



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.05.2003 Bulletin 2003/22

(51) Int Cl.7: **D01H 5/82**

(21) Application number: **02026353.9**

(22) Date of filing: **22.11.2002**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SK TR
 Designated Extension States:
AL LT LV MK RO SI

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(30) Priority: **26.11.2001 JP 2001359039**

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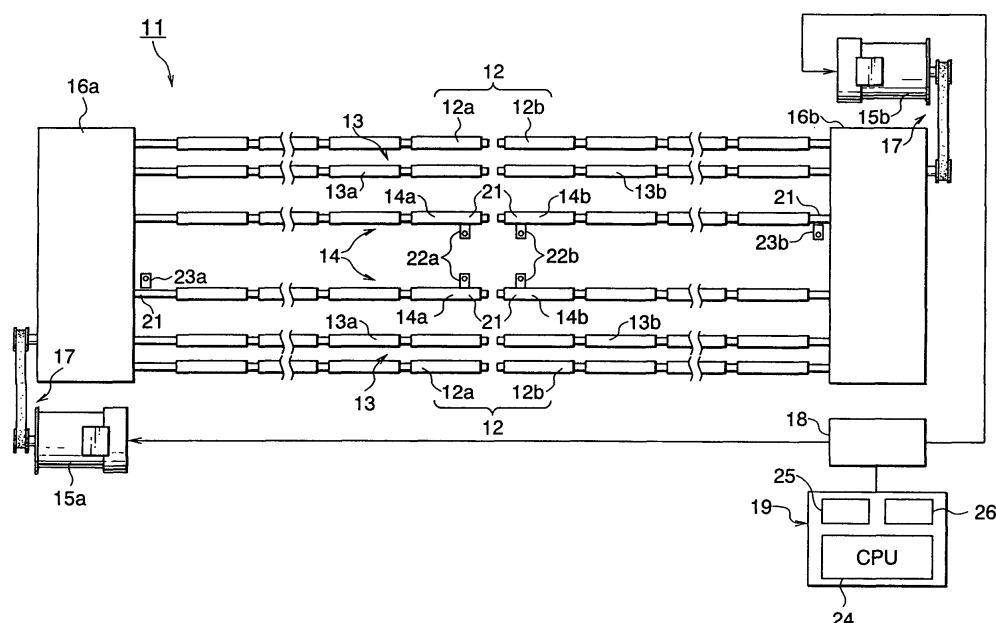
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(54) **Device for detecting looseness in drafting rollers of spinning machine**

(57) Each of the bottom rollers 12 through 14 of a drafting device 11 is divided into two line shafts 12a through 14a and 12b through 14b and driven by driving motors 15a and 15b from the ends of the machine base. Each line shaft consists of a plurality of roller shafts 21 connected to each other through threaded engagement of screw portions 21a and 21b formed at the ends there-

of. Proximity switches 23a and 23b are provided at positions corresponding to those roller shafts 21 of the line shafts 14a and 14b of the back bottom roller 14 which are situated at the driving side ends, and proximity switches 22a and 22b are provided at positions corresponding to those roller shafts 21 situated at the ends on the side opposite to the driving side.

FIG. 1



Description

Background of the Invention

Field of the Invention

[0001] The present invention relates to a device for detecting looseness in the drafting rollers of a spinning machine and, more specifically, to a device for detecting looseness in the drafting rollers of a spinning machine equipped with a drafting device which is equipped with a plurality of bottom rollers each consisting of a plurality of roller shafts connected with each other through threaded engagement of screw portions formed at the ends thereof, each bottom roller being divided into two line shafts and arranged coaxially, each line shaft being driven from the machine base end side.

Description of the Related Art

[0002] In a spinning machine such as a ring spinning machine, roving supplied from a roving bobbin is drafted by a drafting device and sent out from a front roller before it is taken up by a bobbin rotating integrally with the spindle by way of a snail wire, an anti-node ring, and a traveler traveling on the ring.

[0003] Generally speaking, as shown in Fig. 5, a drafting device 51 is of a three line type consisting of front roller 52, middle roller 53, and back roller 54, and as shown in Fig. 4, front bottom roller 52a, middle bottom roller 53a, and back bottom roller 54a are driven by a single motor 55.

[0004] Further, generally speaking, as shown in Fig. 6, each of the bottom rollers 52a through 54a consists of a plurality of roller shafts 56 which are connected with each other through threaded engagement of male screw portions 56a and female screw portions 56b formed at the ends thereof so as to be formed into a single line shaft. And, the fastening direction of each screw is generally determined according to the direction of the load received by each of the bottom rollers 52a through 54a. Thus, each of the bottom rollers 52a through 54a adapted to draft and send out roving R are designed so as to be fastened when rotated in the fiber bundle (roving) sending out direction (counterclockwise in Fig. 5).

[0005] Further, recently, there is a tendency for the machine base to have a large number of spindles (e.g., 400 to 600 spindles on one side). In view of this, an apparatus has been proposed and put into practical use in which a driving motor is provided at either longitudinal end of the machine base and in which each bottom roller of a drafting device is divided substantially at the center into two line shafts, each line shaft being driven from the machine base end side. Also in the construction in which each bottom roller is divided into two line shafts, the spindle pitch is entirely fixed, so that the gap between the opposing end surfaces of the line shafts is as small as several mm to around 10 mm.

[0006] It is to be noted, however, that, as shown in Fig. 5, the load acting on the back roller 54 of the drafting device 51 is a resultant force of a reaction force F1 for drawing in roving R and a pulling force F2 applied by the middle roller 53 through the fiber. And, since the forces F1 and F2 are in opposite directions, the load acting when rotating the back bottom roller 54a fluctuates depending upon the magnitude relationship between the forces F1 and F2. And, when a large difference is generated in the load acting on the roller shafts 56 constituting the back bottom roller 54a due to non-uniformity, etc. of the roving supplied to each spindle, relative rotation is generated between the roller shaft 56 under large load and the roller shaft 56 under small load, so that there is the possibility of a force causing looseness in the screws being exerted. When looseness is generated, not only does the drafting fail to be conducted at a predetermined drafting ratio, but also the back bottom roller 54a expands. And, any looseness generated is likely to augment with the result that the looseness amount, that is, the expansion, increases and that the opposing end surfaces of the divided back bottom roller 54a interfere with each other, resulting in damage to the parts.

Summary of the Invention

[0007] The present invention has been made in view of the above problem in the prior art. It is an object of the present invention to provide a device for detecting looseness in drafting rollers of a spinning machine for use in a drafting device of the type in which a bottom roller consisting of a plurality of roller shafts connected to each other through threaded engagement of screw portions formed at the ends thereof is divided into two line shafts and in which each line shaft is driven from the machine base end side, wherein it is possible to detect generation of looseness in the screw portions of the roller shafts.

[0008] To achieve the above object, according to this invention, each bottom roller consists of a plurality of roller shafts connected to each other through threaded engagement of screw portions formed at the ends thereof, and is divided in the longitudinal direction into two line shafts. The line shafts are arranged coaxially, and driven from the machine base end side. And, there is provided detecting means which detects looseness in the roller shafts on the basis of rotation or axial movement of that roller shaft of the plurality of roller shafts constituting the back bottom roller which is situated at the end on the side opposite to the driving side.

[0009] In this invention, relative rotation is generated in the roller shafts in a condition in which the difference in the load acting on the plurality of roller shafts constituting the back bottom roller divided into two line shafts has become large. And, when looseness is generated in at least a part of the roller shafts, that roller shaft which is situated at the end on the side opposite to the driving

side moves (rotates) to the loosened side, and its axial movement or rotation to the loosened side is detected by the detecting means. Thus, on the basis of a detection signal therefrom, it is possible to take appropriate measures, such as the stopping of the machine base.

[0010] It is also possible for the detecting means to detect the looseness on the basis of rotation of the roller shaft situated at the end on the side opposite to the driving side. In this invention, looseness in the roller shafts is detected on the basis of rotation of the roller shaft situated at the end on the side opposite to the rotating side of the line shaft. Rotation due to looseness in any one of the plurality of roller shafts constituting the line shaft is reflected in the roller shaft situated at the above-mentioned end, so that by detecting rotation of that roller shaft, it is possible to detect generation of looseness in the roller shafts constituting the line shaft. In the arrangement in which axial movement of the above-mentioned roller shaft is directly detected, the gap between the line shafts is small, so that it is difficult to accurately detect movement that is attributable to looseness in the screw portions while excluding the influence of expansion of the line shafts due to thermal expansion. However, in the arrangement in which rotation of the roller shaft is detected, it is possible to perform detection with sufficient accuracy even if the moving amount of the roller shaft per rotation of the roller shaft is small.

[0011] It is also possible for the detecting means to detect the above-mentioned looseness on the basis of relative rotation between the roller shaft situated at the end on the side opposite to the driving side and the roller shaft situated at the driving side end. In this invention, the position of the driving side end of the line shaft is used as a reference, and looseness in the roller shafts is detected on the basis of relative rotation of the roller shaft situated at the end on the side opposite to the driving side with respect to it. Thus, looseness in any roller shaft causes relative rotation of both roller shafts, and as compared to the detecting method based on the relative rotation of the roller shafts provided at the ends of the two line shafts whose end surface are opposed, an improvement is achieved in terms of detection accuracy.

[0012] It is also possible for the detecting means to detect the above-mentioned looseness on the basis of relative rotation between opposing roller shafts situated at the end on the side opposite to the driving side. In this invention, it is possible to detect looseness in the roller shafts constituting one back bottom roller using two sensors. In a case in which both line shafts are loosened simultaneously and in the same manner, the above-mentioned roller shafts make no relative rotation, and it is impossible to detect the looseness. However, this does not lead to any substantial problem since the probability of both line shafts loosening in the same manner is very low.

[0013] In a spinning machine in which a pair of drafting devices as described above are provided on the right and left sides, the above-mentioned detecting means is

provided in each of the drafting device.

[0014] In a spinning machine in which a pair of drafting devices as described above are provided on the right and left sides, the above-mentioned detecting means is provided in each of the drafting device, and the detecting means detect the above-mentioned looseness on the basis of rotation of four roller shafts situated at the end on the side opposite to the driving side. Thus, in this invention, a further improvement is achieved in terms of detection accuracy.

[0015] The detecting means may be provided with a proximity switch as the detecting portion, and the roller shaft on the portion-to-be-detected side may be provided with one or more recesses such that its section in the portion corresponding to the proximity switch is recessed relative to the section around the same.

[0016] Further, the detecting means may be provided with a proximity switch as the detecting portion, and the roller shaft on the portion-to-be-detected side may have a substantially D-shaped section in the portion corresponding to the proximity switch. In this invention, the possibility of erroneous detection due to the influence of lint is lower as compared with the case of the detecting portion which detects any photoreception or the photoreception amount of the photoreceptor portion as in an optical sensor. Further, since the section of the roller shaft portion constituting the portion to be detected has a substantially D-shaped sectional configuration, the portion to be detected is not in the way when arranging the guide plate for the fiber bundle on the downstream side of the back bottom roller as in the case in which the portion to be detected protrudes from the peripheral surface of the circular portion.

Brief Description of the Drawings

[0017]

Fig. 1 is a schematic plan view of a drafting device according to an embodiment of the invention;

Fig. 2a is a partially sectioned plan view showing how roller shafts are connected to each other, Fig. 2b is a schematic end view taken along the line B-B of Fig. 2a, and Fig. 2c is a schematic end view corresponding to Fig. 2b, showing the driving side end of a roller shaft;

Fig. 3 is a graph showing the output pulses of proximity switches;

Fig. 4 is a schematic plan view of a conventional drafting device;

Fig. 5 is a schematic side view of a drafting device; and

Fig. 6 is a partially sectioned plan view showing how roller shafts are connected to each other.

Description of the Preferred Embodiment

[0018] In the following, an embodiment of the present

invention applied to a spinning machine in which a pair of drafting devices are provided on the right and left sides will be described with reference to Figs. 1 through 3. Fig. 1 is a schematic plan view of a drafting device in which top roller is omitted.

[0019] As shown in Fig. 1, a drafting device 11 is of a three-line type construction equipped with a front bottom roller 12, a middle bottom roller 13, and a back bottom roller 14 as the drafting rollers. Each of the bottom rollers 12 through 14 is divided into two line shafts: 12a and 12b, 13a and 13b, 14a and 14b, and the line shafts of each pair: 12a and 12b, 13a and 13b, 14a and 14b are arranged coaxially. The line shafts 12a through 14a and 12b through 14b are each driven from the ends of the machine base by driving motors 15a and 15b.

[0020] The line shafts 12a through 14a are operationally connected by a gear row (drive gearing) (not shown) contained in a gear box 16a arranged at one end of the machine base. The line shafts 12b through 14b are operationally connected by a gear row (drive gearing) (not shown) contained in a gear box 16b arranged at the other end of the machine base. Rotation of the driving motors 15a and 15b is transmitted to the gear boxes 16a and 16b through a belt transmission mechanism 17. The driving motors 15a and 15b are speed-change controlled by a machine base control device 19 through an inverter 18.

[0021] As shown in Fig. 2a, each of the line shafts 12a through 14a and 12b through 14b consists of a plurality of roller shafts 21 connected to each other through threaded engagement of male screw portions 21a and female screw portions 21b formed at the ends thereof. Fig. 2a shows the line shafts 14a and 14b of the back bottom roller 14. Of the roller shafts 21, both roller shafts 21 situated at the end on the side opposite to the driving side are supported by bearings 20a at opposing ends thereof. Further, the roller shafts 21 are supported by bearings 20b in the vicinity of the connecting portions thereof.

[0022] The back bottom roller 14 is equipped with detecting means for detecting looseness in that roller shaft 21 of the plurality of roller shafts 21 constituting the back bottom roller 14 which is situated at the end on the side opposite to the driving side. The detecting means is designed so as to detect looseness in the roller shafts on the basis of rotation of the roller shaft 21 situated at the end on the side opposite to the driving side. In this embodiment, the above-mentioned looseness is detected on the basis of relative rotation of the roller shaft 21 situated at the end on the side opposite to the driving side and the roller shaft 21 situated at the driving side end.

[0023] In this embodiment, the detecting means is equipped with proximity switches 22a and 22b as detecting portions arranged at positions corresponding to the roller shaft 21 situated at the end on the side opposite to the driving side of the line shafts 14a and 14b and proximity switches 23a and 23b (See Fig. 1) as detecting portions arranged at positions corresponding to the roller shaft 21 situated at the driving side end. The roller shafts 21 situated at the driving side ends of the line shafts 14a and 14b are free from looseness, so that one proximity switch 23a, 23b is provided for each of the line shafts 14a and 14b that each consist of two line shafts.

[0024] Further, as shown in Figs. 2b and 2c, each of the roller shafts 21 on the portion-to-be-detected side has a substantially D-shaped sectional configuration at a position corresponding to the proximity switch 22a, 22b, 23a, 23b, with a flat portion 21c being formed in a part of the cylindrical peripheral surface. The positions of the flat portions 21c are determined such that there is a phase deviation of 180 degrees between the positions corresponding to the proximity switches 22a and 22b and the positions corresponding to the proximity switches 23a and 23b. Thus, when the roller shafts 21 rotates in a connecting condition free from looseness, rotation of the back bottom roller 14 by 180 degrees after the proximity switches 22a and 22b are opposed to the flat portions 21c results in the proximity switches 23a and 23b being opposed to the flat portions 21c.

[0025] The machine base control device 19 is equipped with a CPU 24, a ROM 25, a RAM 26, an input device, and an input/output interface (not shown). The CPU 24 controls the driving motors 15a and 15b through the inverter 18, and controls a motor (not shown) for driving a lifting driving system and a spindle driving system (not shown), thus functioning as the control device of the spinning machine.

[0026] The machine base control device 19 is electrically connected to the proximity switches 22a, 22b, 23a, and 23b, and output signals from the proximity switches 22a, 22b, 23a, and 23b are input to the CPU 24. The CPU 24, which constitutes the detecting means, makes a judgment, on the basis of a signal thereof, as to whether that roller shaft 21 of each of the line shafts 14a and 14b of the back bottom roller 14 which is situated at the end on the side opposite to the driving side has made a relative rotation with respect to the roller shaft 21 at the driving side end; when it is determined that it has made a relative rotation, an abnormality signal (looseness detection signal) is output. Further, when it outputs the above-mentioned abnormality signal, the CPU 24 performs control so as to stop the operation of the spinning machine. Thus, the CPU 24 constitutes a control device which stops the operation of the spinning machine when a looseness detection signal is output from the looseness detecting device of the drafting device 11.

[0027] The ROM 25 stores program data and various items of data necessary for the execution thereof. The program data includes various fiber materials, spinning conditions, such as spinning yarn number count and number of twist, spindle rotating speed during normal operation, correspondence data regarding the rotating speeds of the driving motors for the draft driving system and the lifting driving system, a map indicating the relationship between RPM and supply electric current amount to the driving motors 15a and 15b at various

winding amounts, etc. The RAM 26 temporarily stores data input from the input device, results of computation processing in the CPU 24, etc. The input device is used to input spinning condition data, such as spinning yarn number count, fiber type (material), maximum spindle RPM during spinning operation, spinning length, lift length, chase length, and the length of the bobbin used.

[0028] Next, the operation of the device, constructed as described above, will be illustrated. Prior to the operation of the spinning machine, the spinning conditions, such as fiber material, spinning yarn count, and number of twist, are input to the machine base control device 19 by the input device. When the operation of the spinning machine is started, the driving motors 15a and the 15b are rotated and controlled through the inverter 18 in correspondence with the spinning conditions on the basis of a command from the machine base control device 19. Further, the driving motor for the spindle driving system and the lifting system is also controlled such that it attains a predetermined rotating speed.

[0029] When the spinning machine is operated, roving R runs from the back rollers of the drafting device 11 and passes between the front rollers to be thereby drafted, and is then taken up in a take-up portion (not shown) by a bobbin rotated integrally with the spindle.

[0030] Further, when the spinning machine is operated, the bottom rollers 12 through 14 are rotated at a predetermined speed. Each of the roller shafts 21 corresponding to the proximity switches 22a, 22b, 23a, and 23b has a flat portion 21c formed at one position thereof, so that when a roller shaft 21 makes one rotation, one pulse signal is output from the corresponding proximity switch. As shown in Fig. 3 as the normal portion, when there is no looseness, pulse signals are alternately output from the proximity switch 22a on the side opposite to the driving side end and the proximity switch 23a on the driving side end.

[0031] However, when variation is generated in the load acting on the plurality of roller shafts 21 constituting the back bottom roller 14, and a great difference in load is generated between different roller shafts 21, relative rotation is caused between a roller shaft 21 under large load and a roller shaft 21 under small load. For example, when relative rotation occurs in the line shaft 14a and the screw portion is loosened, the roller shaft 21 at the end on the side opposite to the driving side moves to the opposing, line shaft 14b side. In the condition in which the roller shaft 21 at the driving side end and the roller shaft 21 on the side opposite to the driving side make relative rotation as a result of the generation of looseness in the screw portion of the roller shafts 21, pulse signals are output from the proximity switch 23a at the same interval as in the normal state, whereas no pulse is generated from the proximity switch 22a or the interval of generation of pulse signals therefrom is long. Thus, as shown in Fig. 3 as the abnormal state, a condition is attained in which pulse signals are successively generated from the proximity switch 23a. When this state

is attained, the CPU 24 determines that looseness has been generated in the roller shafts 21, and output an abnormality signal. On the basis of this abnormality signal, operation stop control for the machine base is executed, and informing means, such as a buzzer or an alarm lamp, is driven, and the operator is informed of the abnormality.

[0032] Similar looseness detection is performed on the other line shaft 14b. In this embodiment, the CPU 24 performs detection on the four line shafts 14a, 14a and 14b, 14b to see whether there is any looseness in the roller shafts 21.

[0033] The gap between the opposing surfaces of the pair of line shafts 14a and 14b constituting the back bottom roller 14 is as small as approximately 10 mm or less. And, the roller shaft 21 at the end on the side opposite to the driving side also moves to the loosened side due to thermal expansion of the line shafts 14a and 14b, so that it is rather difficult to detect the moving amount due to the looseness in the screw portion while subtracting movement attributable to thermal expansion. However, in the arrangement in which looseness in the roller shafts 21 is detected on the basis of rotation of a roller shaft 21, the thermal expansion of the line shafts 14a and 14b has no influence on the rotation, so that it is easy to accurately detect looseness in the screw portion.

[0034] This embodiment of the invention provides the following advantages:

(1) In the drafting device 11 equipped with the back bottom roller 14 divided into the two line shafts 14a and 14b, each of the line shafts 14a and 14b being driven from the machine base end side, there is provided detecting means which detects looseness in the roller shafts 21 on the basis of rotation of the roller shaft 21 of the plurality of roller shafts 21 which is situated at the end on the side opposite to the driving side. Thus, no matter which screw portion may be loosened, it is possible to detect looseness in the roller shafts 21 and to take appropriate measures, such as stopping of the machine base, on the basis of the detection signal. Further, it is possible to accurately detect looseness in the roller shafts 21 without taking into account the expansion of the line shafts due to thermal expansion. Further, in the arrangement in which rotation of the roller shaft 21 is detected, detection can be effected with sufficient degree of accuracy even if the moving amount of the roller shaft 21 per rotation of the roller shaft 21 is small.

(2) The detecting means detects the looseness on the basis of relative rotation between the roller shaft 21 situated at the end on the side opposite to the driving side and the roller shaft 21 situated at the driving side end. Thus, no matter which roller shaft 21 may be loosened, both roller shafts 21 make relative rotation, and the detection accuracy is im-

proved as compared with the detection method which is based on relative rotation between the roller shafts 21 provided at the ends of the two line shafts 14a and 14b whose end surface are opposed to each other.

(3) The proximity switches 22a, 22b, 23a, and 23b are used as the detecting portions of the detecting means. Thus, the possibility of erroneous detection due to the influence of lint is lowered as compared with the case of the detecting portion which uses as the detecting portion an optical sensor or the like which detects any photoreception in the photoreceptor portion or the photoreception amount.

(4) A substantially D-shaped sectional configuration is imparted to the portions of the portion-to-be-detected side roller shaft 21, forming the flat portions 21c. Thus, unlike the case in which the portion to be detected protrudes from the peripheral surface of the circular portion, there is no protrusion on the outer side of the peripheral surface of the back bottom roller 14. As a result, the portion to be detected is not in the way when arranging the guide plate for the fiber bundle on the downstream side of the back bottom roller 14 in close proximity thereto. Further, when fixing some other component as the portion to be detected by means of adhesive or the like, the durability thereof is a matter of concern. However, in the construction in which partial cutting is effected, there is no need to worry about durability.

(5) Since the operation of the spinning machine is stopped on the basis of a detection signal issued upon detection of looseness in the screw portion, it is possible to prevent the operation from being continued in the abnormal state, thus preventing damage, etc. of the components of the drafting device 11.

(6) In a spinning machine in which a pair of drafting devices 11 are provided on the right and left sides, each drafting device 11 is equipped with the detecting means. Thus, it is possible to achieve the advantages (1) through (5) in an ordinary ring spinning machine, etc.

[0035] The above-described embodiment should not be construed restrictively. For example, the following modifications are also possible.

[0036] It is also possible to omit the proximity switches 23a and 23b provided at the driving side ends of the line shafts 14a and 14b and to detect looseness in the roller shafts 21 on the basis of rotation of the roller shafts 21 situated at the ends of the pair of line shafts 14a and 14b on the side opposite to the driving side. The CPU 24 compares the output pulse signals of the proximity switches 22a and 22b of the pair of line shafts 14a and 14b, and when the output pulse signals of one of the proximity switches are input successively, determines that looseness has been generated in the screw portion. In the case in which the two line shafts 14a and 14b are

loosened simultaneously and in the same manner, the roller shafts 21 make no relative rotation, and it is impossible to detect movement toward the loosened side. However, this presents substantially no problem since the probability of the two line shafts 14a and 14b being loosened simultaneously and in the same manner is very low. In this construction, it is possible to reduce the number of proximity switches, thereby achieving a reduction in cost.

[0037] In a spinning machine in which a pair of drafting devices 11 are provided on the right and left sides, instead of performing comparison on the output pulse signals of the proximity switches 22a and 22b provided in correspondence with the pair of line shafts 14a and 14b, it is also possible to perform comparison between the proximity switches of the line shafts driven by the same driving motor. Further, it is also possible to perform comparison on the output pulse signals of the four proximity switches 22a, 22b, 23a, and 23b. In the arrangement in which comparison is performed on the output pulse signals of the four proximity switches 22a, 22b, 23a, and 23b, the probability of all the four line shafts 14a, 14a and 14b, 14b being loosened simultaneously and in the same manner is lower than in the case of two line shafts, so that it is assumed that there is practically no fear of erroneous detection.

[0038] It is also possible to set the positions of the flat portions 21c such that in the condition in which the back bottom roller 14 is rotating in the normal fashion, the proximity switches 22a, 22b, 23a, and 23b come to face the flat portions 21c simultaneously, that is, the pulse signals are output simultaneously from the proximity switches 22a, 22b, 23a, and 23b. Further, it is not absolutely necessary to effect phase deviation by 180 degrees as in the above-described embodiment. The same effect can be obtained by setting the angle arbitrarily.

[0039] The arrangement in which looseness in the screw portion is detected through comparison of the output pulse signals of at least two proximity switches should not be construed restrictively. It is also possible to adopt an arrangement in which it is determined that looseness has been generated when the rotation speed of the roller shaft 21 as computed from the output pulse generation interval of the proximity switch 22a for detecting rotation of the roller shaft 21 situated at the end on the side opposite to the driving side is different from the rotation speed thereof as computed from the rotation speed of the driving motors 15a and 15b.

[0040] It is also possible to provide a plurality of (e.g., two) flat portions 21c. In this case, two pulses are output through one rotation of the roller shaft 21, so that detection is possible at a stage where the looseness generated is less than in the case of one flat portion. However, one flat portion suffices.

[0041] Instead of forming the flat portion 21c as the portion to be detected on the roller shaft 21 by machining, it is also possible to fix an iron piece or a magnet to

the outer periphery of the roller shaft 21.

[0042] The detecting portions (sensors) constituting the detecting means are not restricted to the proximity switches. It is also possible to use sensors, such as magnetic sensors or optical sensors.

[0043] It is also possible to adopt an arrangement other than the one in which, on the basis of detection signals from the sensors, the CPU 24 of the machine base control device 19 detects looseness in the roller shafts 21 on the basis of rotation of the roller shaft 21 situated at the end on the side opposite to the driving side. For example, when the proximity switches 22a, 22b, 23a, and 23b are in the normal state, the pulse signals may be output simultaneously from them, each output signal being input to an AND circuit. In this arrangement, in the normal state, H-level signals are input to the AND circuit with the same timing, so that the output is at the H-level in the while. When looseness is generated, H-level signals are not simultaneously input to the AND circuit, and its output is at the L-level. Thus, when the output of the AND circuit does not attain H-level within a predetermined period of time, it is to be determined that looseness has been generated in the screw portion.

[0044] Instead of detecting looseness in the roller shafts 21 on the basis of rotation of the roller shaft 21 situated at the end on the side opposite to the driving side, it is also possible to adopt an arrangement in which there is detected axial movement in the loosened side (opposite to the driving side) of the roller shaft 21 situated at the end on the side opposite to the driving side by an amount not less than a predetermined amount. An amount not less than a predetermined amount refers to an amount larger than the expansion due to thermal expansion.

[0045] Instead of the construction in which the line shafts 12a, 13a, and 14a are driven by the driving motor 15a and in which the line shafts 12b, 13b, and 14b are driven by the driving motor 15b, it is also possible to adopt a construction in which the line shafts 12a, 13a and the line shafts 12b, 13b of the front bottom roller 12 and the middle bottom roller 13 are respectively driven by driving motors different from the driving motors 15a and 15b. In this case, changing of the drafting ratio is facilitated.

[0046] The drafting device 11 is not restricted to the three-line type; it may also be a device having four or more drafting rollers on one side.

[0047] The present invention is applicable not only to a ring spinning machine equipped with the drafting device 11 on either side but also to a ring spinning machine performing spinning on one side only, for example, a ring spinning machine which directly spins fine spinning thread by drafting sliver skipping the stage of roving R.

Claims

1. A device for detecting looseness in drafting rollers

of a spinning machine equipped with a drafting device (11) which is equipped with a plurality of bottom rollers (12, 13, 14) consisting of a plurality of roller shafts (21) connected to each other through threaded engagement of screw portions formed at the ends thereof, each bottom roller (12, 13, 14) being divided into two line shafts (12a, 12b, 13a, 13b, 14a, 14b) and arranged coaxially, each line shaft (12a, 12b, 13a, 13b, 14a, 14b) being driven from the end side of a machine base,

characterized in that the detecting device comprises detecting means (22a, 22b, 24) for detecting looseness in the roller shafts on the basis of rotation or axial movement of that roller shaft (21) of the plurality of roller shafts (21) constituting the back bottom roller (14) which is situated at the end on the side opposite to the driving side.

2. A device for detecting looseness in drafting rollers of a spinning machine according to Claim 1, **characterized in that** the detecting means (22a, 22b, 24) detects the looseness on the basis of rotation of the roller shaft (21) situated at the end on the side opposite to the driving side.
3. A device for detecting looseness in drafting rollers of a spinning machine according to Claim 2, **characterized in that** the detecting means (22a, 22b, 23a, 23b, 24) detects the looseness on the basis of relative rotation between the roller shaft (21) situated at the end on the side opposite to the driving side and the roller shaft (21) situated at the driving side end.
4. A device for detecting looseness in drafting rollers of a spinning machine according to Claim 2, **characterized in that** the detecting means (22a, 22b, 24) detects the looseness on the basis of relative rotation between opposing roller shafts (21) situated at the end on the side opposite to the driving side.
5. A device for detecting looseness in drafting rollers of a spinning machine according to any one of Claims 1 through 4, **characterized in that**, in a spinning machine having a pair of the drafting devices (11) on right and left sides, the detecting means (22a, 22b, 23a, 23b, 24) is provided in each drafting device(11).
6. A device for detecting looseness in drafting rollers of a spinning machine according to Claim 2, **characterized in that**, in a spinning machine having a pair of the drafting devices (11) on right and left sides, the detecting means (22a, 22b, 23a, 23b, 24) is provided in each drafting device, and that the detecting means detects the looseness on the basis of rotation of four roller shafts (21) situated at the ends on the side opposite to the driving side.

7. A device for detecting looseness in drafting rollers of a spinning machine according to any one of Claims 2 through 6, **characterized in that** the detecting means includes a proximity switch (22a, 22b, 23a, 23b) as a detecting portion, and that the roller shaft (21) on the portion-to-be-detected side has at least one recess at a position corresponding to the proximity switch (22a, 22b, 23a, 23b) where its section is recessed relative to its section around the recess.

8. A device for detecting looseness in drafting rollers of a spinning machine according to any one of Claims 2 through 7, **characterized in that** the detecting means is equipped with a proximity switch (22a, 22b, 23a, 23b) as a detecting portion, and that the roller shaft (21) on the portion-to-be-detected side has at a position corresponding to the proximity switch (22a, 22b, 23a, 23b) a substantially D-shaped section.

FIG. 1

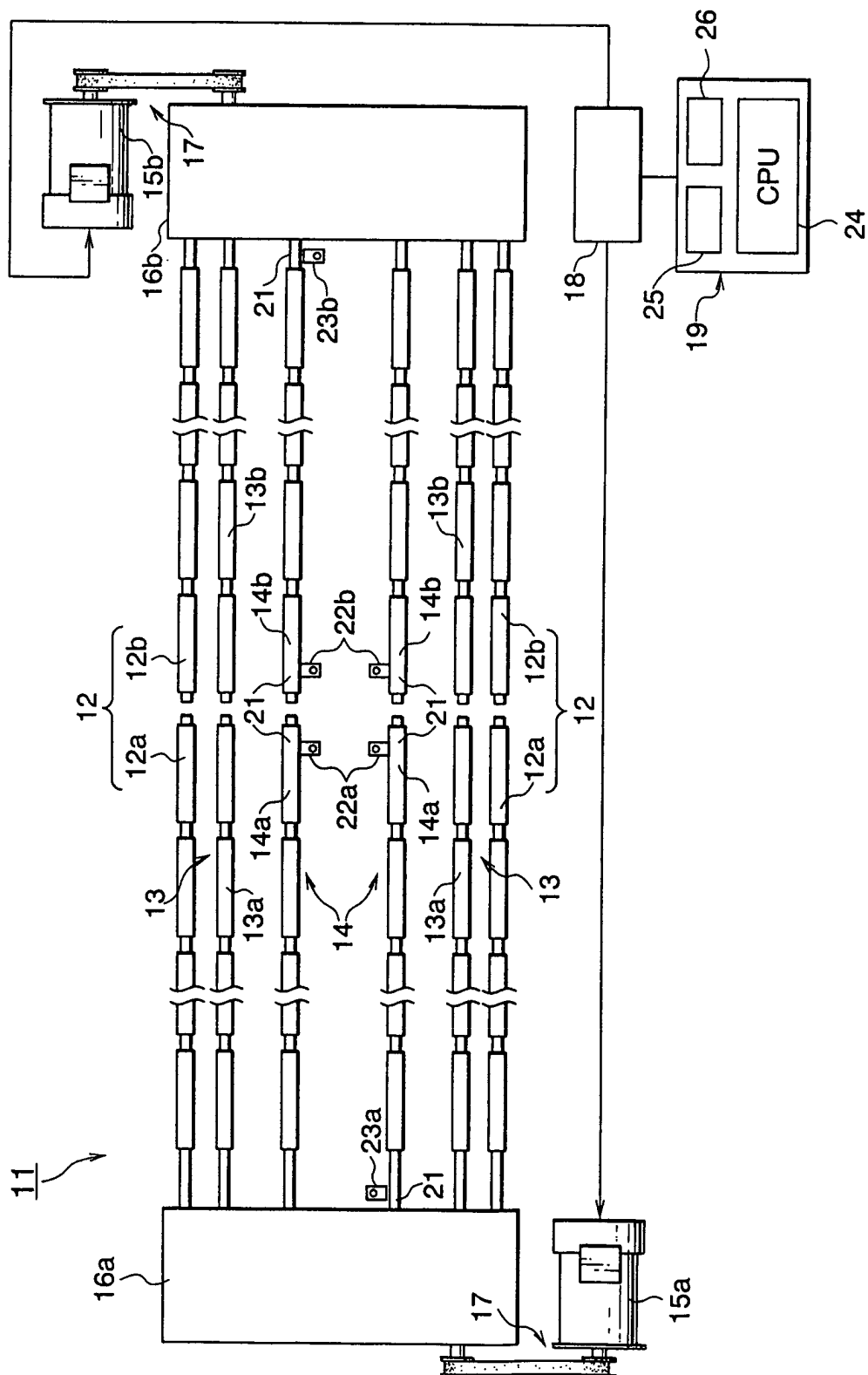


FIG. 2a

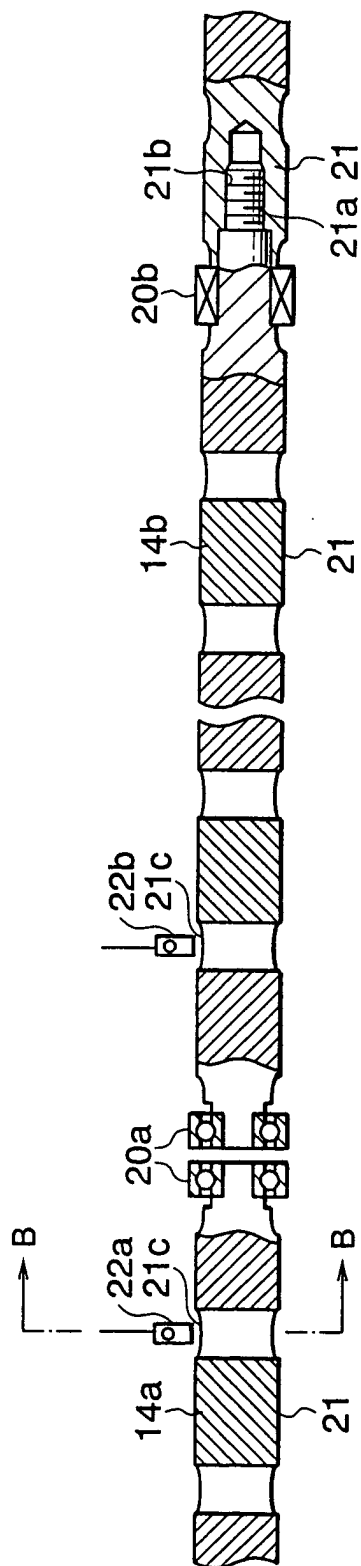


FIG. 2c

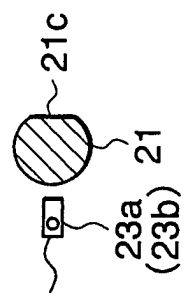


FIG. 2b

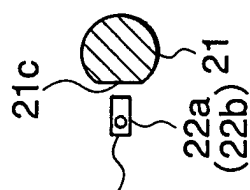


FIG. 3

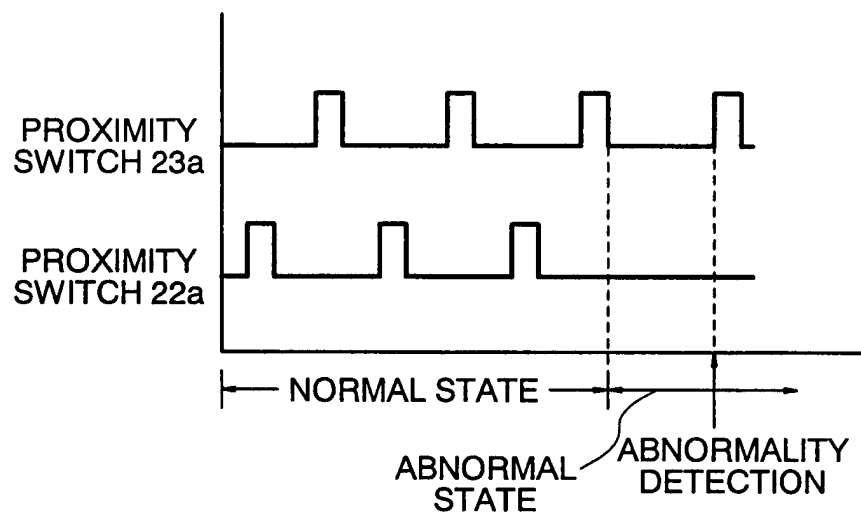


FIG. 4

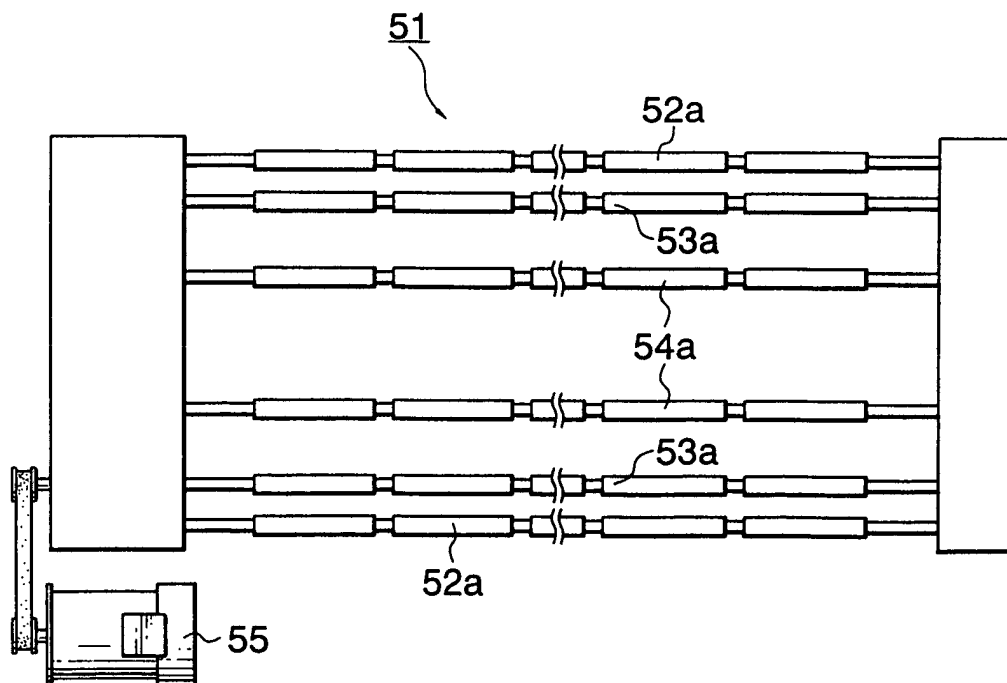


FIG. 5

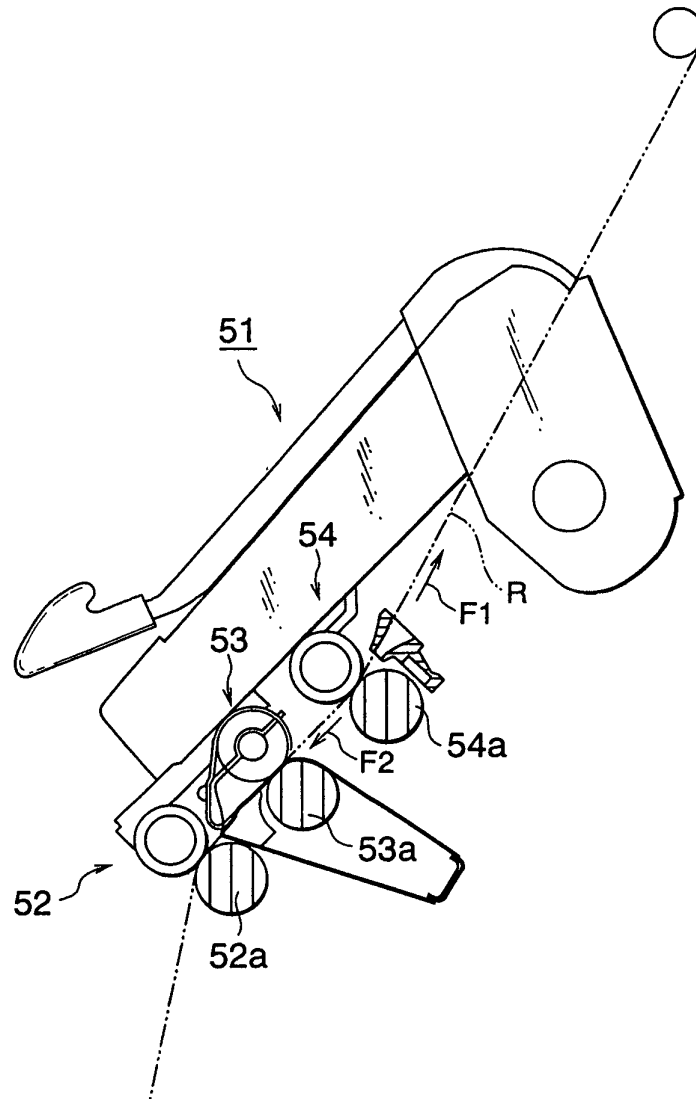


FIG. 6

