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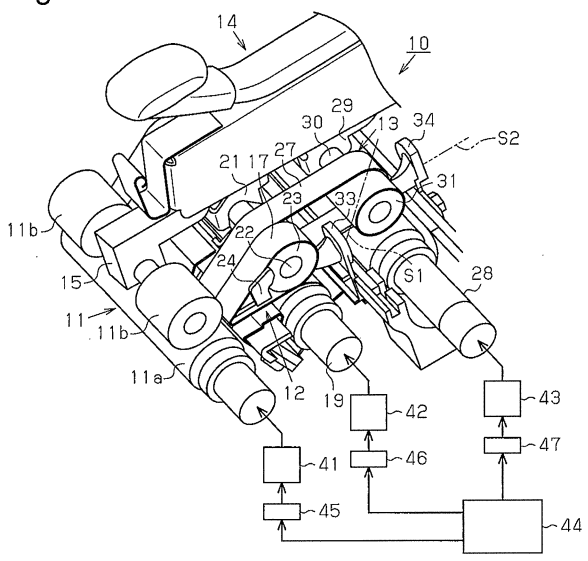
(54) DRAFT DEVICE OF SPINNING MACHINE, AND CONTROL METHOD THEREFOR

(57) A draft device (10) of a spinning machine comprises a plurality of apron pairs (12, 13) provided so as to correspond respectively to a plurality of fiber feeders, a front roller (11) that is common to the apron pairs (12, 13), and a speed change controller (44) configured so as to change the speed of the apron pairs (12, 13) according to preset conditions. The speed change controller (44) is configured such that, when any one of the plurality of fiber feeders initiates fiber feeding, the controller outputs a drive command to the apron pair (12, 13) corresponding to the fiber feeder that initiates fiber feeding, and causes the apron pair (12, 13) to drive at a lower speed than during steady spinning for a predetermined duration and subsequently shift to a steady spinning speed.

Fig.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a drafting device for a spinning frame and a method for controlling the drafting device for the spinning frame, and more particularly, to a drafting device for a spinning frame that changes fiber feed periods and fiber feed amounts of fiber feed portions in accordance with predetermined conditions to spin a special yarn having continuous portions of different colors and raw materials and a method for controlling the drafting device for the spinning frame.

BACKGROUND ART

[0002] A method for sequentially feeding roving of different types of colors and fibers and manufacturing a special yarn (special design spun yarn) having continuous portions of different colors, raw materials, and thicknesses has been proposed (refer to, for example, patent document 1).

[0003] Such a special yarn is manufactured by using, for example, first and second aprons that respectively correspond to two roving feed portions. Fig. 7 shows the relationship between the speed of each apron when a raw-material roving of each apron is switched and the state of the manufactured special yarn. As shown in the lower graph in Fig. 7, at a raw-material roving switch time Ts1, deceleration of the second apron starts at the same time as when driving of the first apron starts. The speed of the first apron reaches the speed for normal spinning within a predetermined period from when driving of the first apron starts. The speed of the second apron becomes zero within the predetermined period from when the deceleration of the second apron starts. This stops the feeding of the roving. At a raw-material roving switch time Ts2, deceleration of the first apron starts at the same time as when driving of the second apron starts.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0004] Patent Document 1: Japanese Laid-Open Patent Publication No. 61-70026

SUMMARY OF THE INVENTION

PROBLEMS THAT ARE TO BE SOLVED BY THE INVENTION

[0005] When the feeding of a certain type of roving is started, the yarn strength may be insufficient at a feed start portion of the roving. Since the amount of intertwining is small between the fibers of two types of raw materials (friction between fibers), the yarn strength is insufficient at the feed start portion. Fig. 8 schematically shows the portion where the yarn strength is insufficient. Pills 51 and lint 52 are formed around the yarn at this portion. This is because fibers that are intertwined for a small amount are not twisted into a yarn. These fibers extend out of the yarn to form the lint 52 and wind around the outer side of the yarn to form the pills 51. When the intertwining amount of fibers decreases, the yarn strength decreases at the feed start portion. The same problem occurs when a sliver is used as a raw-material fiber instead of a roving.

[0006] It is an object of the present invention to provide a drafting device for a spinning frame that is capable of spinning a special yarn having continuous portions of different colors and raw materials while limiting decreases in the yarn strength of a feed start portion of a raw-material fiber and a method for controlling the drafting device for the spinning frame.

MEANS FOR SOLVING THE PROBLEM

[0007] A drafting device for a spinning machine that solves the above problem includes apron pairs respectively arranged in correspondence with fiber feed portions, a front roller shared by the apron pairs, and a speed change controller configured to change speeds of the apron pairs in accordance with predetermined conditions. The speed change controller is configured so that when any one of the fiber feed portions starts feeding fibers, the speed change controller outputs a drive instruction to the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, to drive the apron pair during a predetermined period at a lower speed than a speed for normal spinning and subsequently to shift the apron pair to the speed for normal spinning.

[0008] A method for controlling a drafting device for a spinning machine that solves the above problem, the drafting device including apron pairs respectively arranged in correspondence with fiber feed portions, a front roller shared by the apron pairs, and a speed change controller configured to change speeds of the apron pairs in accordance with predetermined conditions, includes when any one of the fiber feed portions starts feeding fibers, driving the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, during a predetermined period at a lower speed than a speed for normal spinning, and subsequently shifting the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, to the speed for normal spinning.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a schematic view showing a first embodiment of a drafting device.

Fig. 2 is a partially cutaway side view of the drafting device shown Fig. 1.

Fig. 3A is a graph showing the relationship of an obtained special yarn and changes in the speed of each of a first apron and a second apron in the first embodiment.

Fig. 3B is a schematic view showing a pattern of the special yarn.

Fig. 4 is a schematic view showing a feed start portion of the special yarn.

Fig. 5 is a graph showing the relationship of an obtained special yarn and changes in the speed of each of a first apron and a second apron in a second embodiment.

Fig. 6 is a graph showing the relationship of an obtained special yarn and changes in the speed of each of a first apron and a second apron in a third embodiment.

Fig. 7 is a graph showing the relationship of an obtained special yarn and changes in the speed of each of a first apron and a second apron in the prior art.

Fig. 8 is a schematic view showing a feed start portion of the special yarn in the prior art.

EMBODIMENTS OF THE INVENTION

First Embodiment

[0010] A first embodiment of a drafting device 10 using a roving reel, which is suspended from a creel of a spinning machine, as a fiber feed portion will now be described with reference to Figs. 1 to 4.

[0011] The drafting device 10 basically includes a bottom roller, a top roller, a weighting arm, and a cradle in the same manner as a known three-line drafting device for a spinning frame. The drafting device 10 differs from the known drafting device in that the drafting device 10 includes two apron pairs respectively corresponding to two types of roving so that two different types of roving are fed to a common front roller device 11.

[0012] As shown in Figs. 1 and 2, the drafting device 10 includes the front roller device 11, a first apron pair 12 located at the rear of the front roller device 11, and a second apron pair 13 located at the rear of the front roller device 11. The first apron pair 12 feeds a first roving S1 to the front roller device 11, and the second apron pair 13 feeds a second roving S2 to the front roller device 11. The first roving S1 and the second roving S2 are respectively fed from fiber feed portions suspended from creels (not shown), namely, a first roving reel and a second roving reel. More specifically, the drafting device 10 includes the apron pairs 12 and 13, which are arranged in correspondence with the fiber feed portions, and the front roller device 11, which is shared by the apron pairs 12 and 13.

[0013] The drafting device 10, which is of a two-spindle integrated type, includes a weighting arm 14 and top rollers such as front top rollers 11b that are respectively located at the two sides of the weighting arm 14. The front roller device 11 includes a front bottom roller 11a and the two front top rollers 11 b. The front top rollers 11 b are supported by a support arm 15 on the weighting arm 14. A set of the first and second apron pairs 12 and 13 are located at the two sides of the weighting arm 14.

[0014] The first apron pair 12 includes a middle bottom apron 16 and a middle top apron 17. The middle bottom apron 16 runs around a tensor bar 18, a middle bottom roller 19, and a tensioner 20. A support arm 21 is fixed to the weighting arm 14, and a support shaft 22 is supported by the support arm 21. The middle top apron 17 runs between a middle top roller 23, which is rotationally supported by each of the two ends of the support shaft 22, and an apron cradle 24, which is supported by the support shaft 22. The apron cradle 24 includes a tensioner 25.

[0015] The second apron pair 13 includes a back bottom apron 26 and a back top apron 27. The back bottom apron 26 runs around the tensor bar 18, a back bottom roller 28, and the tensioner 20. That is, the back bottom apron 26 shares the tensor bar 18 and the tensioner 20 with the middle bottom apron 16 and runs around the back bottom roller 28 so that the back bottom apron 26 passes by the vicinity of the middle bottom roller 19.

[0016] A support arm 29 is fixed to the weighting arm 14, and a support shaft 30 is supported by the support arm 29. The back top apron 27 runs between a back top roller 31, which is rotationally supported by each of the two ends of the support shaft 30, and the tensioner 25, which is arranged on the apron cradle 24. That is, the back top apron 27 shares the tensioner 25 with the middle top apron 17 and runs around the back top roller 31 so that the back top apron 27 passes by the vicinity of the middle top roller 23.

[0017] As shown in Fig. 2, a support bar 32 extends parallel to the axis of the back bottom roller 28 at the rear of the back bottom roller 28. The support bar 32 supports a first trumpet 33, which guides the first roving S1, and a second trumpet 34, which guides the second roving S2, with a bracket 35.

[0018] As shown in Fig. 1, a front roller motor 41 drives the front bottom roller 11 a, a middle roller motor 42 drives the middle bottom roller 19, and a back roller motor 43 drives the back bottom roller 28. In other words, the middle roller motor 42 is a drive unit that drives the first apron pair 12, and the back roller motor 43 is a drive unit that drives the second apron pair 13. The front roller motor 41, the middle roller motor 42, and the back roller motor 43 are respectively driven by inverters 45, 46, and 47, which are independent from one another. The inverters 45, 46, and 47 are controlled based on instructions of a controller 44.

[0019] A processor, namely, the controller 44, includes a microcomputer and operates based on predetermined program data stored in a memory to control the motors 41 to 43 using the inverters 45 to 47. The controller 44 functions as a speed change controller configured to change the speed of each of the apron pairs 12 and 13 in accordance with predetermined conditions. The speed

of each of the apron pairs 12 and 13 refers to the circumferential speed of the two aprons of the apron pairs 12 and 13. The controller 44 outputs a drive instruction to the apron pair 12 or 13 corresponding to one of the fiber feed portions that is to start feeding fibers to drive the apron pair 12 or 13 at a lower speed than the speed for normal spinning during a predetermined period t and subsequently shifts the apron pair 12 or 13 to the speed for normal spinning. Further, at the same time as this instruction, the controller 44 outputs a drive instruction to the apron pair 12 or 13 corresponding to the other one of the fiber feed portions that is to stop feeding fibers to drive the apron pair 12 or 13 at a lower speed than the speed for normal spinning during the predetermined period t and subsequently stops the apron pair 12 or 13. Specifically, the output of a drive instruction (or stop instruction) to the apron pair 12 or 13 indicates the output of a drive instruction (or stop instruction) to the motor 42 or 43 that drives the apron pair 12 or 13. The controller 44 is capable of adjusting the acceleration rate and the deceleration rate of the middle roller motor 42 and the back roller motor 43 in multiple stages, for example, six stages.

[0020] The operation of the drafting device 10 will now be described.

[0021] The first roving S1 is fed from the first roving reel, which is suspended from the creel (not shown), through the first trumpet 33 to the first apron pair 12. The second roving S2 is fed from the second roving reel, which is suspended from the creel (not shown), through the second trumpet 34 to the second apron pair 13. The first roving S1 and the second roving S2 are the same except for color. The first roving S1 and the second roving S2 are formed by the same raw-material fiber and have the same thickness.

[0022] The first roving S1 fed to the first apron pair 12 is drafted between the front roller device 11 and the first apron pair 12 into a fleece. Then, the fleece is wound around a bobbin via a snail wire (not shown) and a traveler (not shown). The second roving S2 fed to the second apron pair 13 is drafted between the front roller device 11 and the second apron pair 13 into a fleece. Then, the fleece is wound around the bobbin via the snail wire (not shown) and the traveler (not shown).

[0023] The feeding of the first roving S1 and the feeding of the second roving S2 are switched during a predetermined period, and only one of the first roving S1 and the second roving S2 are fed except for the switching period. The amount of the first roving S1 fed per unit of time is proportional to the speed of the first apron pair 12. The amount of the second roving S2 fed per unit of time is proportional to the speed of the second apron pair 13.

[0024] When the feeding of the first roving S1 is stopped, the driving of the middle bottom roller 19 is stopped. When the driving of the middle bottom roller 19 is stopped, the driving of the middle bottom apron 16 is stopped. At the same time, the driving of the middle top apron 17 is stopped, and the driving of the first apron pair 12 is stopped. When the first apron pair 12 is stopped, the spun first roving S1 is cut between a nip point of the first apron pair 12 and a nip point of the front roller device 11. When the feeding of the first roving S1 is restarted and the driving of the middle bottom roller 19 is started, the driving of the first apron pair 12 is started. Thus, the first roving S1 is smoothly drafted between the front roller device 11 and the first apron pair 12.

[0025] When the feeding of the second roving S2 is stopped, the driving of the back bottom roller 28 is stopped. When the driving of the back bottom roller 28 is stopped, the driving of the back bottom apron 26 is stopped. At the same time, the driving of the back top apron 27 is stopped, and the driving of the second apron pair 13 is stopped. When the second apron pair 13 is stopped, the spun second roving S2 is cut between a nip point of the second apron pair 13 and a nip point of the front roller device 11. When the feeding of the second roving S2 is restarted and the driving of the back bottom roller 28 is started, the driving of the second apron pair 13 is started. Thus, the second roving S2 is smoothly drafted between the front roller device 11 and the second apron pair 13.

[0026] As shown in Fig. 3A, in the first embodiment, the maximum speed of the first apron pair 12 is the same as the maximum speed of the second apron pair 13. When the fed roving is switched from the first roving S1 to the second roving S2, the controller 44 outputs a drive instruction to the second apron pair 13 corresponding to the second roving S2 to drive the second apron pair 13 at a lower speed than the speed for normal spinning from the predetermined period t prior to a predetermined switch time Ts1 for the predetermined period t and subsequently shifts the second apron pair 13 to the speed for normal spinning. At the same time, the controller 44 outputs a stop instruction to the first apron pair 12 corresponding to the first roving S1 to drive the first apron pair 12 at a lower speed than the speed for normal spinning during the predetermined period t and subsequently stops the first apron pair 12.

[0027] In the same manner, when the fed roving is switched from the second roving S2 to the first roving S1, the controller 44 outputs a drive instruction to the first apron pair 12 corresponding to the first roving S1 to drive the first apron pair 12 at a lower speed than the speed for normal spinning from the predetermined period t prior to a predetermined switch time Ts2 for the predetermined period t and subsequently shifts the first apron pair 12 to the speed for normal spinning. At the same time, the controller 44 outputs a stop instruction to the second apron pair 13 corresponding to the second roving S2 to drive the second apron pair 13 at a lower speed than the speed for normal spinning during the predetermined period t and subsequently stops the second apron pair 13.

[0028] Fig. 3B shows a pattern P of a special yarn Y when, for example, a white roving is used as the first roving S1 and a black roving is used as the second roving S2 so that the special yarn Y is spun from the two colors of roving. In this case, the portion of a length L (spun yarn

length L) of the special yarn Y spun between the switch time Ts1 and the switch time Ts2 is a portion in a second color (black), and the portion of a spun yarn length from the switch time Ts2 that is prior to the switch time Ts1 to the switch time Ts1 or from the switch time Ts2 to the subsequent switch time Ts1 is a portion in a first color (white). To change the color of the special yarn Y from white to black, the amount of black fibers is increased and the amount of white fibers is accordingly decreased from the time prior to the switch time Ts1 by the predetermined period t. To change the color of the special yarn Y from black to white, the amount of white fibers is increased and the amount of black fibers is accordingly decreased from the time prior to the switch time Ts2 by the predetermined period t.

[0029] In the prior art, the feeding of the second roving S2 from the second roving reel is started at the switch time Ts1 at the same time as when the feeding of the first roving S1 from the first roving reel is stopped, whereas in the first embodiment, the feeding of the second roving S2 from the second roving reel is started at the time prior to the predetermined switch time Ts1. The feed amount of the second roving S2 is smaller than the feed amount of the normal spinning from when the feeding of the second roving S2 is started to the predetermined period t. Thus, since the second roving S2 that starts to be newly fed is gradually mixed with the first roving S1, the two types of raw-material fibers, namely, the first roving S1 and the second roving S2, are intertwined with each other in a preferred manner. This limits decreases in the yarn strength of the feed start portion of the raw-material fiber, that is, at the switching portion of the first roving S1 and the second roving S2.

[0030] Further, in the first embodiment, during the predetermined period t, the first roving S1 is fed when the feed amount of the first roving S1 is smaller than the normal spinning in correspondence with the start of the feeding of the second roving S2. Subsequently, the feed amount of the first roving S1 further decreases in correspondence with the increase in the feed amount of the second roving S2. Thus, when the fed roving is switched, the sum of the feed amount of the first roving S1 and the feed amount of the second roving S2 is maintained at a constant value. Accordingly, the thickness of the yarn remains the same at the switching portion. This improves the aesthetic appeal of the obtained special yarn Y.

[0031] In the same manner, when the second roving S2 is switched to the first roving S1, the controller 44 outputs a drive instruction to the first apron pair 12 corresponding to the first roving S1 to drive the first apron pair 12 at a lower speed than the speed for normal spinning from the time prior to the predetermined switch time Ts2 and subsequently shifts the first apron pair 12 to the speed for normal spinning. At the same time, the controller 44 outputs a stop instruction to the second apron pair 13 corresponding to the second roving S2 to drive the second apron pair 13 at a lower speed than the speed for normal spinning and subsequently stops the second apron pair 13. Thus, even when the fed roving is switched from the second roving S2 to the first roving S1, decreases in the yarn strength at the switching portion are limited. This improves the aesthetic appeal of the obtained special yarn Y.

[0032] As shown in Fig. 4, the first embodiment differs from the special yarn obtained from the conventional drafting device in that the switching portion in the special yarn Y obtained from the drafting device 10 of the first embodiment is substantially free from pills and lint.

[0033] The proper values of the length of a raw-material fiber mixing section (mixing section) prior to the switch times Ts1 and Ts2 and the mixing ratio of the first roving S1 and the second roving S2 differ depending on the types of spun fibers and the spinning conditions. The mixing ratio of the first roving S1 and the second roving S2 correlates with the ratio of the speed of the first apron pair 12 and the speed of the second apron pair 13. The mixing ratio of the first roving S1 and the second roving S2 is set to a proper range through experiments in advance.

[0034] The spinning frame is operated in a state in which settings are input to the controller 44 before the operation of the spinning frame. The controller 44 controls the middle roller motor 42 and the back roller motor 43 so that the middle roller motor 42 and the back roller motor 43 are accelerated and decelerated to suit the length of the set mixing section and the set mixing ratio of the first roving S1 and second roving S2.

[0035] The first embodiment has the advantages described below.

(1) The drafting device 10 includes the first apron pair 12 and the second apron pair 13 arranged in correspondence with the fiber feed portions (first roving reel and second roving reel), the front roller device 11 shared by the first and second apron pairs 12 and 13, and the speed change controller (controller 44) that changes the speeds of the apron pairs 12 and 13 in accordance with predetermined conditions. When the fiber feed portions are switched, that is, when any one of the fiber feed portions starts feeding fibers, the controller 44 outputs a drive instruction to the corresponding apron pair to drive the apron pair during the predetermined period t at a lower speed than the normal spinning and subsequently to shift the corresponding apron pair to the speed for normal spinning.

In such a structure, two types of raw-material fibers are intertwined in a preferred manner. This limits decreases in the yarn strength of the switching portion (feed start portion). This spins the special yarn Y having continuous portions of different colors and raw materials while limiting decreases in the yarn strength at the switching portion of a raw-material fiber.

(2) When switching the fiber feed portions, the controller 44 outputs a drive instruction to the apron pair

corresponding to the fiber feed portion that starts feeding fibers (first apron pair 12 or second apron pair 13). At the same time, the controller 44 outputs a drive instruction to the apron pair corresponding to the fiber feed portion that stops feeding fibers (fiber feed portion other than fiber feed portion that starts feeding fibers) to drive the apron pair at a lower speed than the normal spinning during the predetermined period t.

In such a structure, at the same time as when the fiber feed portion, which starts feeding fibers, starts to feed fibers, the fiber feed portion that stops feeding fibers decreases the feed amount of fibers. The feed amount that is decreased is approximately the same as the amount of fibers that are newly fed. This limits changes in the yarn thickness at the switching portion (feed start portion). This improves the aesthetic appeal of the special yarn Y.

(3) The controller 44 is configured to change the mixing section and the mixing ratio of multiple types of roving (roving of which feed is stopped and roving that is newly fed). This allows the fed fibers to be switched in a proper state in accordance with the types of fibers and the operation conditions.

Second Embodiment

[0036] A second embodiment will now be described with reference to Fig. 5. The second embodiment differs from the first embodiment in the drive instruction output by the controller 44 during the predetermined period t to the apron pair corresponding to the fiber feed portion that stops feeding fibers of the first apron pair 12 and the second apron pair 13 when switching the fiber feed portions. In the second embodiment, like or same reference numerals are given to those components that are the same as the corresponding components of the first embodiment. Such components will not be described in detail.

[0037] As shown in Fig. 5, when switching the fiber feed portions, the controller 44 outputs a drive instruction to the apron pair corresponding to the fiber feed portion that starts feeding fibers to drive the apron pair at a lower speed than the speed for normal spinning during the predetermined period t from the time prior to the predetermined switch time Ts1 or Ts2 by the predetermined period t and subsequently shifts the apron pair to the speed for normal spinning. Further, the controller 44 outputs a stop instruction at the predetermined switch times Ts2 and Ts1 to the apron pair corresponding to the fiber feed portion that stops feeding fibers (fiber feed portion other than fiber feed portion that starts feeding fibers).

[0038] Thus, for example, when switching from a state in which the first roving S1 is fed from the first roving reel to a state in which the second roving S2 is fed from the second roving reel, the second roving S2 is fed from the second roving reel at the mixing section, which is prior to the switch time Ts1, with the same amount of the first reel S1 fed from the first roving reel as the normal spinning. As a result, the yarn increases in thickness at a portion corresponding to the switching portion. Thus, the yarn does not become thin at any portion even when the distal end of the fibers of the roving that has been cut at the previous switch time Ts2 is not inserted into the front roller device 11 in a timely manner. This ensures the yarn strength. To facilitate understanding, the thick portion of the yarn is emphasized in Fig. 5.

[0039] The embodiment is not limited to the foregoing structure. It should be understood that the embodiment may be implemented in the following forms.

[0040] The speeds of the first apron pair 12 and the second apron pair 13 when switching the fiber feed portions do not have to change in a single step and may change, for example, in several steps. Alternatively, as shown in a third embodiment of Fig. 6, the speeds of the first apron pair 12 and the second apron pair 13 may change halfway in a curved manner (for example, quadratic curve) and then change in a straight manner.

[0041] When switching the fiber feed portions, the speeds of the first apron pair 12 and the second apron pair 13 may both change in a curved manner until the speed of the first apron pair 12 becomes equal to the speed of the second apron pair 13.

[0042] The drafting device 10 is not limited to a three-line type and may be of a four-line type. More specifically, a second back roller may be arranged at the rear of the back roller around which the back bottom apron 26 runs so that the first apron pair 12 and the second apron pair 13 perform roving drafting with the second back roller.

[0043] The number of the fiber feed portions does not have to be two and may be three or more. For example, three fiber feed portions that feed three types of fibers of different colors and raw materials may be configured to feed fibers in a predetermined order during different periods.

[0044] The roving fed from the fiber feed portions does not have to have the same thickness and may have different thicknesses. When the yarns differ in thickness, the cutting positions where the roving is cut when the first apron pair 12 or the second apron pair 13 stops are changed. Thus, yarn unevenness easily occurs at the switching portion. Since thin portions are formed in the yarn, the yarn strength easily decreases. In such a case, the second embodiment is employed to limit decreases in the yarn strength.

[0045] Both the length of the mixing section and the mixing ratio do not have to be changed. Instead, only one of the length of the mixing section and the mixing ratio may be changed.

[0046] When the drafting device 10 is of a four-line type, the fiber fed from the fiber feed portion does not have to be a roving and may be a sliver.

[0047] The present invention need only increase the mixing proportion of newly fed fibers in a special yarn from zero and does not have to set the mixing proportion of fibers in the special yarn that have already been fed

to zero.

[0048] The present invention may be combined with formation of a slub yarn (yarn in which slubs that differ in thickness are formed in longitudinal direction of yarn). In the second embodiment, the speed of the apron pair corresponding to the fiber feed portion that stops feeding fibers is not changed from the normal spinning during the predetermined period t. Instead, the speed of the apron 27 of the apron pair 13 corresponding to the fiber feed portion that stops feeding fibers may be higher than the normal spinning during the predetermined period t so that the feed start portion further increases in thickness.

Claims

1. A drafting device for a spinning machine comprising:

apron pairs respectively arranged in correspondence with fiber feed portions;
a front roller shared by the apron pairs; and
a speed change controller configured to change speeds of the apron pairs in accordance with predetermined conditions,
wherein the speed change controller is configured so that when any one of the fiber feed portions starts feeding fibers, the speed change controller outputs a drive instruction to the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, to drive the apron pair during a predetermined period at a lower speed than a speed for normal spinning and subsequently to shift the apron pair to the speed for normal spinning.

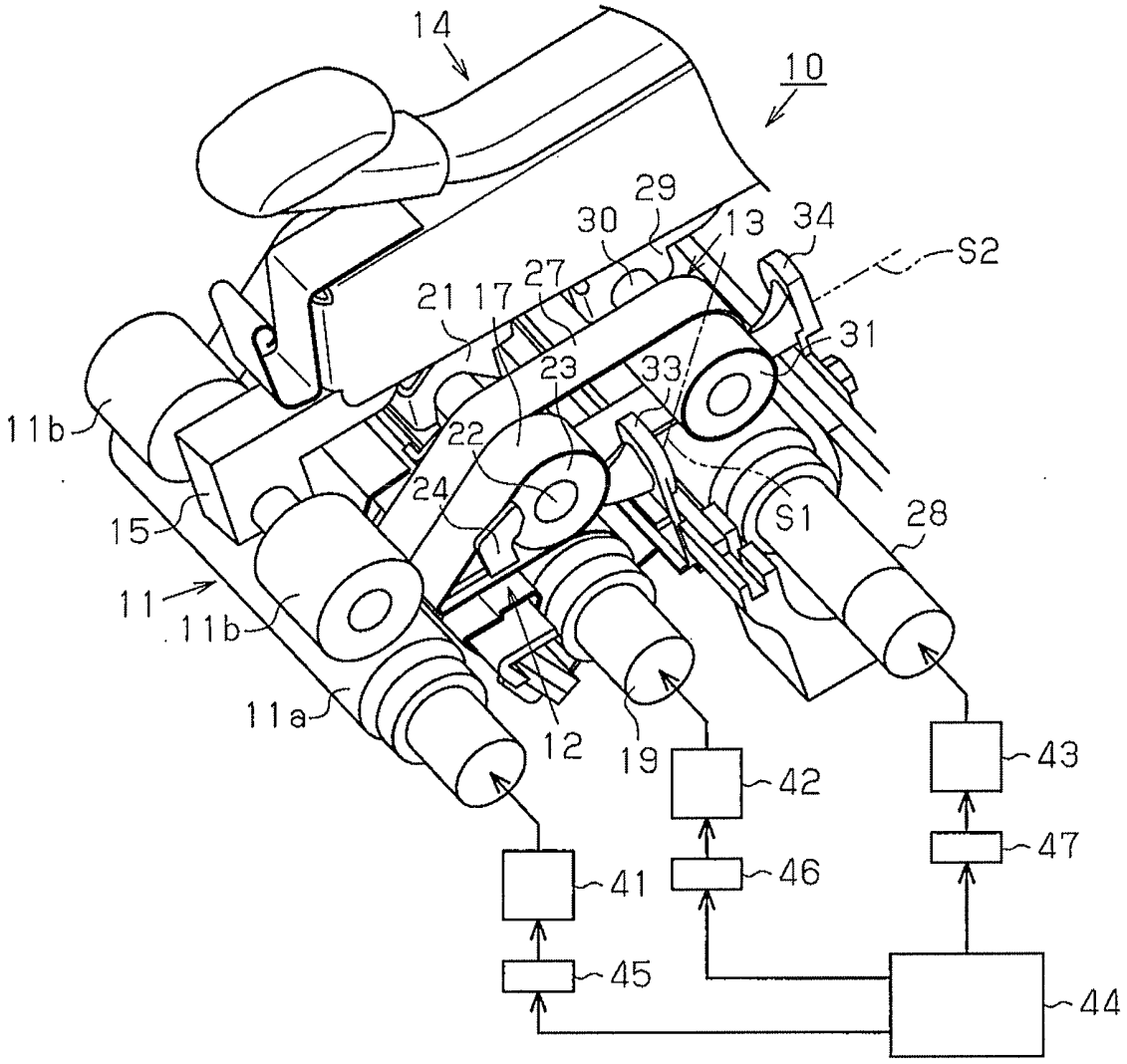
2. The drafting device according to claim 1, wherein the speed change controller is configured so that the speed change controller outputs the drive instruction to the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, while the speed change controller outputs a drive instruction to the apron pair, the apron pair corresponding to a fiber feed portion other than the fiber feed portion that starts feeding fibers, to drive the apron pair during the predetermined period at a lower speed than the speed for normal spinning so that a yarn remains unchanged in thickness.

3. The drafting device according to claim 1, wherein the speed change controller is configured so that when feeding of fibers is started, the speed change controller outputs the drive instruction to the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, and outputs a drive instruction to the apron pair, the apron pair corresponding to a fiber feed portion other than the fiber feed portion that starts feeding fibers, to drive the apron pair during the predetermined period at a speed that is higher than or equal to the speed for normal spinning so that a yarn becomes thicker than before the feeding of fibers is started.

4. A method for controlling a drafting device for a spinning machine, the drafting device including apron pairs respectively arranged in correspondence with fiber feed portions, a front roller shared by the apron pairs, and a speed change controller configured to change speeds of the apron pairs in accordance with predetermined conditions, the method comprising:

when any one of the fiber feed portions starts feeding fibers, driving the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, during a predetermined period at a lower speed than a speed for normal spinning; and
subsequently shifting the apron pair, the apron pair corresponding to the fiber feed portion that starts feeding fibers, to the speed for normal spinning.

Fig.1


14
10
29
30
13
34
S2
21
17
27
31
23
33
11b
22
24
S1
28
15
11
11b
11a
12
19
42
43
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41
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45
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Fig.2

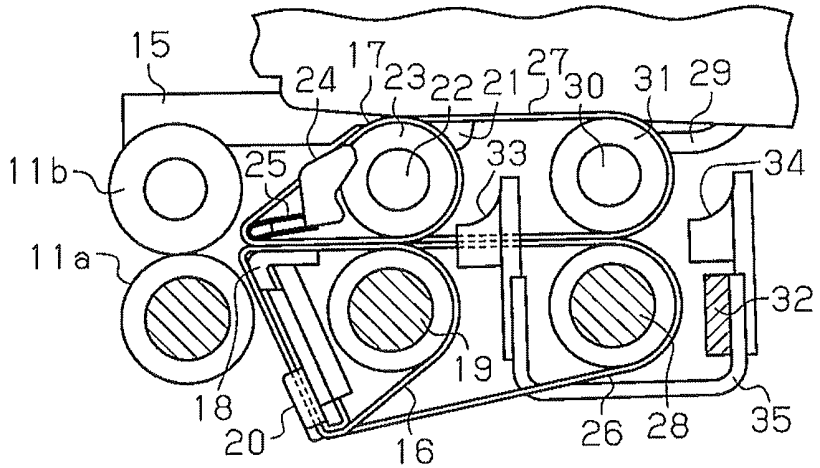
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Fig.3A

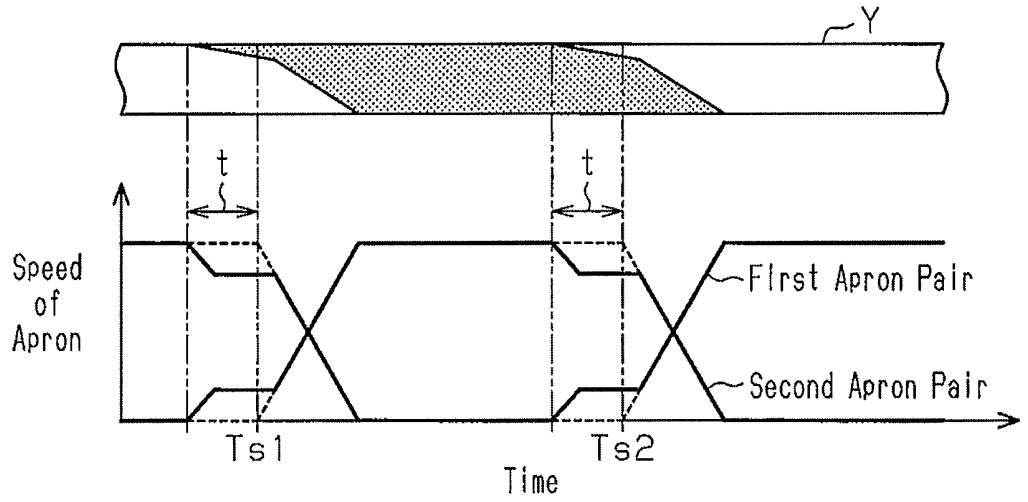


Fig.3B

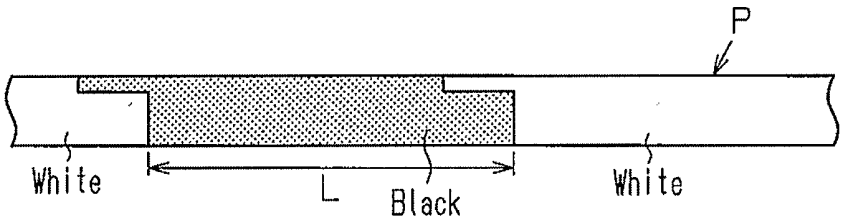


Fig.4

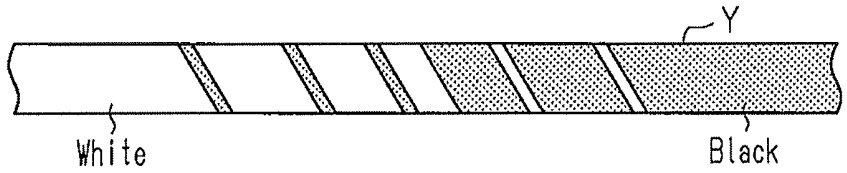


Fig.5

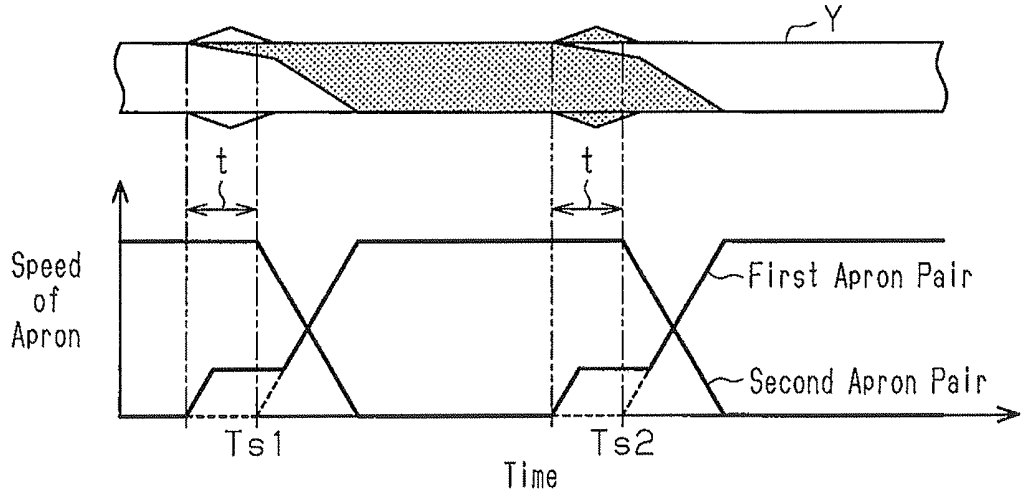


Fig.6

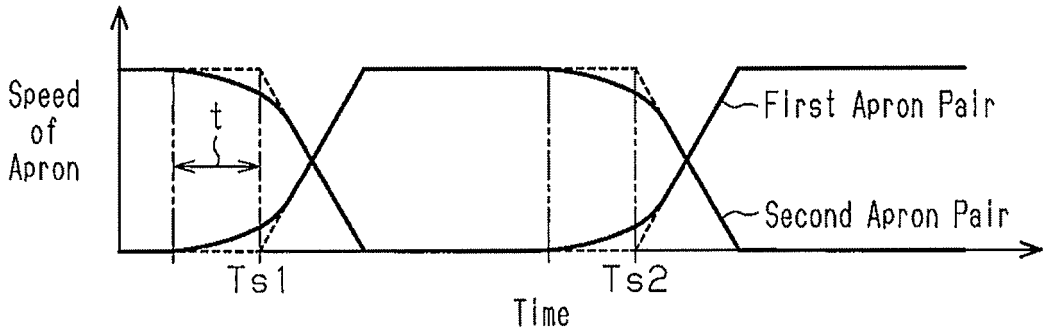


Fig.7

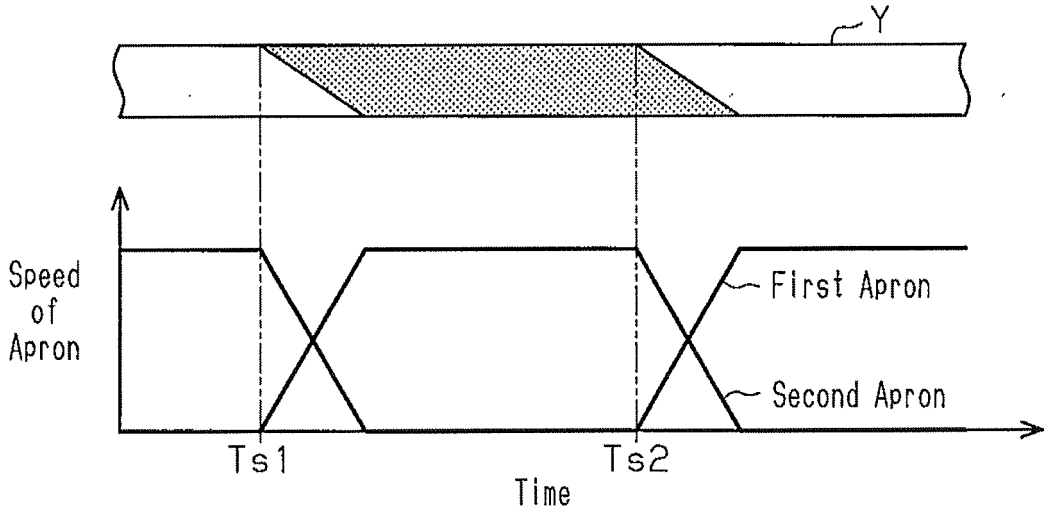
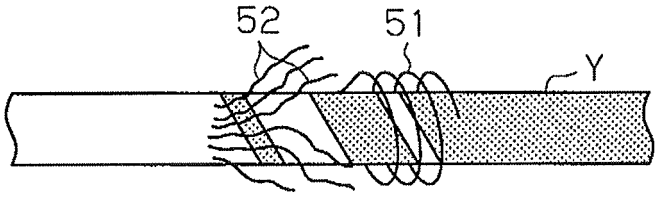


Fig.8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/056554

A. CLASSIFICATION OF SUBJECT MATTER
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)
D01H5/36

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 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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.
Y A	JP 61-070026 A (Mitsubishi Rayon Co., Ltd.), 10 April 1986 (10.04.1986), page 2, upper left column, line 11 to page 3, upper left column, line 4 (Family: none)	1,2,4 3
Y A	JP 2000-303271 A (Nisshinbo Industries, Inc.), 31 October 2000 (31.10.2000), paragraphs [0022] to [0024]; fig. 1 to 3 & US 2002/0152738 A1 & EP 1028182 A1 & CN 1263175 A	1,2,4 3
A	JP 2002-220751 A (Maschinenfabrik Rieter AG.), 09 August 2002 (09.08.2002), claims; fig. 1 to 3 & US 2002/0144496 A1 & EP 1219737 A1 & CN 1360100 A	1-4

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 May 2015 (11.05.15)	26 May 2015 (26.05.15)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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

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Patent documents cited in the description

- JP 61070026 A **[0004]**