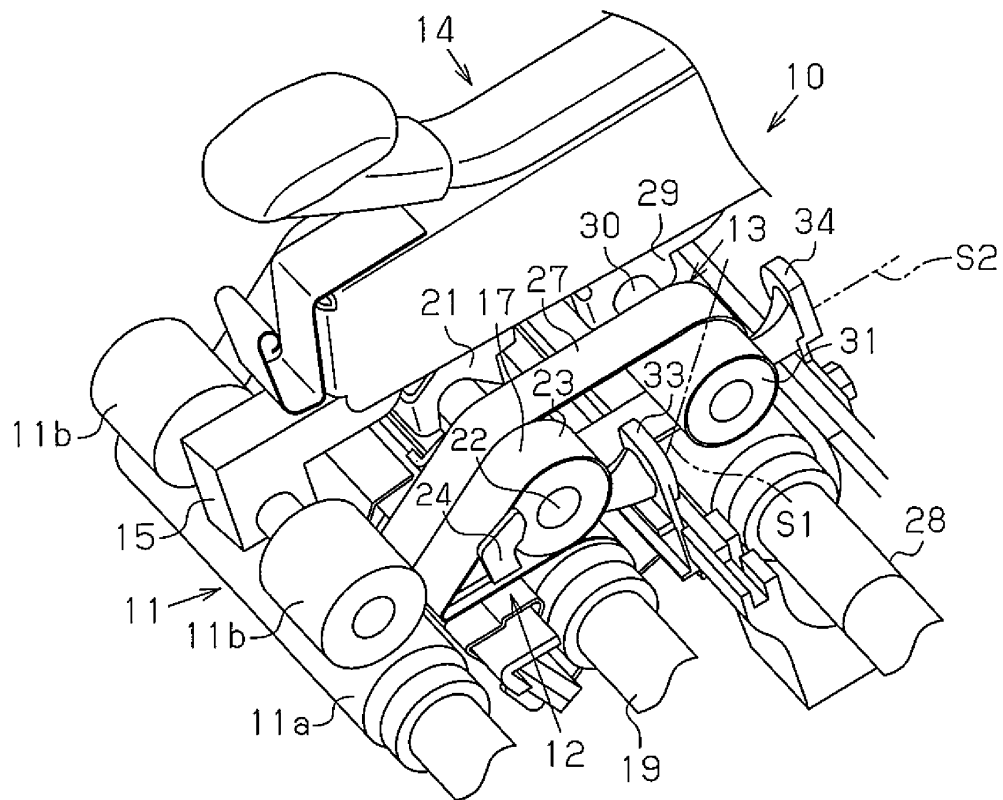


Fig.2

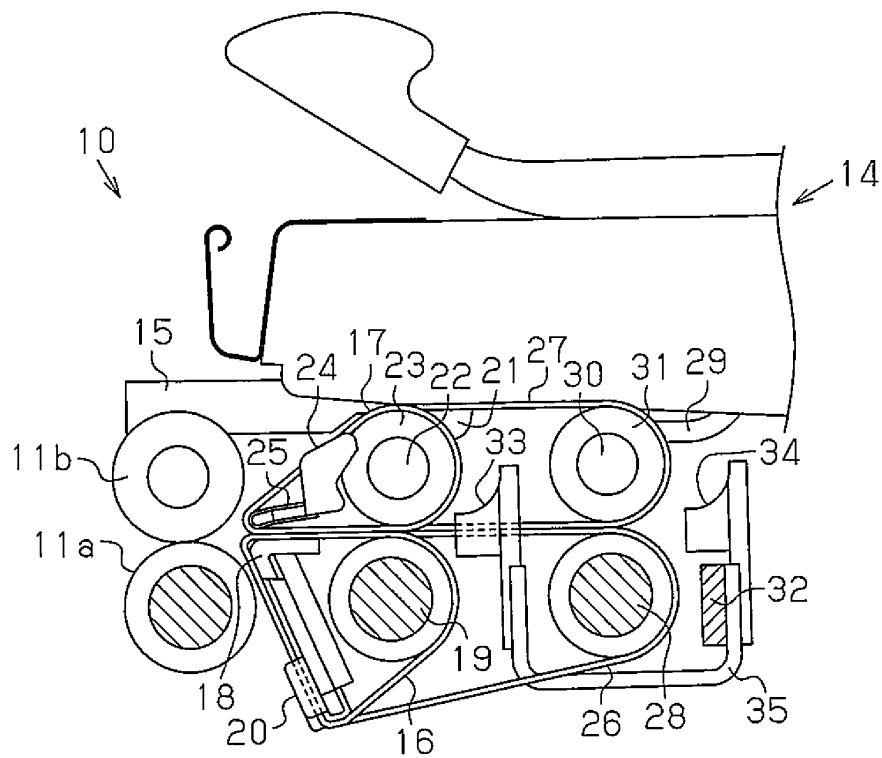


Fig.3

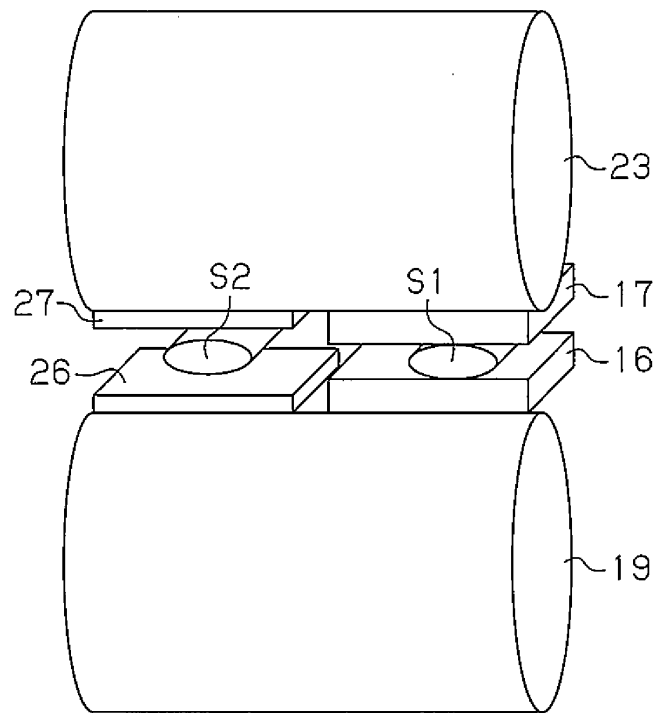


Fig.4A

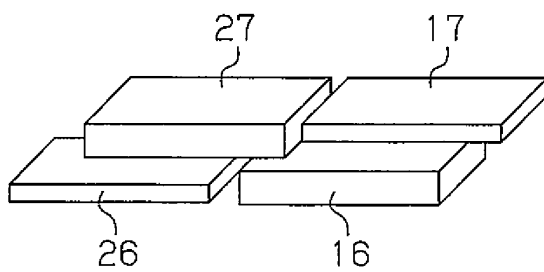


Fig.4B

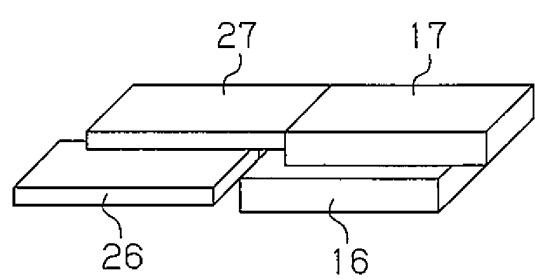
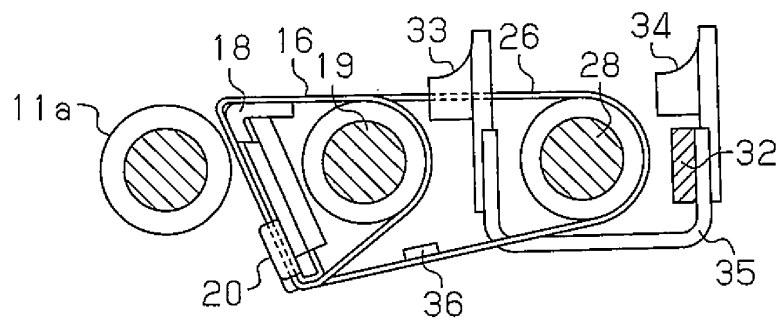


Fig.5



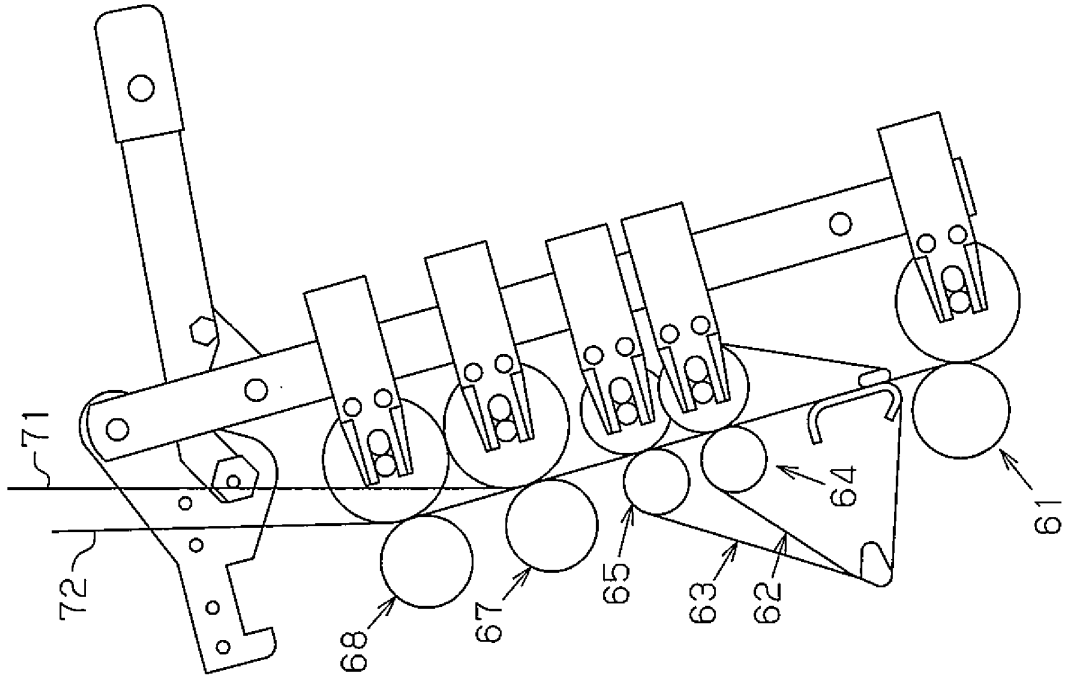


Fig. 7

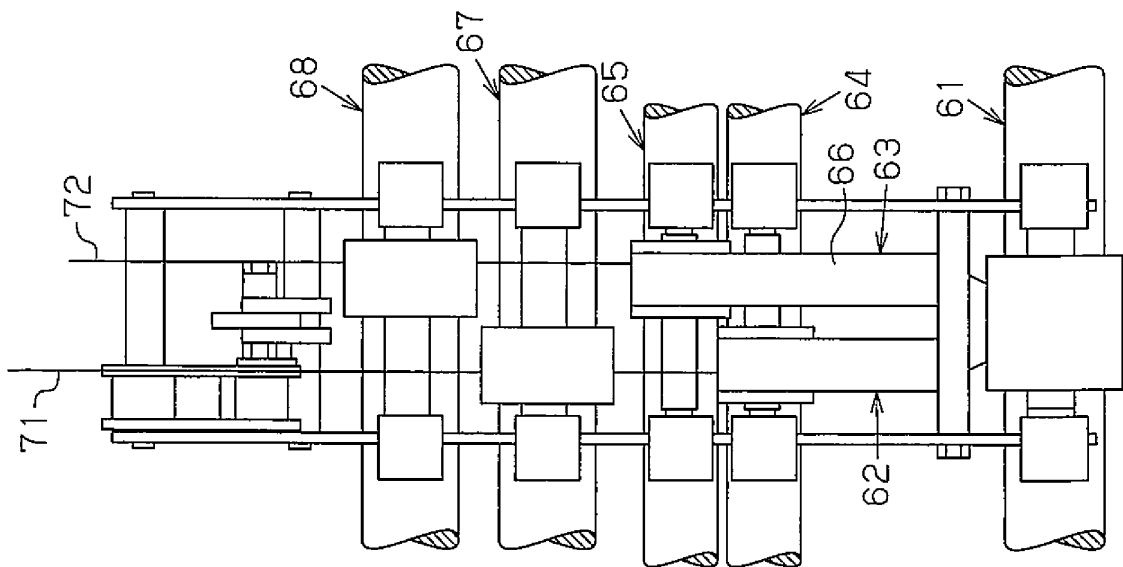


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/072116

A. CLASSIFICATION OF SUBJECT MATTER

D01H5/26(2006.01)i, D01H5/36(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D01H5/26, D01H5/36, D02G3/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
 Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 48-43976 B1 (Asahi Chemical Industry Co., Ltd.), 21 December 1973 (21.12.1973), column 7, line 41 to column 8, line 32; fig. 3 & US 3596458 A & GB 1183381 A & DE 1685631 A1	1-4
A	US 3789461 A (ASAHI KASEI KOGYO KABUSHIKI KAISHA), 05 February 1974 (05.02.1974), column 6, line 53 to column 7, line 21; fig. 4 (Family: none)	1-4

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
10 October, 2014 (10.10.14)Date of mailing of the international search report
21 October, 2014 (21.10.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/072116

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 1587469 A (HONGYUAN FRAME CO., LTD. JIANGSU), 02 March 2005 (02.03.2005), entire text; all drawings (Family: none)	1-4

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 1587469 [0005]
- WO 2011018685 A [0005]
- WO 2013041565 A [0005]