



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
27.06.2007 Bulletin 2007/26

(51) Int Cl.:
D01H 13/16 (2006.01) **D01H 13/26** (2006.01)
D01H 4/02 (2006.01) **D02G 3/32** (2006.01)

(21) Application number: **05777046.3**

(86) International application number:
PCT/JP2005/016261

(22) Date of filing: **05.09.2005**

(87) International publication number:
WO 2006/030661 (23.03.2006 Gazette 2006/12)

(84) Designated Contracting States:
CH DE LI

(30) Priority: **16.09.2004 JP 2004269217**
16.09.2004 JP 2004269218

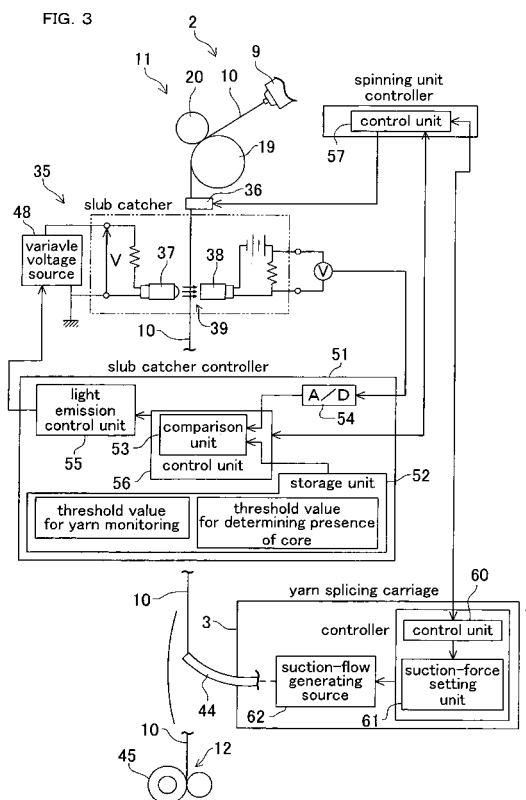
(71) Applicant: **MURATA KIKAI KABUSHIKI KAISHA**
Kyoto 6018326 (JP)

(72) Inventors:
• **SATOMI, Shinichi**
5240063 (JP)
• **INOUE, Kei**
5200105 (JP)

(74) Representative: **Müller-Boré & Partner**
Patentanwälte
Grafinger Strasse 2
81671 München (DE)

(54) **CORE YARN SPINNING MACHINE, METHOD OF DETERMINING PRESENCE OR ABSENCE OF CORE OF CORE YARN, AND METHOD OF SERVICING IN CORE YARN SPINNING MACHINE**

(57) A core yarn spinning machine (1) having a spinning device (9) for spinning a core yarn and a winding device (12) for winding the spun core yarn (10) is further provided with a slub catcher (35) for determining a presence or an absence of a core in the core yarn (10). In the spinning device (9), at a time before winding from a time when the spinning of the core yarn (10) is started to a time prior to the winding of the core yarn (10) by the winding device (12), the spun core yarn (10) is introduced into the slub catcher (35). The existence of a core is made more conspicuous at introduction of the core yarn than after a time when the winding operation of the core yarn (10) by the winding device (12) is started.



Description

Technical Field

[0001] The present invention relates to a core yarn spinning machine capable of determining a presence or an absence of a core. Further, the present invention relates to a method for determining the presence or the absence of the core in a core yarn. Still further, the present invention relates to a method for conducting services in a core yarn spinning machine.

Background of the Invention

[0002] A core yarn spinning machine disclosed in Patent Document 1 is constituted in a manner that an air-spinning device is used to conduct air spinning for an elastic yarn fed as a core from an elastic yarn feeding device and a fiber bundle (sheath fiber) drafted by a draft device, thereby manufacturing a core yarn structured to wrap the core with the sheath fiber. Further, the core yarn spinning machine is provided with a winding device for winding a core yarn as a package and a slub catcher (yarn monitoring means) for detecting yarn defects such as unevenness of yarn in the core yarn fed to the winding device. Further, the elastic yarn feeding device is provided with an elastic yarn detecting sensor for detecting an elastic yarn. When the sensor detects that no elastic yarn is fed, the sensor automatically stops the spinning operation.

Patent Document 1: Japanese Published Unexamined Patent Application No. 2002-363834 (regarding an elastic yarn detecting sensor (reference numeral 32) in Fig. 4, refer to Paragraph No. 0058)

Summary of the Invention

Problems to be Solved by the Invention

[0003] In the above-described Patent Document 1, since the elastic yarn detecting sensor is mounted on an upstream side of the air spinning device, even when the elastic yarn sensor detects an elastic yarn, the detected elastic yarn may not be inside a sheath fiber at downstream side of the air spinning device. For example, at the start of spinning of a core yarn, an elastic yarn may be sucked into a suction nozzle in such a manner as to pass beside an air spinning device, and a yarn having only a sheath fiber may be spun from the air spinning device. Such yarn without a core is wound into a package that results in severely deteriorated package quality.

[0004] The present invention has been made in view of the above-described situation, and an object of the present invention is to provide a method for reliably detecting whether or not a core is present in a core yarn, and a core yarn spinning machine capable of such detection.

Another object of the present invention is to provide a

means capable of carrying out the detection while a textile machine is stopped for a shortest possible time.

Means for Solving the Problems and Effects

[0005] Problems to be solved by the present invention are as described above. Next, a description will be given of the means for solving the problems and the effects.

[0006] According to a first aspect of the present invention, a core yarn spinning machine constituted as follows is provided. The core yarn spinning machine is provided with a spinning device for spinning a core yarn and a winding device for winding the spun core yarn. The core yarn spinning machine is also provided with a core presence determining means for determining whether or not a core is present in the core yarn. At a pre-winding time from start of spinning of the core yarn by the spinning machine until start of winding of the core yarn by the winding device, the core yarn is introduced into the core presence determining means.

[0007] Accordingly, it is possible to determine whether or not the core is present at a stage prior to winding the core yarn and also to prevent a yarn without the core from being wound into a package. It is, therefore, possible to provide a high-quality winding package.

More specifically, the timing prior to the winding operation is a timing prior to joining yarns together during yarn splicing when a start edge of the core yarn on a side started to be spun by the spinning device after the yarn is broken is spliced together with an end edge of the core yarn wound by the winding device, or a timing prior to setting a yarn during doffing motion when a fully wound package wound by the winding device is exchanged with an empty winding tube around which no yarn is wound and the yarn is set on winding tube. The doffing motion includes a case where only such an operation is conducted for setting a yarn on an empty winding tube set at the winding device and the yarn is yet to be wound by the winding device.

[0008] In the above-described core yarn spinning machine, it is preferable that the existence of core is made more conspicuous at a time when the core yarn is introduced into the core presence determining means than at a time after a winding operation of the core yarn is started by the winding device.

That is, if the existence of core is made more conspicuous at a time when the core yarn is introduced into the core presence determining means than at a time after a winding operation of the core yarn is started by the winding device, it is possible to make a more reliable determination by the core presence determining means. Further, since a core yarn before being wound by the winding device is used to make the existence of core conspicuous, the core yarn in which the core has been made conspicuous is wound by the winding device, thereby providing no chance of deteriorating the quality.

In this instance, to make the existence of core conspicuous is a processing in which the existence of core is made conspicuous, if the core exists. For example, to

make the existence of the core conspicuous is a processing for generating a predetermined variance in core yarn in the existence of the core, as compared with a case where no core is present (for example, a processing for slackening an elastic core yarn to be described later) or a processing for increasing a percentage of the core with respect to a thickness of the entire core yarn.

[0009] In the above-described core yarn spinning machine, the core of the core yarn is an elastic yarn, and the core presence determining means determines the presence of core by referring to a fact that thickness of the core yarn or a variation in the thickness is greater than a threshold value. It is, therefore, preferable that the existence of core is made conspicuous by weakening a tensile force of the core yarn or slackening the core yarn to a greater extent than at a time after a winding operation is started.

That is, when the core of the core yarn is a highly-stretchable elastic yarn, a normal core yarn having a core undergoes contraction of the core to result in a radial expansion, depending on a tensile force in the longitudinal direction. Therefore, when the core yarn is slackened or given a weaker tensile force than at a time after the start of a winding operation, if the core yarn is a normal core yarn with a core, the thickness of the core yarn or a variation in the thickness detected by the core presence determining means is tend to be larger. In contrast, there is no such tendency when the core yarn is an abnormal core yarn without a core. It is, therefore, possible to make an appropriate detection on whether or not a core is present in a core yarn by weakening a tensile force or slackening the core yarn to a greater extent than at a time after the start of a winding operation and determining the presence or the absence of the core based on whether or not the thickness of the core yarn or a variation in the thickness detected by the core presence determining means is greater than a predetermined value.

[0010] In the above-described core yarn spinning machine, the core presence determining means also acts as a yarn monitoring means at a time after the start of a winding operation. It is, therefore, preferable that the core presence determining means has a threshold value for determining the presence or the absence of a core separately from a threshold value for yarn monitoring at a time after the start of a winding operation.

Thereby, it is possible to make common use of the core presence determining means and the yarn monitoring means and also to determine the presence or the absence of the core and conduct appropriate yarn monitoring by using a separate threshold value depending on individual purposes.

[0011] According to a second aspect of the present invention, in a core presence determining method for determining a presence or an absence of a core in a core yarn, an existence of the core in the core yarn is made more conspicuous than a core of a core yarn in a normal state, the core yarn is introduced into a detecting unit for detecting thickness of the core yarn or variation in the

thickness, and the presence of the core is determined by referring to a fact that the thickness of the core yarn or the variation in the thickness detected at the detecting unit is greater than a predetermined value.

[0012] That is, when a core yarn is made more conspicuous with regard to the existence of a core than in a normal state, in case of a normal core yarn having a core, the core yarn detected at the detecting unit is greater in its thickness or varies to a greater extent in its thickness compared with an abnormal core yarn without a core. It is, therefore, possible to make an appropriate detection on whether or not a core is present in a core yarn by determining the presence or the absence of the core based on whether or not the thickness of the core yarn or the variation in the thickness detected at the detecting unit is greater than a predetermined value.

[0013] In the above-described method for determining the presence or the absence of a core in the core yarn, when the core of the core yarn is an elastic yarn, it is preferable that the existence of the core is made conspicuous by weakening a tensile force of the core yarn or slackening the core yarn to a greater extent than in a normal state.

[0014] That is, when the core of the core yarn is an elastic yarn great in stretching property, a normal core yarn having a core undergoes contraction of the core to result in a radial expansion, depending on a tensile force in the longitudinal direction. Therefore, when the core yarn is slackened or given a weaker tensile force than in a normal state, in case of a normal core yarn having a core, the thickness of the core yarn or a variation in its thickness detected by the detecting unit is tend to be larger. In contrast, there is no such tendency when the core yarn is an abnormal core yarn without a core. It is, therefore, possible to make an appropriate detection on whether or not the core is present in the core yarn by weakening a tensile force or slackening the core yarn to a greater extent than in a normal state and determining the presence or the absence of the core based on whether or not the thickness of the core yarn or the variation in the thickness detected at the detecting unit is greater than a predetermined value.

[0015] According to a third aspect of the present invention, in a service method in a core yarn spinning machine, at a time of conducting the concerned service, a core yarn is guided into a core presence determining means for determining the presence or the absence of a core in the core yarn.

[0016] Accordingly, while some services are conducted in a core yarn spinning machine, for example, during a splicing operation or a doffing operation accompanying the start of spinning operation, the core presence determining means is used to determine whether or not the core is present in the core yarn, thereby making it possible to reliably detect whether or not the core is present in the core yarn, without increasing a winding stop time of the spinning machine, and to prevent a deterioration in quality of the package.

[0017] In the above-described service method, it is preferable that the core yarn is guided into the core presence determining means at a time prior to completion of a yarn winding service.

Accordingly, a determination on the presence or the absence of the core in the core yarn can be terminated easily within the service time to prevent an increased winding stop time in the spinning machine.

[0018] In the above-described service method, it is preferable that the presence or the absence of the core is determined by the core presence determining means at a time prior to completion of the concerned service.

It is, thereby, possible to attain no increase in winding stop time in a spinning machine. A determination is made on whether or not a core is present at a time prior to the resumption of a winding operation after completion of the service. Thus, even when the core presence determining means determines that no core is present, a recovery from abnormal conditions can be made easily.

[0019] According to a fourth aspect of the present invention, a core yarn spinning machine constituted as follows is provided. The core yarn spinning machine is provided with a unit for spinning and winding a core yarn and a service device for conducting service for the unit. The core yarn spinning machine is also provided with a core presence determining means for determining whether or not a core is present in a core yarn and a guide means for capturing the core yarn when service is conducted for the unit and also guiding the captured core yarn to the core presence determining means.

[0020] Accordingly, by capturing the core yarn by the guide means when service is conducted, the core yarn can be easily guided to the core presence determining means. It is, therefore, possible to make an appropriate determination on whether or not the core is present while the service is conducted.

[0021] In the above-described core yarn spinning machine, it is preferable that the core presence determining means is provided for the unit, the service device is arranged so as to face the unit, and the guide means is provided for the service device with a movable guide which guides a core yarn to the core presence determining means.

Accordingly, the guide is moved, and the core yarn can be easily guided from the service device to the core presence determining means.

[0022] In the above-described core yarn spinning machine, it is preferable that the guide is retracted to the service device side when the service is not conducted. Accordingly, the guide is retracted to the service device side when the service is not conducted, making it possible to prevent the guide from interfering with a traveling core yarn or components on the unit side and to provide a smooth winding operation.

[0023] In the above-described core yarn spinning machine, it is preferable that the guide swings from a retracted state, extends to a yarn path of a core yarn, and thereby captures the core yarn to guide the core yarn to

the core presence determining means.

Accordingly, the core yarn can be appropriately guided to the core presence determining means. Further, the guide is made compact in a retracted state prior to the swinging and extending, thereby downsizing the service device.

[0024] In the above-described core yarn spinning machine, it is preferable that the core presence determining means also acts as a yarn defect detecting means mounted on the unit side. It is, thereby, possible to eliminate a necessity for providing a core presence determining means additionally and further simplify the constitution.

[0025] In the above-described core yarn spinning machine, it is preferable that a plurality of units are arranged and the service unit travels between a plurality of these units.

Accordingly, one service device can handle the plurality of the units, providing a further simplified constitution to decrease the production cost.

Brief Description of the Drawings

[0026]

Fig. 1 is a front view illustrating a core yarn spinning machine according to a first embodiment of the present invention.

Fig. 2 is a side view illustrating a vertical cross section of the core yarn spinning machine.

Fig. 3 is a block diagram illustrating a slub catcher functioning as a core presence determining means of the core yarn spinning machine.

Fig. 4 is a graph diagram illustrating a difference in output voltage of a light receiving unit of the slub catcher depending on a presence or an absence of core inside core yarn.

Fig. 5 is a front view illustrating a core yarn spinning machine according to a second embodiment of the present invention.

Fig. 6 is a side view illustrating a vertical cross section of the core yarn spinning machine.

Fig. 7 is a block diagram illustrating a slub catcher functioning as a core presence determining means of the core yarn spinning machine.

Fig. 8 is a side view illustrating a state in which a doffing motion of a doffing carriage is started to remove a fully wound package and to suck and capture a core yarn by a suction pipe in the core yarn spinning machine.

Fig. 9 is a side view illustrating a state in which a core yarn is pulled out downward from a state illustrated in Fig. 8 and a guide is used to guide the core yarn into the slub catcher.

Fig. 10 is a block diagram illustrating the slub catcher functioning as a core presence determining means and a drawing corresponding to Fig. 9.

Fig. 11 is a perspective view from a doffing carriage illustrating a state of the guide immediately after a

doffing motion is started by the doffing carriage.

Fig. 12 is a perspective view illustrating a state in which the guide is swung from a retracted state and projected to a spinning unit side, by which a yarn path is brought closer by a yarn handling plate.

Fig. 13 is a perspective view illustrating a state in which a pneumatic cylinder is further extended to guide the core yarn to a slub catcher.

Fig. 14 is a perspective view illustrating a state in which the yarn path is removed from the yarn handling plate.

Fig. 15 is a perspective view illustrating a state in which guiding of the yarn path by the guide has been completed.

Description of Reference Numerals

[0027]

- 1: core yarn spinning machine
- 2: spinning unit
- 9: spinning device
- 11: feeding device
- 12: winding device
- 22: elastic yarn (core)
- 35: slub catcher (yarn defect detector, core presence determining device, core presence determining means)
- 43: splicing device
- 44: suction pipe (capture introducing means, means for making core conspicuous)

- 101: core yarn spinning machine
- 102: unit (spinning unit)
- 104: doffing device (service device, service carriage)
- 110: core yarn
- 122: elastic yarn (core)
- 135: slub catcher (core presence determining means, core presence determining device, yarn defect detecting means)
- 158: guide
- 188: suction pipe (core yarn capturing means, means for making core conspicuous)

Best Mode for Carrying Out the Invention

[0028] Hereinafter, a detailed description will be given of a first preferred embodiment of the present invention by referring to the attached drawings.

[0029] Fig. 1 shows a core yarn spinning machine 1 having a plurality of spinning units 2 arranged in sequence. The spinning machine 1 is provided with a yarn splicing carriage (service device) 3 provided to travel freely in a direction in which the spinning units 2 are arranged, a blower box 4 and a motor box 5.

[0030] As illustrated in Fig. 1, each of the spinning units 2 is constituted mainly with a draft device 7, a spinning device 9, a feeding device 11 and a winding device 12.

The draft device 7 is mounted in vicinity of an upper end of a casing 6 on the body of the spinning machine 1 and constituted so as to spin a fiber bundle 8 fed from the draft device 7 by using the spinning device 9. The spun yarn (core yarn) 10 discharged from the spinning device 9 is fed downward through a slub catcher (yarn defect detector, yarn monitoring means) 35, which cuts the yarn and removes yarn defects when detecting yarn defects, and the spun yarn 10 is wound around a bobbin as a winding tube by the winding device 12, thereby forming a package 45. The slub catcher 35 may include, for example, a function to detect a defective unevenness in thickness of yarn, a function to detect foreign matter mixed in the spun yarn 10 or combination with these functions.

[0031] As illustrated in Fig. 2, the draft device 7 drafts a sliver 13 to form a fiber bundle 8 and is constituted with four rollers, that is, a back roller 14, a third roller 15, a middle roller 17 with an apron belt 16, and a front roller 18.

[0032] Further, the feeding device 11 includes a delivery roller 19 supported by a casing 6 on the body of the spinning machine 1, and a nip roller 20 provided making contact with the delivery roller 19. The core yarn 10 discharged from the spinning device 9 is held between the delivery roller 19 and the nip roller 20, and the delivery roller 19 is rotated and driven, thereby feeding the core yarn 10 to the winding device 12 side.

[0033] An elastic yarn feeding device 23 is provided above the draft device 7. An elastic yarn 22 fed from the elastic yarn feeding device 23 is joined with a fiber bundle 8 from a clearance between the front roller 18 and the middle roller 17, passed through the front roller 18 together with the fiber bundle 8, and introduced into the spinning device 9.

[0034] The elastic yarn feeding device 23 is provided with a rotating roller 26 rotating in contact with the peripheral surface of an elastic yarn package 25, and a motor 24 rotating and driving the rotating roller 26 via a belt 28 for each of the spinning units 2. The elastic yarn package 25 is rotatively supported by a cradle arm 27, which is pivotally supported in a manner capable of being swung.

[0035] According to the above constitution, the elastic yarn 22 unwound from the elastic yarn package 25 is passed through an air sucker device 30, a clamp cutter device (not illustrated) and a feeding guide tube 31, fed to a position slightly upstream of the front roller 18 and introduced into the spinning device 9 together with the fiber bundle 8. Then, the fiber bundle 8 is sheathed around an outer periphery of the elastic yarn 22 by a whirling air flow generated by the spinning device 9, thereby spinning a core yarn 10 having a highly-stretchable elastic yarn as a core. The spun core yarn 10 is fed further downstream by the feeding device 11. A peripheral velocity of the delivery roller 19 of the feeding device 11 is higher than a peripheral velocity of the rotating roller 26. Accordingly, under a state in which the elastic yarn 22 is stretched to a predetermined draw ratio (for exam-

ple, three times), the fiber bundle 8 is sheathed around the elastic yarn 22 and the elastic yarn 22 is spun by the spinning device 9.

[0036] As illustrated in Fig. 1, a yarn splicing carriage 3 is provided to travel along a rail 41 fixed on a casing 6 of the body of the spinning machine 1. The yarn splicing carriage 3 includes a splicing device 43, composed of for example a splicer, a suction pipe 44 which is mounted on the yarn splicing carriage 3 so as to swing up and down freely, suck and capture the end of a core yarn 10 discharged from the spinning device 9 while swinging around its axis, thereby guiding the yarn into the splicing device 43, and a suction opening 46 which is formed on the yarn splicing carriage 3 so as to swing up and down freely, suck and capture the end of the yarn from a package 45 rotatably supported on a winding device 12, while swinging around its axis, thereby guiding the yarn into the splicing device 43.

[0037] A slub catcher 35 and a cutter device 36 are provided on the front surface of the casing 6 of the spinning machine 1, and the core yarn 10 spun by the spinning device 9 passes through a detecting unit of the slub catcher 35. The slub catcher 35 monitors thickness of the traveling core yarn 10. When a thin yarn part or a thick yarn part of the core yarn 10 (yarn defects) are detected, the slub catcher 35 sends a yarn defect detection signal. A controller of the spinning unit 2, which has received the signal, immediately drives the cutter device 36 to cut the core yarn 10 and also temporarily stops the draft device 7, the spinning device 9, and the elastic yarn feeding device 23 or the like, thereby allowing the yarn splicing carriage 3 to travel to the front of the concerned spinning unit 2. Thereafter, the controller drives the spinning device 9 and the elastic yarn feeding device 23 again, thereby allowing the yarn splicing carriage 3 to conduct yarn splicing to resume a spinning operation and a winding operation.

[0038] As illustrated in Fig. 3, the detecting unit 39 of the slub catcher (yarn clearer) 35 is provided with a light emitting part 37 composed of Light Emitting Diode (LED) and the like, and a light receiving unit 38 composed of photoelectric conversion elements. Light emitted from the light emitting part 37 is blocked by the core yarn 10 to result in a shadow formed at the light receiving unit 38, and the size (area) of the shadow is converted into a voltage signal by the concerned light receiving unit 38. A photoelectric conversion element characterized by elevating a voltage level in proportion to the area of the shadow is used as the light receiving unit 38 in the present embodiment.

[0039] A slub catcher controller 51 is composed of a known microcomputer and provided with a Central Processing Unit (CPU) (computing means), a Read Only Memory (ROM), a Random Access Memory (RAM) (storage means) and an interface which are not illustrated in the drawings. The storage means is provided with an appropriate program. The above-described hardware and the software constitute a control unit 56, a storage

unit 52, a comparison unit 53, and a light emission control unit 55 or the like inside the slub catcher controller 51.

[0040] The storage unit 52 is substantially composed of the RAM and constituted to store a range of voltage values (permissible voltage values) corresponding to a permissible range of thickness of a normal core yarn 10, that is, a threshold value for yarn monitoring and also a separate threshold value to be described later for determining whether or not a core is present. A control unit 56 controls entire motions and also carries out communication or the like with a controller on the spinning unit 2 side. The comparison unit 53 is constituted inside the control unit 56, and the comparison unit 53 compares a voltage value input from the light receiving unit 38 with the above-described permissible voltage value.

[0041] According to the above-described constitution, a voltage signal from the light receiving unit 38 is sequentially input into the slub catcher controller 51, thereby monitoring the variation in thickness of the traveling core yarn 10. That is, when the thickness (contour thickness) of the traveling core yarn 10 varies, size of the shadow formed at the light receiving unit 38 varies and appears as a variation in voltage value output from the light receiving unit 38. After being subjected to digital conversion by an Analog-to-Digital (A/D) converter 54, the voltage value is input into the comparison unit 53 and compared with the above permissible voltage value. When yarn defects such as a thick yarn part or a thin yarn part are found in the core yarn 10 and these yarn defects pass through the detecting unit 39, an output voltage value of the light receiving unit changes and deviates from a range of the permissible voltage value. This fact is detected at the comparison unit 53 by the control unit 56 of the slub catcher controller 51, which then sends a yarn defect signal to a control unit 57 of a controller of the spinning unit 2. When receiving this signal, the spinning unit 2 immediately sends the signal to the cutter device 36 to cut the core yarn 10, thereby generating a request for yarn splicing motions by the splicing device 43. At the same time, the spinning device 9, the elastic yarn feeding device 23, and the draft device 7 or the like are also stopped to discontinue a winding operation. Thereafter, the control unit 57 of the spinning unit 2 sends a signal to a control unit 60 of the yarn splicing carriage 3, thereby allowing the yarn splicing carriage 3 to travel to the spinning unit 2. When the yarn splicing carriage 3 arrives at the spinning unit 2, the spinning device 9 and the elastic yarn feeding device 23 or the like are driven again, thereby allowing the yarn splicing carriage 3 to conduct a pre-determined yarn splicing motion. Then, a start edge of the core yarn 10 on the spinning side is joined together with an end edge of the core yarn 10 on the package 45 side to conduct yarn splicing.

[0042] Further, a driving voltage of the light emitting part 37 can be changed by a variable voltage source 48, and the light emission control unit 55 of the slub catcher controller 51 is connected to the variable voltage source 48. According to the above-described constitution, when

the light emitting part 37 undergoes deterioration or temperature drift, the variable voltage source 48 changes a voltage value applied to the light emitting part 37 so that the light emission control unit 55 can compensate the deterioration or temperature drift. As a result, yarn defects can be detected stably.

[0043] The above-described motions are normal motions conducted by the slub catcher 35 when winding the core yarn 10 by the winding device 12. In the present embodiment, the slub catcher 35 also functions as a determination device for determining whether or not an elastic yarn 22 is present inside the core yarn 10 at a time of yarn splicing (in other words, during a period from the start of spinning of the core yarn 10 by the spinning device 9 until the start of winding of the core yarn 10 by the winding device 12). This constitution will be described hereinafter.

[0044] That is, when a yarn breakage occurs in core yarn 10 or when yarn defects are detected in the core yarn 10 by the slub catcher 35 and the core yarn 10 is cut by the cutter device 36, the yarn splicing carriage 3 splices the core yarn 10 at the spinning device 9, which has started spinning, and the core yarn at the winding device 12 by using the splicing device 43. At this stage, a winding operation of the core yarn 10 by the winding device 12 is stopped.

[0045] In this instance, the core yarn 10 spun by the spinning device 9 and sucked and captured by the suction pipe 44 is, as illustrated in Fig. 3, guided so that the yarn path passes through the detecting unit 39 of the slub catcher 35 and the cutter device 36. As a result, the core yarn 10 continuously spun from the spinning device 9 is fed by the feeding device 11 and after passing through the cutter device 36 and the light emitting part 37, the core yarn 10 is sucked by the suction pipe 44.

[0046] Further, the core yarn 10 is sucked by the suction pipe 44 using a suction-flow generating source 62. A suction force of the suction-flow generating source 62 is set by a suction-force setting unit 61 of the controller of the yarn splicing carriage 3 so as to be slightly lower than a yarn feeding force of the feeding device 11. Therefore, a tensile force of the core yarn 10 between the feeding device 11 and the suction pipe 44 is lower than that of the core yarn 10 at an upstream side of the feeding device 11.

[0047] In this instance, the core yarn 10 of the present embodiment is spun by sheathing the fiber bundle 8 around the elastic yarn 22 as a core under a state in which the elastic yarn 22 is drawn. Therefore, when a tensile force is weakened or no tensile force is applied, the core yarn 10 undergoes contraction in a longitudinal direction to result in a slight expansion in a radial direction. Further, since the elastic yarn 22 is stretchable, the core yarn 10 undergoes contraction to cause shrinkage. In particular, since the suction force of the suction pipe 44 is set low in the present embodiment as described above, the core yarn 10 between the feeding device 11 and the suction pipe 44 is made more apparent in radial

expansion tendency and shrinkage tendency than after yarn splicing by the splicing device 43 has been completed and winding of the core yarn 10 by the winding device 12 is resumed, thereby making conspicuous the existence of the elastic yarn 22, which is a core of the core yarn 10.

[0048] Therefore, when a normal core yarn 10 having an elastic yarn 22 is spun by the spinning device 9 and the spun core yarn 10 passes through the slub catcher 35 between the feeding device 11 and the suction pipe 44, an area of a shadow formed on the light receiving unit 38 increases, resulting in an increase in output voltage of the light receiving unit 38. Then, a radial expansion can be detected not by detecting an actual thickness of the core yarn 10 but by detecting a clearance between the contours of reflected shadows when viewed from a radial direction as a contour thickness. Further, the above-described shrinkage results in a greater variation (variance) in output voltage of the light receiving unit 38. In contrast, when a defective core yarn without an elastic yarn 22 is spun from the spinning device 9 due to some reason, there is no tendency in the development of the above-described radial expansion. Therefore, the area of the shadow remains substantially unchanged and the output voltage of the light receiving unit 38 hardly increases. Further, since shrinkage hardly develops, variation in the output voltage at the light receiving unit 38 is small.

[0049] Therefore, in the slub catcher controller 51, a predetermined threshold voltage for determining a presence or an absence of a core is stored in the storage unit 52, as described above, to determine at the comparison unit 53 whether or not a voltage value input from the light receiving unit 38 exceeds the threshold value. When the voltage value is the threshold value or greater, the core yarn 10 is determined to be a normal core yarn 10 having an elastic yarn 22. When the voltage value is lower than the threshold value, the core yarn 10 is determined to be a defective core yarn without the elastic yarn 22.

[0050] When the core yarn is determined to be a defective core yarn without the elastic yarn 22, the control unit 56 of the slub catcher controller 51 sends a detection signal indicating that a core is not included to the control unit 57 at the spinning unit 2 side. The spinning unit 2 side which has received this signal immediately uses the cutter device 36 to cut the defective core yarn, and conducts a resumption operation again as conducted at the above-described yarn breakage. Alternatively, an operator who is notified of an abnormality may stop a corresponding spinning unit 2 and manually remove the defect.

[0051] In order to confirm the effect of the above-described constitution, inventors of the present invention conducted an experiment in which a normal core yarn with an elastic yarn 22 and a core yarn with only sheath fiber and without an elastic yarn 22 (abnormal core yarn) are allowed to travel and pass through the detecting unit 39 of the slub catcher 35 respectively at the time of yarn winding (a state after the yarn winding by the winding

device 12 is started) and at the time of yarn splicing (a state before the yarn winding by the winding device 12 is started and when the yarn end is sucked by the suction pipe 44 to give a relatively small tension to the yarn), thereby checking a tendency of the output voltage value at the light receiving unit 38.

[0052] Fig. 4(A) shows the result obtained from the core yarn having a thickness of Ne30 spun in a state that an elastic yarn having the thickness of 40 denier is drawn 3.1 times. The average voltage value is approximately 3.1V at the time of yarn winding, while it is approximately 4.1V at the time of yarn splicing.

[0053] Fig. 4(B) shows the result obtained from yarn having the thickness of Ne30 spun with only the sheath fiber (without an elastic yarn) on the assumption that the core yarn is abnormal. In this instance, there is hardly any difference in the voltage value between the time of yarn winding and the time of yarn splicing, with the average value of approximately 3.1V.

[0054] As apparent from the comparison of Figs. 4(A) and (B), at the time of yarn splicing, a difference of approximately 1V is found in output voltage values of a normal core yarn with an elastic yarn and an abnormal core yarn without an elastic yarn. Therefore, when a threshold value is given, for example, 3.6V and this value is stored in the storage unit 52 and used for determination at the comparison unit 53, an appropriate determination can be made for whether or not the elastic yarn 22 is present inside the core yarn 10.

[0055] As described above, the present embodiment is provided with the slub catcher 35 for determining whether or not a core (elastic yarn) 22 is present inside a core yarn 10, and constituted so that the spun core yarn 10 is introduced into the slub catcher 35 to determine the presence or the absence of the elastic yarn 22 at a time prior to yarn winding, i.e., from the start of spinning of the core yarn 10 by the spinning device 9 to the start of winding of the core yarn 10 by the winding device 12, in other words, at a time of conducting yarn splicing service by the splicing device 43. Therefore, a presence or an absence of the core inside the core yarn 10 can be reliably determined by a simple constitution. Further, since the presence or the absence of the core is determined after the spinning device 9 starts to spin the core yarn 10 and before the winding device 12 starts to wind the yarn, the core yarn 10 used for determining the presence or the absence of the core is not wound by the winding device 12.

[0056] Further, in the present embodiment, the core yarn 10 is sucked weakly by the suction pipe 44 after the start of the above-described spinning and introduced into the slub catcher 35 under a state in which the presence of the core (elastic yarn) 22 is made more conspicuous than at a time after the start of winding operation by the winding device 12. It is, therefore, possible to make an appropriate determination on whether or not the elastic yarn 22 is present inside the core yarn 10.

[0057] In the present embodiment, the core in the core

yarn 10 is an elastic yarn 22. The slub catcher 35 determines that the core (elastic yarn) 22 is present by referring to a fact that the thickness of the core yarn 10 is larger than a predetermined threshold value. Then, the existence of the core (elastic yarn) 22 is made conspicuous by weakening a tensile force of the core yarn 10 than at a time after the start of the winding operation or by slackening the core yarn 10.

That is, in the present embodiment, since the core is a highly stretchable elastic yarn 22, a normal core yarn 10 having a core undergoes contraction of the core to result in a radial expansion, depending on a tensile force in the longitudinal direction. Therefore, when the core yarn 10 is slackened or given a weaker tensile force than at the timing after the start of winding operation by the winding device 12 (during the winding operation), there is a tendency of an increase in the thickness of the normal core yarn 10 having the core detected by the slub catcher 35. In contrast, there is no such tendency when the core yarn is an abnormal core yarn without the core. It is, therefore, possible to make an appropriate detection by the slub catcher 35 on whether or not the core (elastic yarn 22) is present inside the core yarn.

[0058] Further, in the present embodiment, the slub catcher 35 determines the presence or the absence of a core before winding operation is started at the winding device 12, and also acts as a yarn monitoring means for monitoring defects of the core yarn 10 after the winding operation is started in the winding device 12. The slub catcher 35 acting as a core presence determining means has a threshold value for determining the presence or the absence of the core in addition to a threshold value for monitoring the yarn during a spinning operation. Therefore, the slub catcher 35 is not only able to provide common use of a core presence determining means and a yarn monitoring means but also able to appropriately carry out a determination on the presence or the absence of a core and yarn monitoring by using a different threshold value, depending on an intended purpose.

[0059] In the present embodiment, the concerned core yarn 10 is introduced into the detecting unit 39 of the slub catcher 35 for detecting the contour of the core yarn 10 to determine that an elastic yarn 22 is present inside the core yarn 10 by referring to a fact that the thickness of the core yarn 10 detected by the detecting unit 39 is larger than a predetermined threshold value. Therefore, the presence or the absence of the core in the core yarn 10 can be reliably determined by a simple constitution.

[0060] A description has been so far given of the first preferred embodiment of the present invention. Various modifications can be made to the above-described constitution, examples of which will be described in the following.

[0061]

(1) In the above-described embodiment, the presence or the absence of a core is determined by referring to whether or not an output voltage of the light

receiving unit 38 corresponding to the size of the contour (contour thickness) exceeds a predetermined threshold value during the determination of the presence or the absence of the core. As another example, a slub catcher controller 51 may be provided with a function to calculate a variance (variation) in output voltage of the light receiving unit 38, such as standard deviation, thereby determining the presence or the absence of the core by referring to whether or not the variance exceeds a predetermined threshold value. Further, the presence or the absence of the core may be comprehensively determined by referring to both the thickness of the core yarn detected by the light receiving unit 38 and the variation (variance).

[0062]

(2) A yarn defect detector or a slub catcher as a device for determining the presence or the absence of the core is not limited to a so-called photo-electric constitution. For example, a capacitance-type slub catcher may also be used.

[0063]

(3) In the above-described embodiment, the device for determining the presence or the absence of the core also acts as a slub catcher. The device for determining the presence or the absence of the core may be provided separately from the slub catcher. However, it is preferable to provide the slub catcher which also acts as the device for determining the presence or the absence of the core in view of a more simplified constitution.

[0064] Next, a detailed description will be given of a second preferred embodiment of the present invention by referring to the attached drawings.

[0065] Fig. 5 is a drawing illustrating a spinning machine 101 for spinning a core yarn which has a plurality of spinning units 102 arranged in sequence. The spinning machine 101 is provided with a yarn splicing carriage 103 provided to travel freely in a direction in which the spinning units 102 are arranged, a doffing carriage (service carriage, service device) 104 provided to travel freely and independent of the yarn splicing carriage, a blower box 180 and a motor box 181.

[0066] As illustrated in Fig. 5, each of the spinning units 102 is mainly constituted with a draft device 107, a spinning member 109, a feeding device 111 and a winding device 112. The draft device 107 is mounted in vicinity of an upper end of a casing 106 on the body of the spinning machine 101 and constituted so as to spin a fiber bundle (sheath fiber) 108 fed from the draft device 107 and an elastic yarn (core) 122 fed from an elastic yarn feeding device 123 to be described later by using the spinning member 109. A core yarn 110 as a spun yarn

discharged from the spinning member 109 is fed downward by the feeding device 111, passed through a cutter device 136 and a slub catcher (yarn defect detecting means) 135 and then wound by the winding device 112 to form a package 145.

[0067] As illustrated in Fig. 6, the draft device 107 drafts a sliver 113 to form a fiber bundle 108 and is constituted with four rollers, that is, a back roller 114, a third roller 115, a middle roller 117 with an apron belt 116 and a front roller 118.

[0068] Further, the feeding device 111 includes a delivery roller 139 supported by a casing 106 on the body of the spinning machine 101 and a nip roller 140 provided capable of making contact with or separating from the delivery roller 139. A core yarn 110 discharged from the spinning member 109 is held between the delivery roller 139 and the nip roller 140, and the delivery roller 139 is rotated and driven, thereby feeding the core yarn 110 to the winding device 112 side.

[0069] As illustrated in Fig. 5 and Fig. 6, an elastic yarn feeding device 123 is provided with a rotating roller 126 which drives an elastic yarn package 125 for each of the spinning units 102. The elastic yarn package 125 is rotatably supported by a cradle arm 127, which is pivotally supported in a manner capable of being swung, and also constituted so as to make contact with a peripheral surface of the rotating roller 126. The rotating roller 126 is connected to a motor 124 via a belt 128 at each of the spinning units 102.

[0070] The elastic yarn feeding device 123 stops the driving of the rotating roller 126 by controlling the motor 124 during yarn breakage of an elastic yarn 122, thereby individually stopping the rotation of the elastic yarn package 125 for each of the spinning units 102.

[0071] The elastic yarn 122 unwound from the elastic yarn package 125 is passed through an air sucker device 130, a clamp cutter device (not illustrated) and a feeding guide tube 131, fed to a position slightly upstream of the front roller 118, and introduced into the spinning member 109, together with the fiber bundle 108. Then, the fiber bundle 108 is sheathed around an outer periphery of the elastic yarn 122 by a whirling air flow generated by the spinning member 109, thereby spinning a core yarn 110 and fed further downstream by the feeding device 111. A peripheral speed of the delivery roller 139 of the feeding device 111 is higher than a peripheral velocity of the rotating roller 126. Accordingly, under a state in which the elastic yarn 122 is stretched to a predetermined draw ratio (for example, three times), the fiber bundle 108 is sheathed around the elastic yarn 122 and the elastic yarn 122 is spun by the spinning member 109.

[0072] The winding device 112 is constituted so as to carry axially both ends of a bobbin (winding tube) 148 as a core of a package 145 in a freely rotating manner, allowing a driving drum 179 to make contact with a peripheral surface of the bobbin 148, thereby rotating the bobbin 148 and winding the core yarn 110.

[0073] As illustrated in Fig. 5 and Fig. 6, the yarn splic-

ing carriage 103 includes a carriage 142, a splicing device 143 such as a splicer mounted on the carriage 142, a suction pipe 144 which is mounted on the carriage 142 so as to swing up and down freely, suck and capture the yarn end discharged from the spinning member 109 and passed through the feeding device 111, while swinging around its axis, thereby guiding the yarn into the splicing device 143, and a suction opening 146 which is formed on the carriage 142 so as to swing up and down freely, suck and capture the yarn end from a package 145 rotatably supported on a winding device 112, while swinging around its axis, thereby guiding the yarn into the splicing device 143.

[0074] As illustrated in Fig. 6, a traveling space 150 of the yarn splicing carriage 103 is constituted inside the rear side of the casing 106. The traveling space 150 is formed in an elongated shape along a direction in which the spinning units 102 are arranged. A rail 141 is disposed at the upper and lower parts of the traveling space 150, and a traveling wheel 149 is provided at the lower part of the carriage 142. According to this constitution, the yarn splicing carriage 103 is guided in the traveling direction by the rail 141 and travels inside the traveling space 150 by a driving force of the traveling wheel 149.

[0075] A slub catcher 135 and a cutter device 136 are provided on the front surface of the casing 106 of the spinning machine 101 and a position slightly downward from the feeding device 111, and the core yarn 110 spun by the spinning member 109 passes through a detecting unit of the slub catcher 135 before being wound by the winding device 112. The slub catcher 135 monitors the thickness of the traveling core yarn 110. When a thin yarn part or a thick yarn part of the core yarn 110 (yarn defects) are detected, the slub catcher 135 sends a yarn defect detection signal. A controller of the spinning unit 102 which has received the signal immediately drives the cutter device 136 to cut the core yarn 110 and also temporarily stops the draft device 107, the spinning member 109, and the elastic yarn feeding device 123 or the like, thereby allowing the yarn splicing carriage 103 to travel to the front of the concerned spinning unit 102. Thereafter, the controller drives the spinning member 109 and the elastic yarn feeding device 123 again, thereby allowing the yarn splicing carriage 103 to conduct yarn splicing, to resume the spinning and winding operations.

[0076] As illustrated in Fig. 7, the detecting unit 159 of the slub catcher (yarn clearer) 135 is provided with a light emitting part 137 composed of LEDs and the like, and a light receiving unit 138 composed of photoelectric conversion elements. Light emitted from the light emitting part 137 is blocked by the core yarn 110 to result in a shadow formed at the light receiving unit 138, and the size (area) of the shadow is converted into a voltage signal by the concerned light receiving unit 138. In the present embodiment, a photoelectric conversion element characterized by elevating a voltage level approximately in proportion to the area of the shadow is used as the light receiving unit 138.

[0077] In Fig. 7, a slub catcher controller 151 is composed of a known microcomputer and provided with a CPU (computing means), ROM, RAM (storage means) and an interface (not illustrated). The storage means is provided with an appropriate program. The above-described hardware and the software constitute a control unit 156, a storage unit 152, a comparison unit 153, and a light emission control unit 155 or the like inside the slub catcher controller 151.

[0078] The storage unit 152 is mainly composed of the RAM and constituted so as to store a range of voltage values (permissible voltage values) corresponding to a permissible range of thickness of normal core yarn 110, that is, a threshold value for yarn monitoring. The range of permissible voltage values is established by either one or both of an upper threshold value and a lower threshold value, depending on a yarn defect to be detected or the like. Further, the storage unit 152 is constituted to store a threshold value to be described later for determining whether a core is present or not, separately from the above-described threshold value for yarn monitoring. The control unit 156 controls entire motions and also carries out communication or the like with a controller on the spinning unit 102 side. The comparison unit 153 is constituted inside the control unit 156, and the comparison unit 153 compares a voltage value input from the light receiving unit 138 with the threshold value for yarn monitoring.

[0079] According to the above-described constitution, a voltage signal from the light receiving unit 138 is sequentially input into the slub catcher controller 151, thereby monitoring the variation in thickness of the traveling core yarn 110. That is, when thickness (contour thickness) of the traveling core yarn 110 varies, size of the shadow formed at the light receiving unit 138 varies and appears as a variation in voltage value output from the light receiving unit 138. After being subjected to digital conversion by an A/D converter 154, this voltage value is input into the comparison unit 153 and compared with the threshold value for yarn monitoring. When yarn defects such as a thick yarn part and a thin yarn part are found in the core yarn 110 and these yarn defects pass through the detecting unit 159, an output voltage value varies greatly at the light receiving unit to deviate from a range defined by threshold value for yarn monitoring. This fact is detected at the comparison unit 153 by a control unit 156 of the slub catcher controller 151, which then sends a yarn defect signal to a control unit 157 of a controller of the spinning unit 102. When receiving this signal, the spinning unit 102 immediately sends the signal to the cutter device 136 to cut the core yarn 110, thereby generating a request for yarn splicing motions by the splicing device 143. At the same time, the spinning member 109, the elastic yarn feeding device 123, and the draft device 107 or the like are also stopped to discontinue a winding operation. Thereafter, the control unit 157 of the spinning unit 102 allows the yarn splicing carriage 103 to travel to the spinning unit 102. When the yarn splicing

carriage 103 arrives at the concerned spinning unit 102, the spinning member 109 and the elastic yarn feeding device 123 or the like are driven again, thereby allowing the yarn splicing carriage 103 to conduct a predetermined yarn splicing motion. Then, the core yarn 110 on the spinning side is joined together with the core yarn 110 on the package 145 side to conduct yarn splicing.

[0080] Further, a driving voltage of the light emitting part 137 can be changed by a variable voltage source 147, and a light emission control unit 155 of the slub catcher controller 151 is connected to the variable voltage source 147. According to the above-described constitution, when the light emitting part 137 undergoes deterioration or temperature drift, the variable voltage source 147 changes a voltage value applied to the light emitting part 137 so that a light emission control unit 155 can compensate for the deterioration or temperature drift. As a result, yarn defects can be detected stably.

[0081] A doffing carriage 104 is provided independently of the yarn splicing carriage 103. As illustrated in Fig. 5 and Fig. 6, the doffing carriage 104 can travel along a guideway 186 mounted in front of the body of the spinning machine 101 in a direction at which spinning units 102 are arranged. The doffing carriage 104 travels in the same direction as the yarn splicing carriage 103, and is provided in an elongated shape along a direction in which the spinning units 102 are arranged. Further, the doffing carriage 104 is arranged so as to face the front surface of the spinning unit 102 across a traveling passage of the core yarn 110.

[0082] As illustrated in Fig. 5 and Fig. 6, the doffing carriage 104 is provided with a carriage casing 185 which can travel on the guideway 186 by using the traveling wheel 187. The carriage casing 185 is provided with a suction pipe 188 as a core yarn capturing means, a chucker 189 and a bunch-winding device (not illustrated). The suction pipe 188 is mounted on the carriage casing 185 so as to swing up and down and extend or contract freely for the purpose of sucking and capturing the end of the yarn discharged from the spinning member 109 and guiding the yarn to the winding device 112. The chucker 189 is mounted on the carriage casing 185 so as to swing for a purpose of feeding an empty bobbin 148 to the winding device 112.

[0083] Further, a guide 158 is mounted on an upper part of the carriage casing 185, by which the core yarn 110 is guided into the slub catcher 135 during doffing motion. A detailed description will be made later for the guide 158.

[0084] A placement area 195 for a fully wound package 145 is provided further anterior than the guideway 186 of the doffing carriage 104. As illustrated in Fig. 5, the carriage casing 185 of the doffing carriage 104 is constituted in a gate form when viewed from the front and provided with a package passage 193. As illustrated in Fig. 6, the package passage 193 is provided with an inclined floor 194 which becomes lower as it comes closer to the placement area 195. According to the above-described

constitution, when a bobbin 148 carried by the winding device 112 is released and the fully wound package 145 is removed, the removed fully wound package 145 passes through the package passage 193, while rolling on the inclined floor 194, falls down into a shallow groove 196 formed on the placement area 195 and stops. The fully wound package 145 moved to the placement area 195 is collected by an operator and transferred to a next step.

[0085] Next, a description will be given of doffing motion (doffing service) by the doffing carriage 104 with reference to Fig. 8 and subsequent drawings.

[0086] When a package 145 in a certain spinning unit 102 among a plurality of spinning units 102 is detected by a sensor (not illustrated) to be fully wound, the controller of the spinning machine 101 stops the back roller 114 and the third roller 115 of the draft device 107 and the spinning member 109, and also stops the package 145 rotated and driven by the winding device 112. Then, the controller of the spinning machine 101 sends a signal to the doffing carriage 104 and allows the doffing carriage 104 to travel to the front of the spinning unit 102. Fig. 6 illustrates a state in which the doffing carriage 104 has traveled to and stopped at a target spinning unit 102. It is also possible to output a full-winding notice signal from the spinning unit 102 at a stage when the package is wound approximately to a full winding, thereby allowing the doffing carriage 104 to move in advance to the spinning unit 102 and stand by at such spinning unit 102.

[0087] After the stop of the doffing carriage 104, as illustrated in Fig. 8, a fully wound package 145 which is kept supported is released by the doffing carriage 104 through an appropriate operation of the winding device 112. The fully wound package 145 removed from the winding device 112 passes through the package passage 193 inside the doffing carriage 104, while rolling on the inclined floor 194, falls down into the groove 196 of the placement area 195 and stops.

[0088] Approximately at the same time with removal of the fully wound package 145, the doffing carriage 104 allows the suction pipe 188 to swing diagonally upward, extending the suction pipe 188 by using a pneumatic cylinder (not illustrated) and moving the suction opening to immediately downstream of the delivery roller 139 and the nip roller 140 of the feeding device 111 (Fig. 8). Then, the core yarn 110 spun at the spinning member 109 is sucked and captured.

[0089] Further, as illustrated in Fig. 9, the chucker 189 is used to set an empty bobbin 148 without wound yarn stocked inside the carriage casing 185 to the winding device 112. Still further, as illustrated in Fig. 9, the suction pipe 188 which is kept extended is retracted and allowed to swing downward, sucking the end of a yarn spun from the spinning member 109 and guiding the yarn to the vicinity of an empty bobbin 148, thereby setting the yarn which is bunch-wound to the bobbin 148 by using a bunch winding device (not illustrated).

[0090] In this instance, as illustrated in Fig. 9, the guide

158 of the carriage casing 185 moves forward so as to project toward the spinning unit 102 side, thereby guiding the core yarn 110 stretched between the feeding device 111 and the suction pipe 188 such that the yarn path passes through a detecting unit of the slub catcher 135 by a guide plate 173 fixed on a leading end of the guide 158. With this state kept, the slub catcher 135 is used to determine whether or not a core is present inside the core yarn 110. A description will be made later for the core presence determining method.

[0091] Immediately after completion of the above-described bunch winding, the doffing carriage 104 allows the empty bobbin 148 to make contact with the driving drum 179, thereby resuming a winding operation of the core yarn 110. Then, the doffing motion (doffing service) is completed, and the chucker 189, the suction pipe 188 and the guide 158 are returned to their original positions as illustrated in Fig. 6. The above-described chucker 189, the suction pipe 188 and the guide 158 are activated to carry out a sequence of motions when a cam shaft (not illustrated) supported on the doffing carriage 104 is driven by an electric motor, the drawing of which is omitted here.

[0092] Next, a description will be given of a determination by the slub catcher 135 on whether or not a core is present inside the core yarn 110. Fig. 10 is a block diagram illustrating the slub catcher acting as a core presence determining means and corresponding to Fig. 9.

[0093] That is, as previously described by referring to Fig. 6 and Fig. 7, the slub catcher 135 is provided for detecting a yarn defect when winding the core yarn 110 by the winding device 112. The slub catcher 135 also acts as a determination device for determining whether or not an elastic yarn 122 is present inside the core yarn 110, when a fully wound package is subjected to doffing service. Hereinafter, a description will be given of this constitution.

[0094] That is, since the core yarn 110 on the spinning side sucked and captured by the suction pipe 188 is bunch-wound, when the doffing service is performed by the doffing carriage 104, the core yarn 110 is pulled downward. In this instance, as illustrated in Fig. 9, the yarn path is guided so as to pass through the detecting unit of the slub catcher 135 and the cutter device 136 due to the fact that the guide 158 of the doffing carriage 104 moves toward the spinning unit 102 side. Consequently, as illustrated in Fig. 10, the core yarn 110 continuously spun by the spinning member 109 is fed by to the feeding device 111, passes through the cutter device 136 and the light emitting part 137 of the slub catcher 135, and is sucked by the suction pipe 188.

[0095] In this instance, since the core yarn 110 of the present embodiment is spun under a state in which the fiber bundle 108 is sheathed around the elastic yarn 122 as a core and the elastic yarn 122 is stretched, a weak tensile force would result in shrinkage in a longitudinal direction and a slight expansion in a radial direction. Further, the core yarn 110 undergoes shrinkage due to elasticity of the elastic yarn 122. In particular, when a sucking

force by the suction pipe 188 is set weak, the core yarn 110 weakly stretched between the feeding device 111 and the suction pipe 188 is made more apparent in radial expansion tendency and shrinkage tendency.

[0096] Therefore, when a normal core yarn 110 passes through the slub catcher 135 between the feeding device 111 and the suction pipe 144 during doffing motion, an area of a shadow formed at the light receiving unit 138 increases, resulting in an increased output voltage at the light receiving unit 138. Further, the above-described shrinkage results in a greater variation (variance) in output voltage of the light receiving unit 138. In contrast, when a defective core yarn without an elastic yarn 122 is spun from the spinning member 109 due to some reason, there is no tendency in the development of the above-described radial expansion. Therefore, the area of the shadow remains substantially unchanged and the output voltage hardly increases at the light receiving unit 138. Further, since no shrinkage hardly develops, the variation in the output voltage at the light receiving unit 138 is also small.

[0097] Therefore, in the slub catcher controller 151, a threshold voltage for determining a presence or an absence of a core is stored in the storage unit 152 separately from a threshold value for yarn monitoring, as described above, to determine at the comparison unit 153 whether or not a voltage value input from the light receiving unit 138 exceeds the threshold value. When the voltage value is the threshold value or more, the core yarn is determined to be a normal core yarn 110 having an elastic yarn 122. When the voltage value is lower than the threshold value, the core yarn 110 is determined to be a defective core yarn without the elastic yarn 122.

[0098] When the core yarn is determined to be a defective core yarn without the elastic yarn 122, the control unit 156 of the slub catcher controller 151 sends a detection signal indicating that a core is not included to the control unit 157 at the spinning unit 102 side. The spinning unit 2, which has received this signal, immediately uses the cutter device 136 to cut the defective core yarn, notifies the abnormality to stop the operation and notifies an operator to remove the abnormality.

[0099] The above-described principle of determining the presence or the absence of the core is substantially similar to a determination made for the presence or the absence of the core during a yarn splicing operation in the previously described first embodiment (refer to the experiment result illustrated in Fig. 4). Therefore, also in the second embodiment, it is possible to make an appropriate detection on whether or not the elastic yarn 122 is present as a core.

[0100] Next, a detailed description will be given of the constitution of the guide 158 which guides the core yarn 110 into the slub catcher 135 during the above doffing motion by referring to Fig. 11 and subsequent drawings. Fig. 11 is a perspective view from a doffing carriage illustrating a state of the guide immediately after a doffing motion is started by a doffing carriage. Fig. 12 is a per-

spective view illustrating a state in which the guide is swung from a retracted state and projected toward spinning units to bring a yarn path closer by using a yarn handling plate. Fig. 13 is a perspective view illustrating a state in which a pneumatic cylinder is further extended to guide a core yarn to a slub catcher. Fig. 14 is a perspective view illustrating a state in which a yarn path is removed from the yarn handling plate. Fig. 15 is a perspective view showing illustrating a state in which guiding of the yarn path by the guide has been completed.

[0101] As illustrated in Fig. 11, the guide 158 is set on an upper surface of the carriage casing 185 of the doffing carriage 104 and provided with a first arm 161 and a second arm 162 which are overlapped one above the other. These two arms 161 and 162 are supported so as to swing around a pivot 167 installed upright on the upper surface of the carriage casing 185. A driving arm 160 is provided so as to swing inside the carriage casing 185, and the leading end of the driving arm 160 is connected via a rod 168 to one end of the first arm 161. The driving arm 160 is connected to the cam shaft (not illustrated), which is also connected with and drives the suction pipe 188, and the chucker 189 or the like.

[0102] Both the first arm 161 and the second arm 162 are bent at the leading end in a hook form. A yarn removing plate 171 and a yarn handling plate 172 are mounted respectively at the leading end of the first arm 161 and at the leading end of the second arm 162. An urging spring (not illustrated) is contained inside the pivot 167, and the urging spring urges the second arm 162 to swing relatively with respect to the first arm 161 in a clockwise direction in Fig. 11. However, the swinging movement is restricted by bringing a projection 164 formed on the second arm 162 into contact with the first arm 161.

[0103] A pneumatic cylinder 163 is provided on an upper surface of the second arm 162 located above the other arm 161. A guide plate 173 for guiding a yarn path is fixed to the leading end of the movable portion of the pneumatic cylinder 163. A guide groove 174 for inserting the core yarn 110 is formed at an end of the guide plate 173 in a direction in which the cylinder is extended.

[0104] Fig. 11 illustrates a state in which the suction pipe 188 of the doffing carriage 104 is retracted, while sucking and capturing the core yarn 110 in accordance with the above-described constitution. As illustrated in Fig. 11, the guide 158 is kept in a retracted state, not projecting from the upper part of the doffing carriage 104, until the leading end of the suction pipe 188 passes in front of the slub catcher 135 and descends further downward.

[0105] Then, immediately after the leading end of the suction pipe 188 passes downward at the front of the slub catcher 135, the driving arm 160 is driven by a cam shaft, the drawing of which is omitted. As illustrated in Fig. 12, the driving arm 160 stretches the first arm 161 via a rod 168, thereby allowing the first arm 161 to swing. Further, the second arm 162 swings so as to follow the first arm 161 by an urging spring contained inside the

pivot 167. As a result, the yarn handling plate 172 of the second arm 162 comes into contact with the core yarn 110, thereby bringing the yarn path slightly toward the right side. Further, in this state, the yarn removing plate 171 of the first arm 161 is not making contact with the yarn path.

[0106] In a state illustrated in Fig. 12, the pneumatic cylinder 163 is in a retracted state, and the guide plate 173 is positioned at a position slightly forward to a yarn path of the core yarn 110 (on the doffing carriage 104 side). Further, in Fig. 12, the yarn path of the core yarn 110 is illustrated so as to overlap with the guide groove 174 of the guide plate 173. However, in the state illustrated in Fig. 12, the core yarn 110 is not yet inserted into the guide groove 174.

[0107] After the swing of the above-described two arms 161 and 162 are completed, pressurized air is supplied to the pneumatic cylinder 163 at such a time that the arms 161 and 162 project from the doffing carriage 104 as given in Fig. 12, thereby extending the pneumatic cylinder 163. As a result, as shown in Fig. 13, the guide plate 173 advances, while inserting the core yarn 110 into the guide groove 174, and is positioned just below the slub catcher 135 on the spinning unit 102. Consequently, the core yarn 110 fed from the feeding device 111 is guided by the guide plate 173 and the guide groove 174 so that the core yarn 110 passes through the cutter device 136 and the slub catcher 135.

[0108] Immediately after the guide plate 173 advances, the driving arm 160 allows the first arm 161 to slightly swing further via the rod 168. The second arm 162 also attempts to swing, following the first arm 161 by the urging spring contained in the pivot 167. However, the swinging movement is blocked by a restriction projection 165 formed on the second arm 162 making contact with a stopper 166 fixed on the upper surface of the carriage casing 185. Consequently, as illustrated in Fig. 14, only the first arm 161 is swung slightly, by which the yarn removing plate 171 mounted at the leading end thereof comes into contact with the core yarn 110 to bring the yarn path further toward the right side. Therefore, the core yarn 110 is removed from the yarn handling plate 172 of the second arm 162. The swinging movement (yarn removing motion) of the first arm 161 is returned to an original position in a short time. Consequently, as illustrated in Fig. 15 and Fig. 9, the core yarn 110 is kept to be guided only by a guide groove of the guide plate 173. A determination on whether or not a core is present as illustrated in Fig. 10 is made while the first arm 161 is swung and returned to an original position.

[0109] As described so far, the guide 158 acts to guide the core yarn 110 for making a determination on whether or not a core is present. After the determination on the presence or the absence of the core by the slub catcher 135, the pneumatic cylinder 163 is retracted to return the guide plate 173 back to the doffing carriage 104 side, by which the core yarn 110 is removed from the guide groove 174 of the guide plate 173. Then, two arms 161 and 162

are swung to be returned to an original retracted position by the driving arm 160. A series of motions by the guide 158 are completed and the guide 158 is returned to a retracted position as shown in Fig. 11.

[0110] Further, a motion timing of each of the arms 161 and 162 and the pneumatic cylinder 163 are set such that the guiding of the core yarn 110 by the above guide 158 can be completed before a stage when a doffing motion of the doffing carriage 104 (referring to a series of operations including collecting of a fully wound package and bunch-winding) is completed (more particularly, to be completed before the previously described bunch-winding by the bunch winding device is started). That is, a determination on the presence or the absence of a core can be carried out simultaneously with a doffing motion, thereby shortening an operation time. In particular, operation timing can be set so that a determination on the presence or the absence of the core by the slub catcher 135 is completed prior to the bunch winding, thereby making it possible to substantially eliminate an extended operation time. Further, even when the core yarn is determined by the slub catcher 135 to be a defective core yarn without a core, it is easy to correct the abnormality and resume operations since it is before the bunch winding.

[0111] As described above, in the core yarn spinning machine 101 of the present embodiment, when doffing service is conducted by the doffing carriage 104, the core yarn 110 is guided to the slub catcher 135 acting as a core presence determining means for determining whether or not a core is present inside the core yarn 110. It is, therefore, possible to make a determination on whether or not the core is present simultaneously with the doffing service, and also to reliably detect the absence of the core inside the core yarn, without increasing a stopping time of the spinning unit 102.

[0112] Further, the guiding of the core yarn 110 to the slub catcher 135 is conducted before completion of the doffing service. Therefore, a determination on whether or not the core is present inside the core yarn 110 can be completed easily during the doffing service to suppress an increase in winding stop time of the spinning unit 102.

[0113] Furthermore, a determination by the slub catcher 135 on whether or not a core is present is made prior to completion of the doffing service, thereby making it possible to keep an increase in winding stop time of spinning unit 102 to zero. Further, a determination on the presence or the absence of a core is made at a time when the doffing service is completed but before the winding operation is resumed, thereby making it easy to recover from an abnormality and resume an operation even when a determination made by the slub catcher 135 that no core is present.

[0114] Further, in conducting doffing service for the spinning units 102, the doffing carriage 104 conducting the doffing service captures the core yarn 110 by using the suction pipe 188 and guides the captured core yarn 110 to the slub catcher 135 mounted on the spinning

units 102 side. That is, the doffing carriage 104 captures the core yarn 110 by the suction pipe 188 for the doffing service, by which the core yarn 110 can be easily guided to the slub catcher 135 of the spinning unit 102. Therefore, a determination on whether or not an elastic yarn 122 is present can be reliably made by the slub catcher 135.

[0115] Still further, the slub catcher 135 is provided on the spinning unit 102. The doffing carriage 104 is arranged so as to face the spinning unit 102, and provided with the movable guide 158 for guiding the core yarn 110 to the slub catcher 135. Therefore, the movement of the guide 158 makes it possible to easily guide the core yarn 110 from the doffing carriage 104 to the slub catcher 135 on the spinning units 102 facing the doffing carriage 104.

[0116] In addition, the guide 158 is constituted so as to retract to the doffing carriage 104 when doffing operation is not being conducted. Therefore, except when the core yarn 110 is guided, the guide 158 is retracted to the doffing carriage 104 side, as illustrated in Fig. 11 and Fig. 8, thereby preventing interference of the guide 158 with the traveling core yarn 110, the spinning unit 102 and components on the yarn splicing carriage 103, and making it possible to smoothly operate the core yarn spinning machine 101. This effect can be favorably provided particularly in the present embodiment where a doffing device (doffing carriage 104) is constituted so as to travel among a plurality of spinning units 102. That is, since the guide 158 is retracted during traveling of the doffing carriage 104, the guide 158 is prevented from interfering with components on spinning units 102 to smoothly conduct the traveling of the doffing carriage 104 and the motion of each spinning unit 102.

[0117] Further, the guide 158 is constituted so as to capture the core yarn 110 and guide the captured core yarn 110 to the slub catcher 135 by swinging and extending to a yarn path side of the core yarn 110. It is, therefore, possible to appropriately guide the core yarn 110 to the slub catcher 135 on the spinning units 102 side facing the doffing carriage 104. Further, under a state in which the guide 158 is retracted prior to the swinging and extending, the guide 158 can be housed into a compact space as shown in Fig. 11, thereby easily downsizing the doffing carriage 104.

[0118] Further, the core presence determining means also acts as the slub catcher 135 mounted on the spinning units 102 side for detecting a yarn defect, thereby eliminating a necessity for providing an additional device for determining the presence or the absence of a core to further simplify the structure.

[0119] Still further, the core yarn spinning machine 101 of the present embodiment is provided with a plurality of spinning units 102, and the doffing carriage 104 is constituted so as to travel between a plurality of spinning units 102. Therefore, one doffing carriage 104 can conduct doffing service to a plurality of spinning units 102, thereby eliminating a necessity for having a plural number of devices for the doffing service and further sim-

plifying the constitution to result in a decreased production cost.

[0120] Thus far, the preferred embodiments of the present invention have been described. The present invention shall not be technically restricted to the above-described constitutions but may include, for example, the following modifications.

[0121]

(1) Services carried out in a core yarn spinning machine are not restricted to doffing service but may include, for example, yarn splicing service. That is, a yarn splicing carriage may be provided to travel along the previously described guideway 186 (that is, so as to face a spinning unit 102) and a guide 158 may be provided on the yarn splicing carriage. In this instance, it is preferable that a yarn path is guided to the slub catcher 135 by the guide 158 at a time before completion of the yarn splicing service by the yarn splicing carriage.

[0122]

(2) Further, in the same manner as in the first embodiment, a core presence determining means acts as the slub catcher 135 in the above-described second embodiment. However, also in the second embodiment, the core presence determining means may be provided separately from the slub catcher 135.

[0123]

(3) Still further, in the above embodiment, when a determination is made on whether or not a core is present, the presence or the absence of the core is determined by referring to the fact that an output voltage of the light receiving unit 138 corresponding to the size of a contour (contour thickness) exceeds a predetermined threshold value or not. However, for example, the slub catcher controller 151 may be provided with a function to calculate a variation in output voltage of the light receiving unit 138, for example, standard deviation, and the presence or the absence of the core may be determined by referring to whether or not the variation exceeds a predetermined threshold value. Further, the presence or the absence of the core may be comprehensively determined by referring to both thickness of the core yarn detected at the light receiving unit 138 and the variation in thickness. It should be noted that in this instance, the "contour thickness" is not an actual thickness of the core yarn 110 but a clearance formed between contours of shadows reflected when viewed from a radial direction.

[0124]

(4) A slub catcher as a yarn defect detector or a device for determining the presence or the absence of a core is not restricted to a so-called photoelectric constitution in the second embodiment, as in the first embodiment. For example, a capacitance-type slub catcher may also be used.

[0125]

(5) Further, the guide 158 guides the core yarn 110 by swinging and then extending. However, the present invention is not restricted thereto and, for example, may be constituted so as to guide the core yarn 110 simply by swinging or extending. As described above in the above embodiment, when the swinging motion and the extending motion are carried out in sequence, the guide 158 at a retracted position can be housed in a compact space, without interfering with other components, which is preferable.

[0126]

(6) Still further, the doffing carriage 104 is constituted so as to travel between spinning units 102. However, the present invention is not restricted thereto and a doffing device may be simply arranged so as not to move.

[0127]

(7) In addition, the present invention is not restricted to a spinning machine having the spinning member with the above-described constitution, but is applicable to other types of spinning machines having a spinning member with different constitution.

[0128]

(8) The present invention is not restricted to a determination on whether or not a core is present in a doffing motion of the doffing carriage 104, but includes a determination on whether or not the core is present in a yarn splicing motion of the yarn splicing carriage 103. In this instance, the guide means corresponds to the suction pipe 144. That is, the "service" may include both the yarn splicing service and the doffing service.

Claims

1. A core yarn spinning machine comprising:

a spinning device for spinning a core yarn;
a winding device for winding the core yarn; and
a core presence determining means for determining a presence or an absence of a core in

the core yarn;

wherein during a time before winding from a time the spinning of the core yarn in the spinning device is started to a time prior to a winding operation of the core yarn by the winding device, the core yarn is introduced into the core presence determining means.

2. The core yarn spinning machine according to Claim 1 wherein existence of the core is made more conspicuous at a time when the core yarn is introduced into the core presence determining means than at a time after the winding of the core yarn is started by the winding device.

3. The core yarn spinning machine according to Claim 2 wherein the core in the core yarn is an elastic yarn, the core presence determining means determines that the core is present by referring to a fact that thickness of the core yarn or variation in the thickness is larger than a threshold value, and the existence of the core is made conspicuous by weakening a tensile force of the core yarn or slackening the core yarn to a greater extent than a tensile force of the core yarn or a slackened amount of the core yarn at the time after the winding operation is started.

4. The core yarn spinning machine according to any one of Claim 1 through Claim 3 wherein the core presence determining means is a yarn monitoring means at the time after the winding operation is started, and the core presence determining means is provided with a threshold value for determining the presence or the absence of the core separately from a threshold value for yarn monitoring at the time after the winding operation is started.

5. A core presence determining method for determining a presence or an absence of a core in a core yarn, the core presence determining method comprising the steps of:

introducing the core yarn in which existence of the core is made more conspicuous than a core of a core yarn in a normal state into a detecting unit for detecting thickness of the core yarn; and determining the core to be present by referring to a fact that the thickness of the core yarn or variation in the thickness detected at the detecting unit is greater than a predetermined value.

6. The core presence determining method for the core yarn according to Claim 5 wherein the core of the core yarn is an elastic yarn and the existence of the core is made more conspicuous by weakening a tensile force of the core yarn or slackening the core yarn to a greater extent than the core yarn in the normal

state.

7. A service method in a core yarn spinning machine comprising the step of guiding a core yarn to a core presence determining means for determining a presence or an absence of a core in the core yarn during a concerned service.

8. The service method in the core yarn spinning machine according to Claim 7 wherein the core yarn is guided to the core presence determining means at a timing prior to completion of the concerned service.

9. The service method in the core yarn spinning machine according to Claim 8 wherein a determination on a presence or an absence of a core is made by the core presence determining means at the timing prior to the completion of the concerned service.

10. A core yarn spinning machine having a unit for spinning and winding a core yarn and a service device for conducting service for the unit, the core yarn spinning machine comprising:

a core presence determining means for determining a presence or an absence of a core in a core yarn; and

a guide means for capturing the core yarn and guiding the captured core yarn to the core presence determining means when conducting service for the unit.

11. The core yarn spinning machine according to Claim 10 wherein the core presence determining means is provided for the unit, the service device is arranged so as to face the unit, and the guide means is provided on the service device side with a movable guide for guiding the core yarn into the core presence determining means.

12. The core yarn spinning machine according to Claim 11 wherein the guide is retracted to the service device side when the service is not conducted.

13. The core yarn spinning machine according to Claim 12 wherein the guide is swung from the retracted state and also extended to a yarn path side of the core yarn, thereby capturing the core yarn and guiding the core yarn to the core presence determining means.

14. The core yarn spinning machine according to any one of Claim 10 through Claim 13 wherein the core presence determining means also acts as a yarn defect detecting means mounted on the unit side.

15. The core yarn spinning machine according to any one of Claim 10 through Claim 14 wherein a plurality

of units are arranged and the service device is constituted so as to travel between the plurality of the units.

5

10

15

20

25

30

35

40

45

50

55

FIG.1

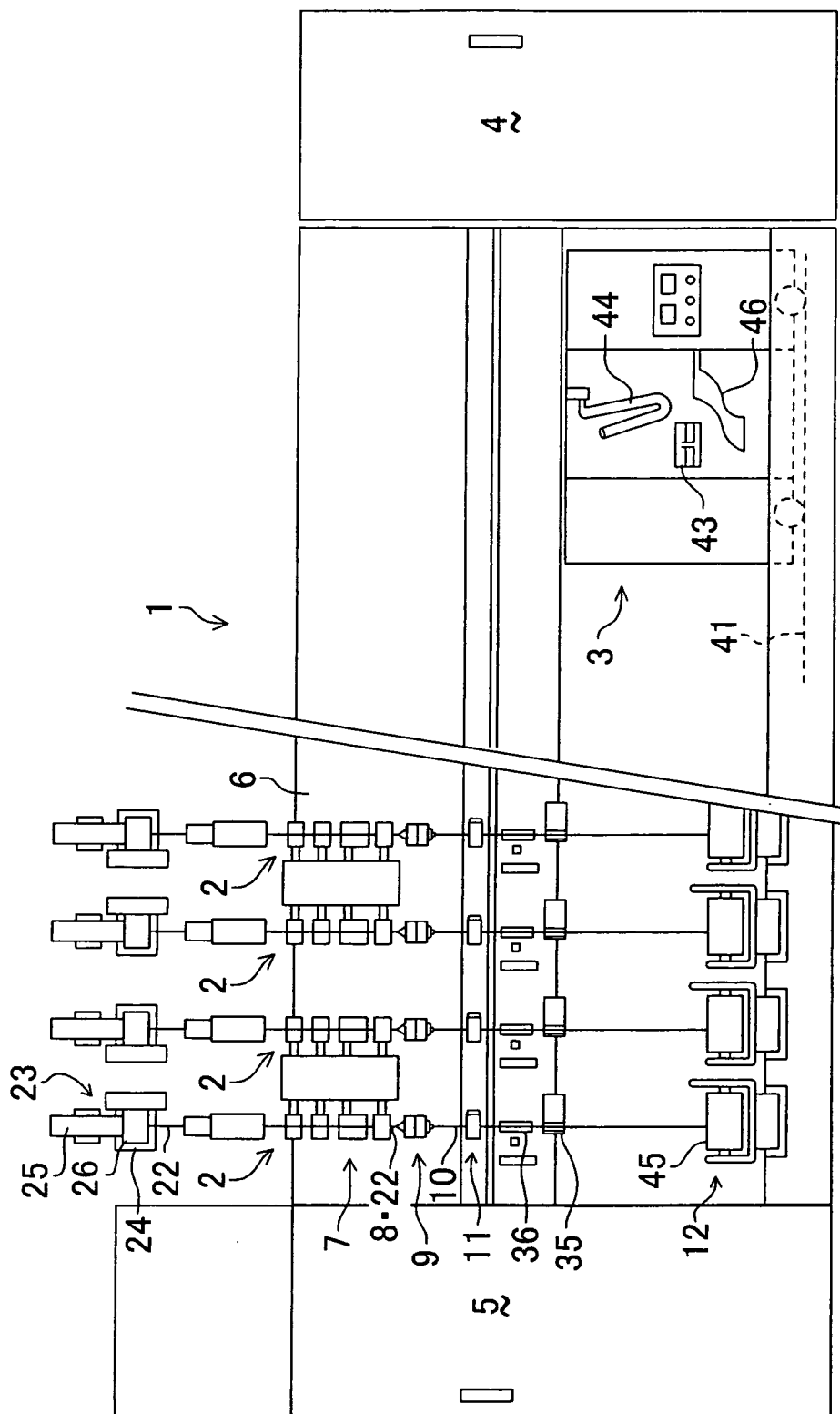


FIG.2

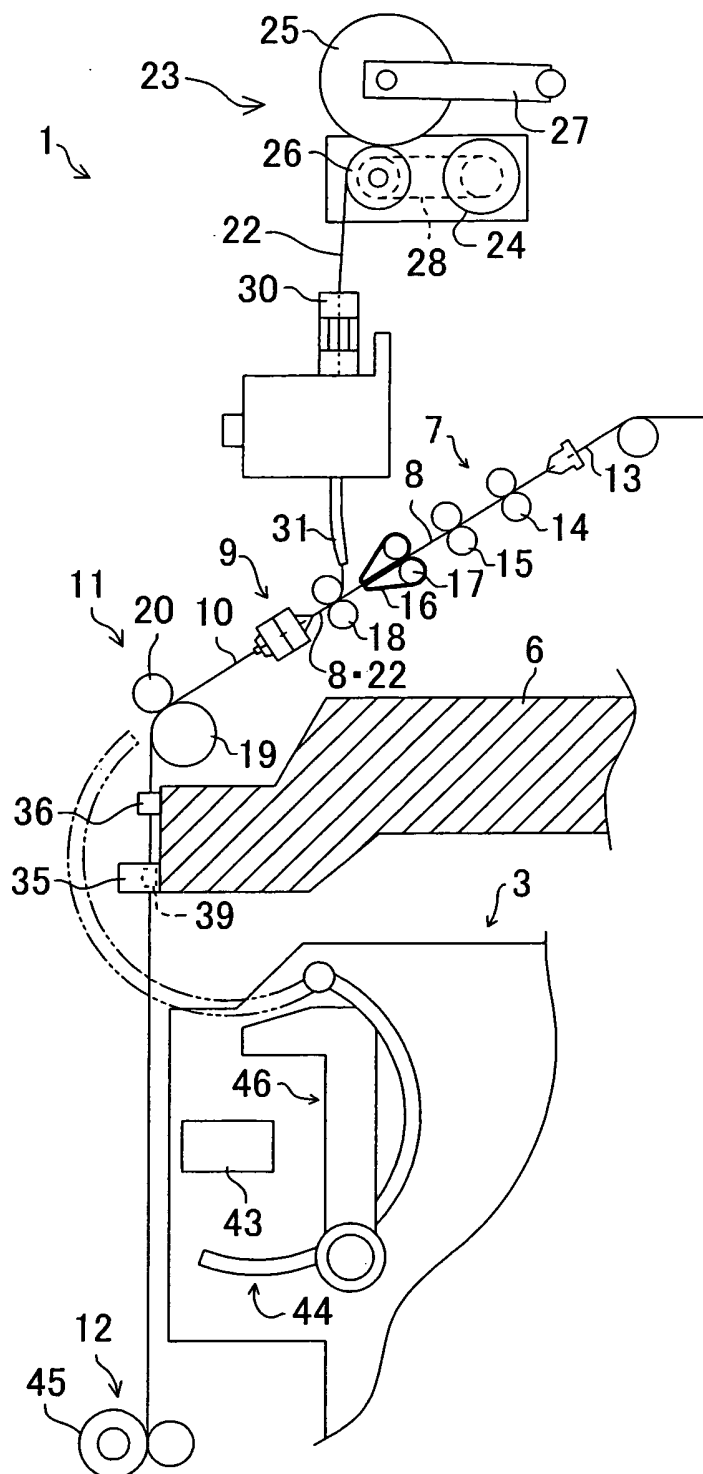


FIG. 3

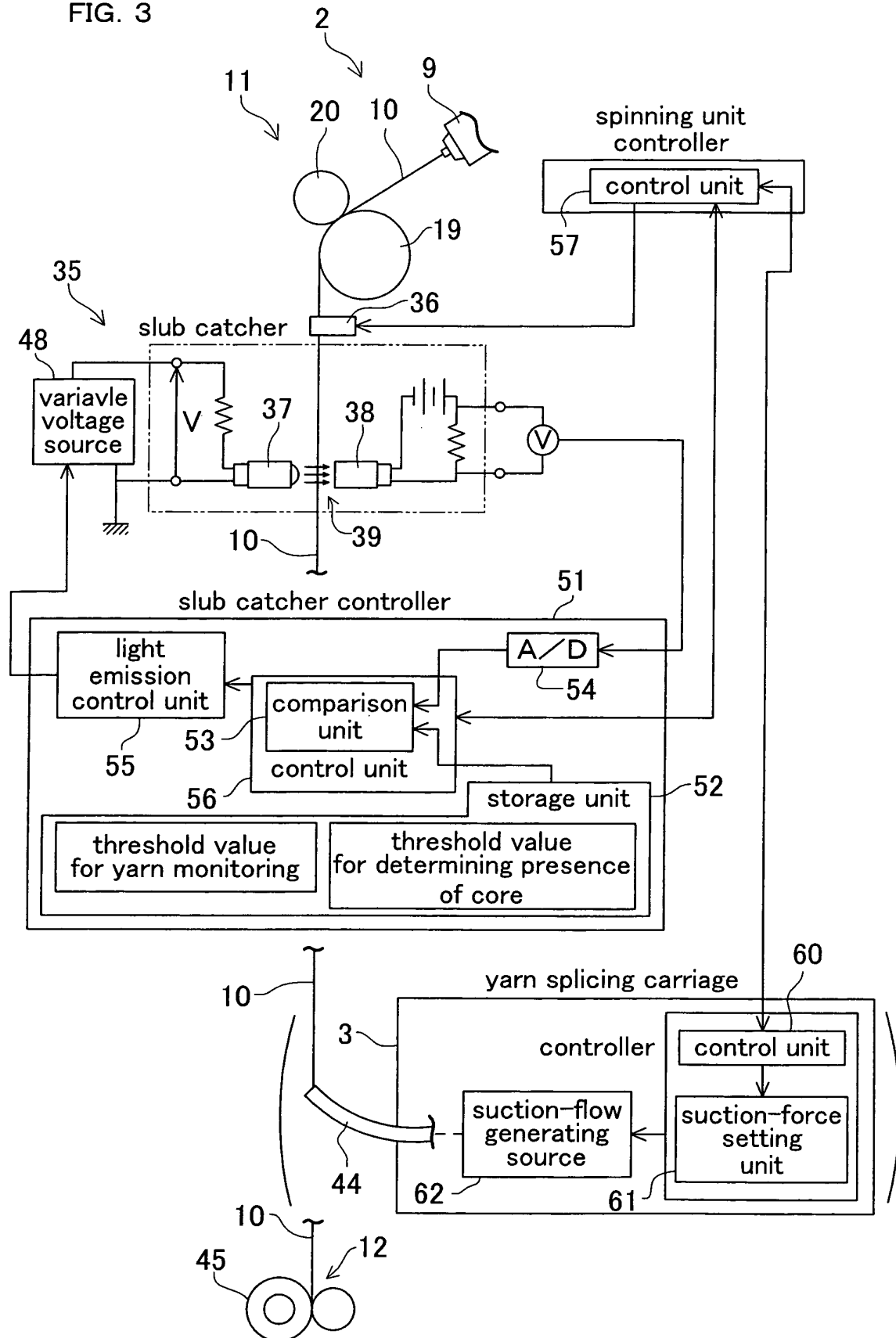


FIG.4

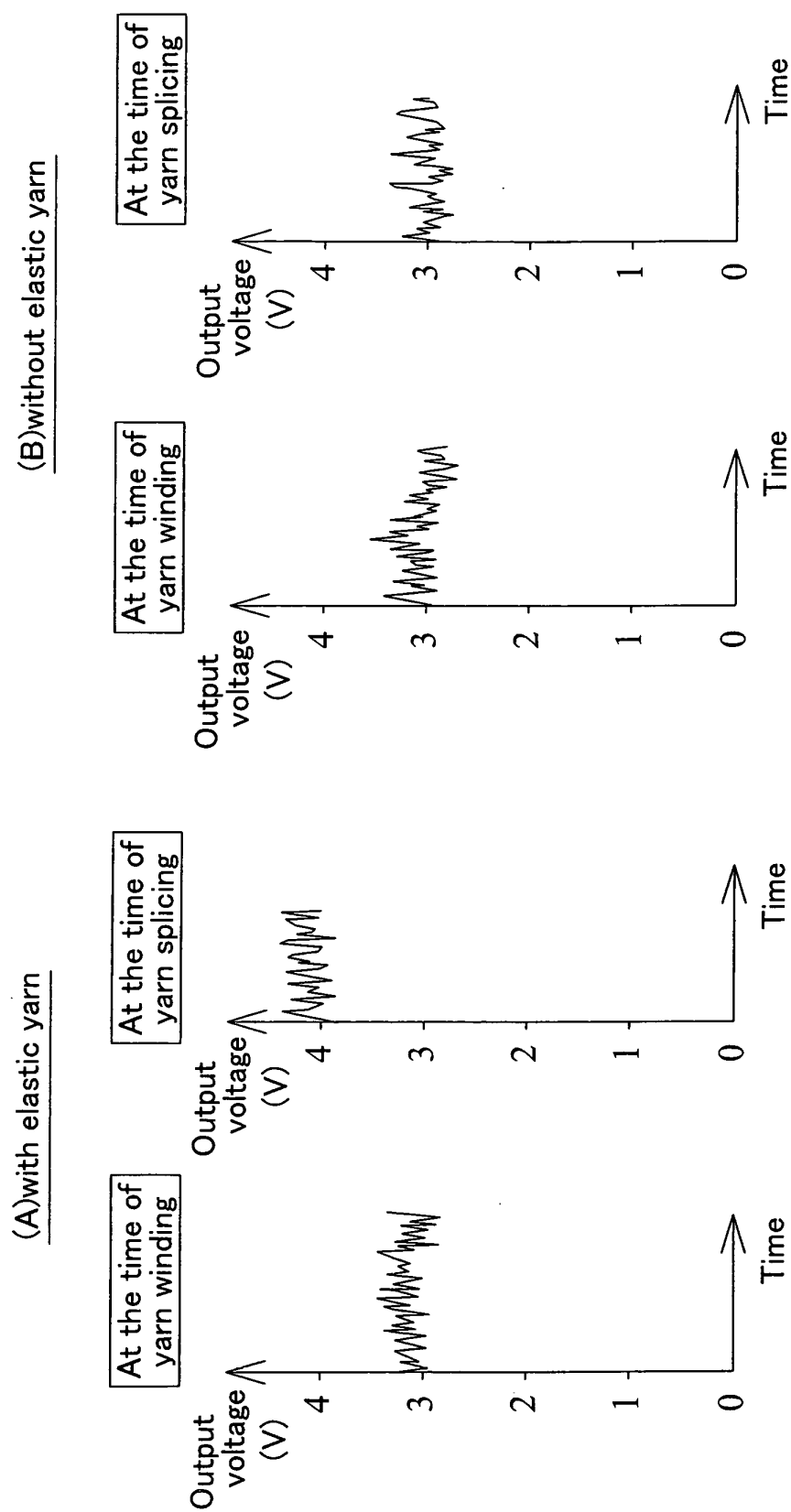


FIG.5

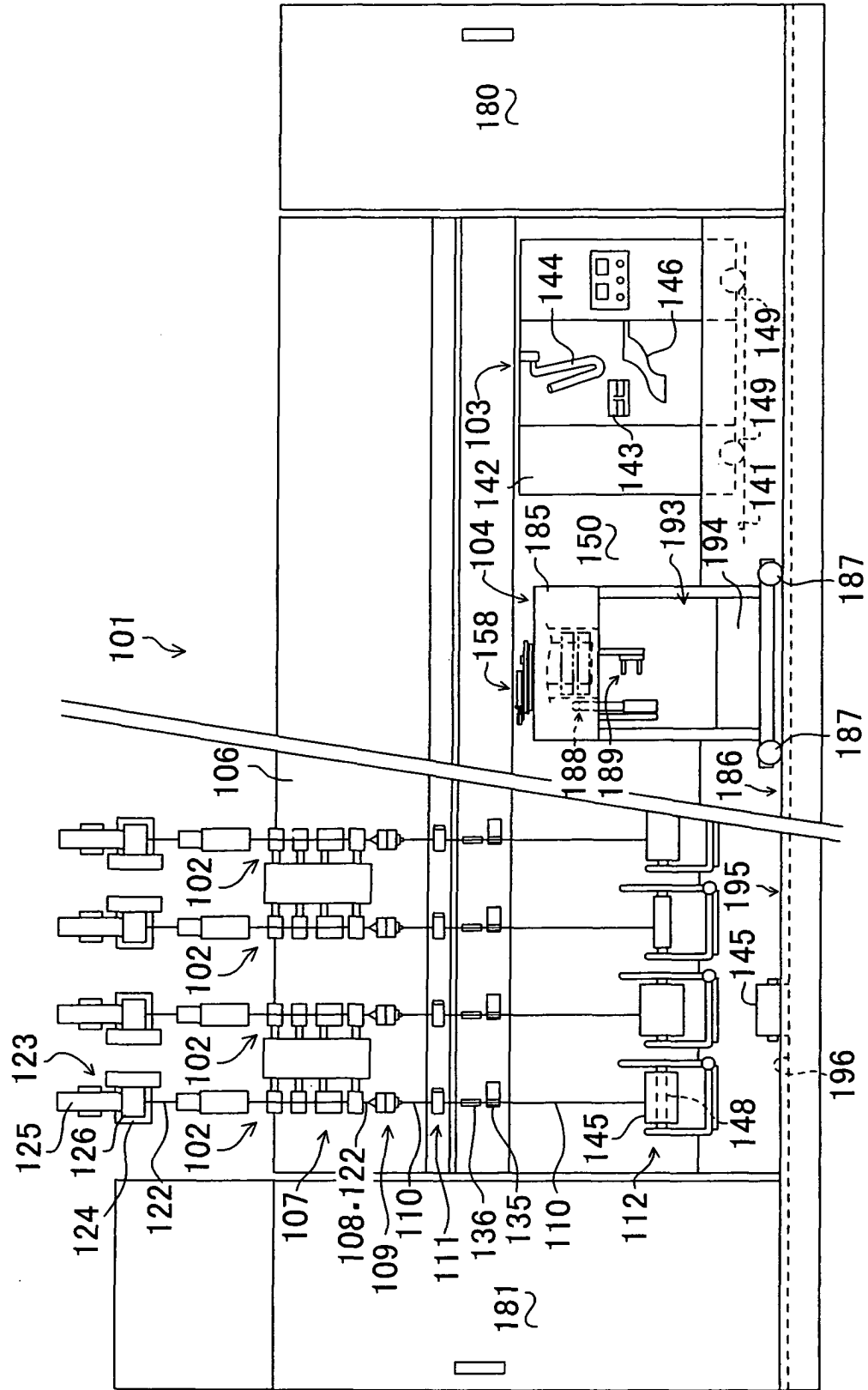


FIG.6

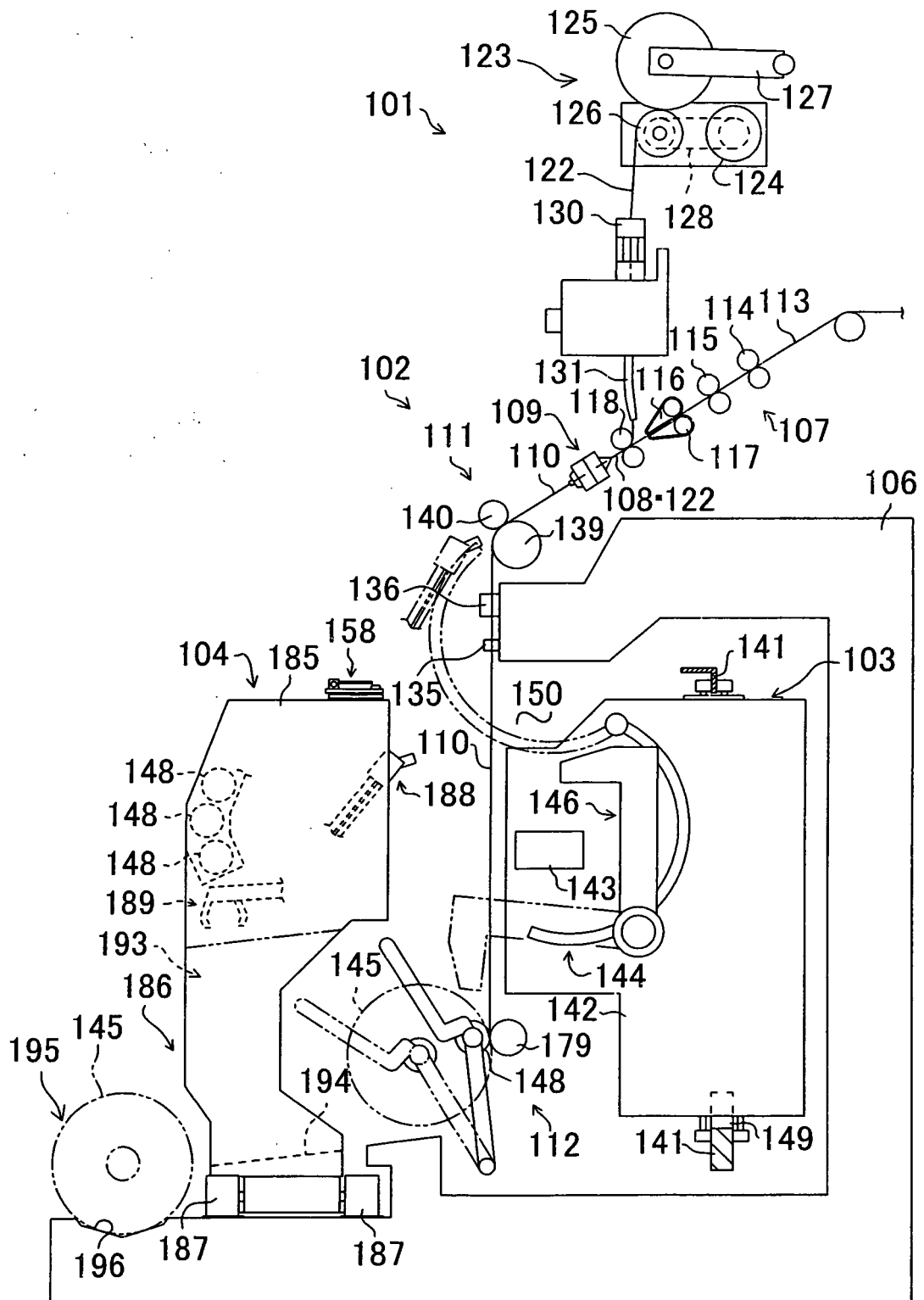


FIG. 7

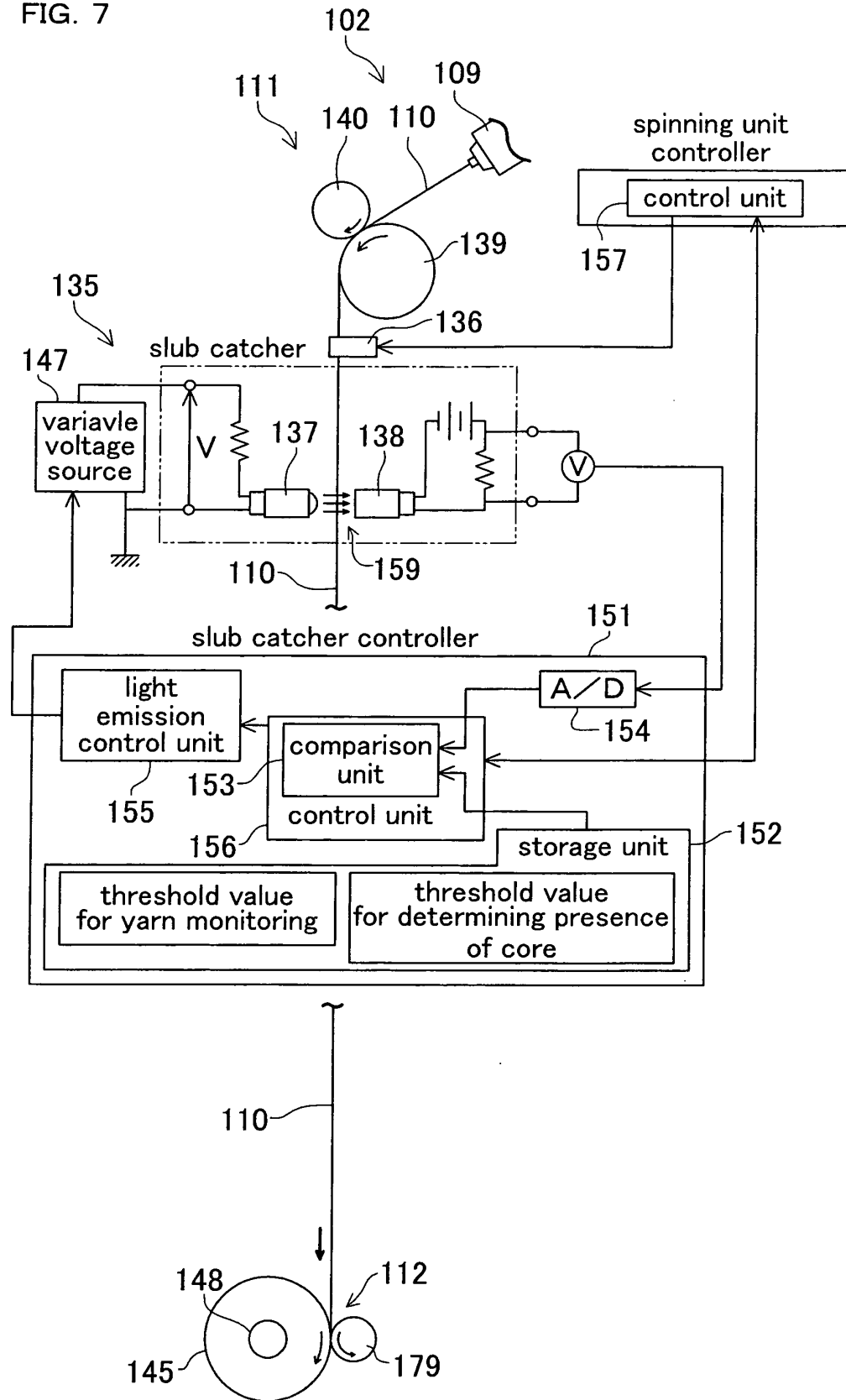


FIG.8

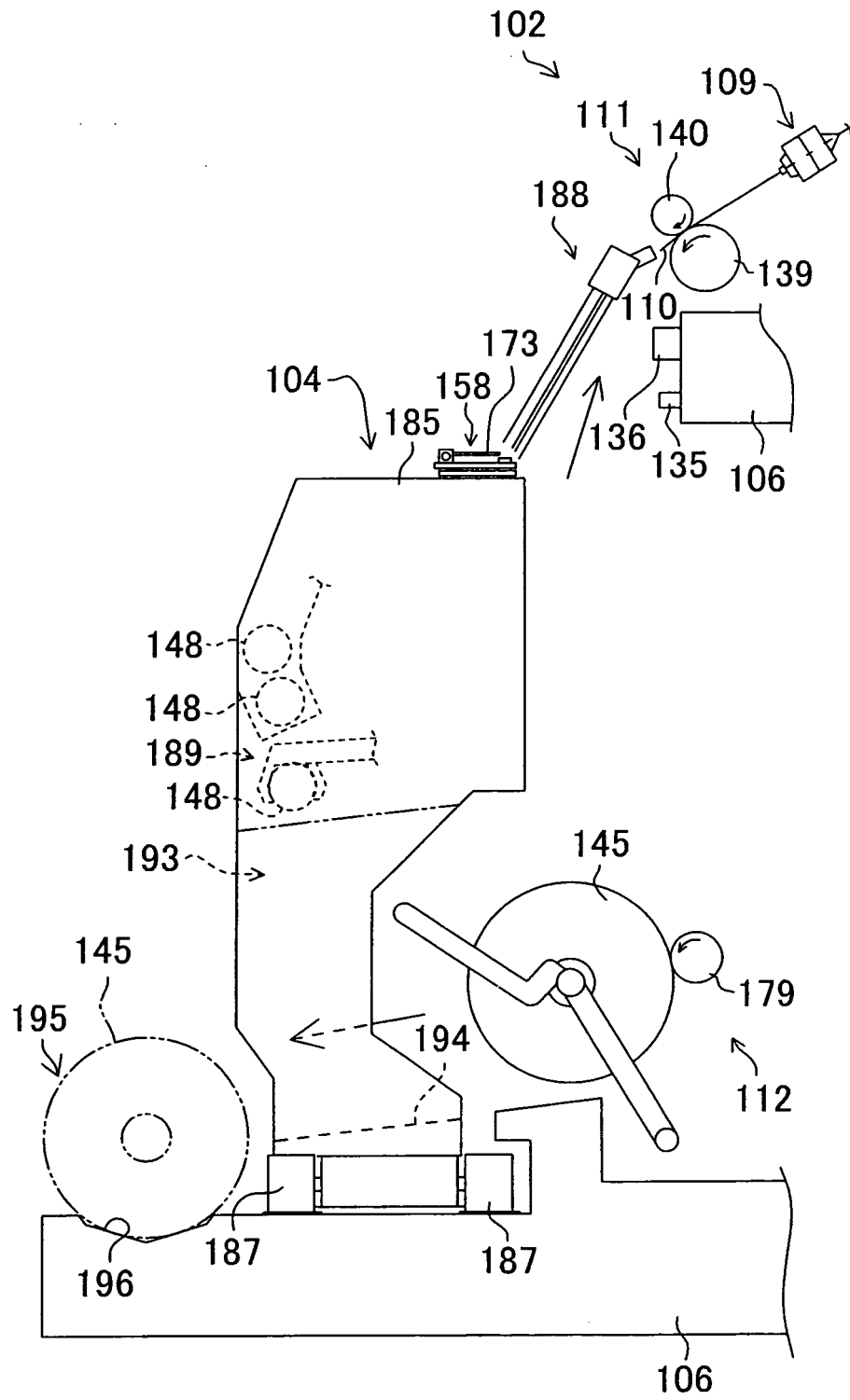


FIG.9

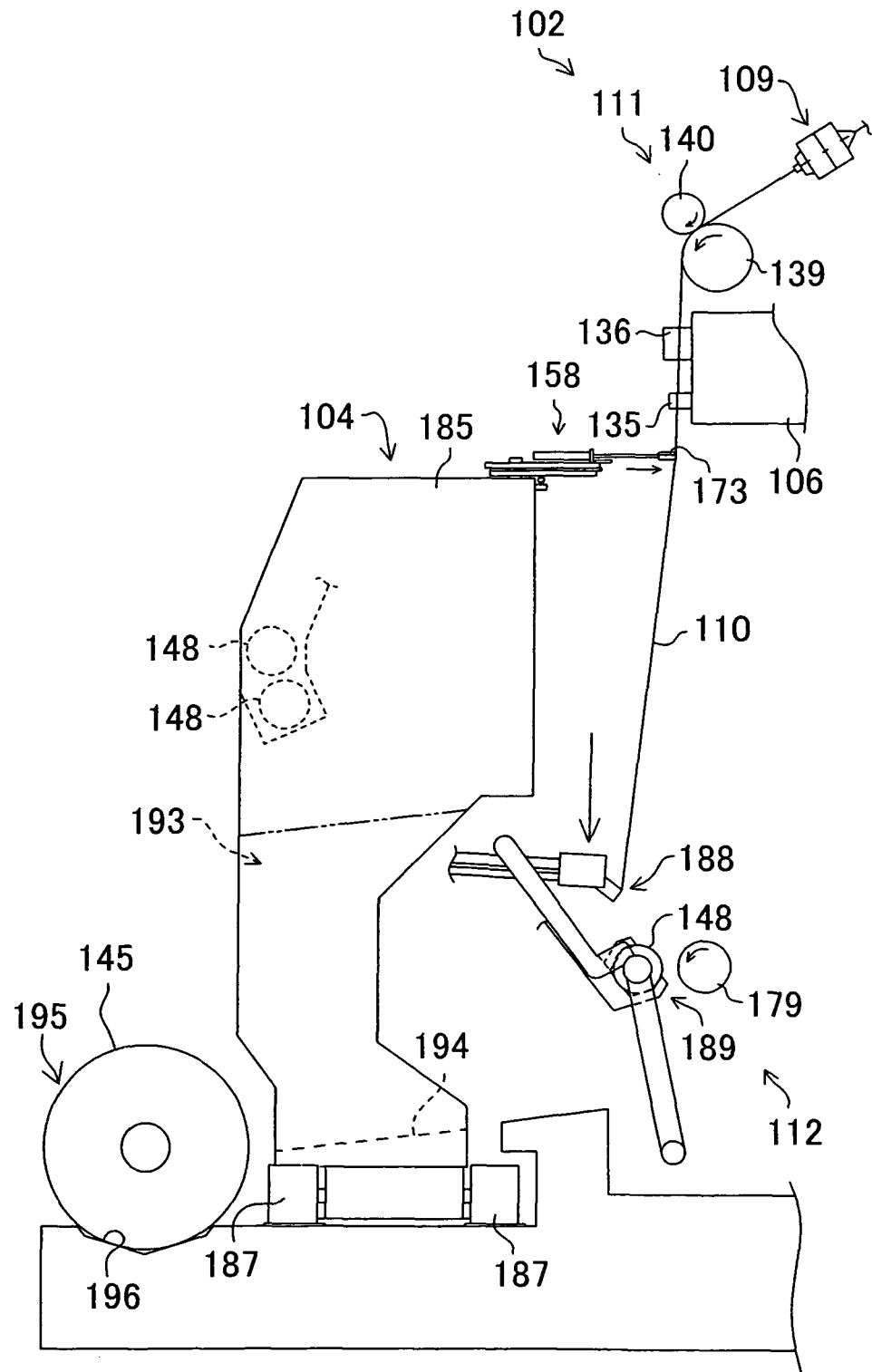


FIG. 10

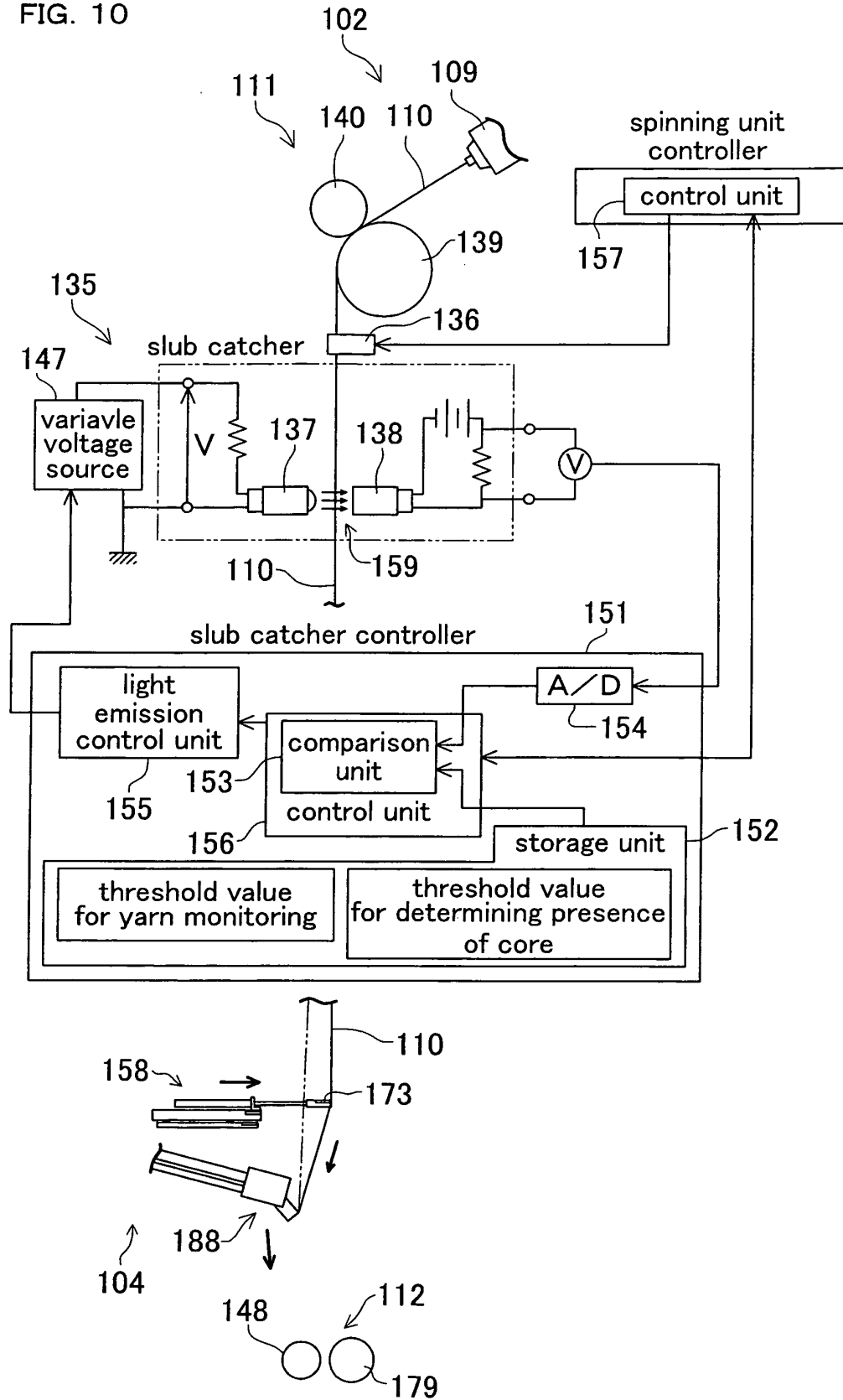


FIG. 11

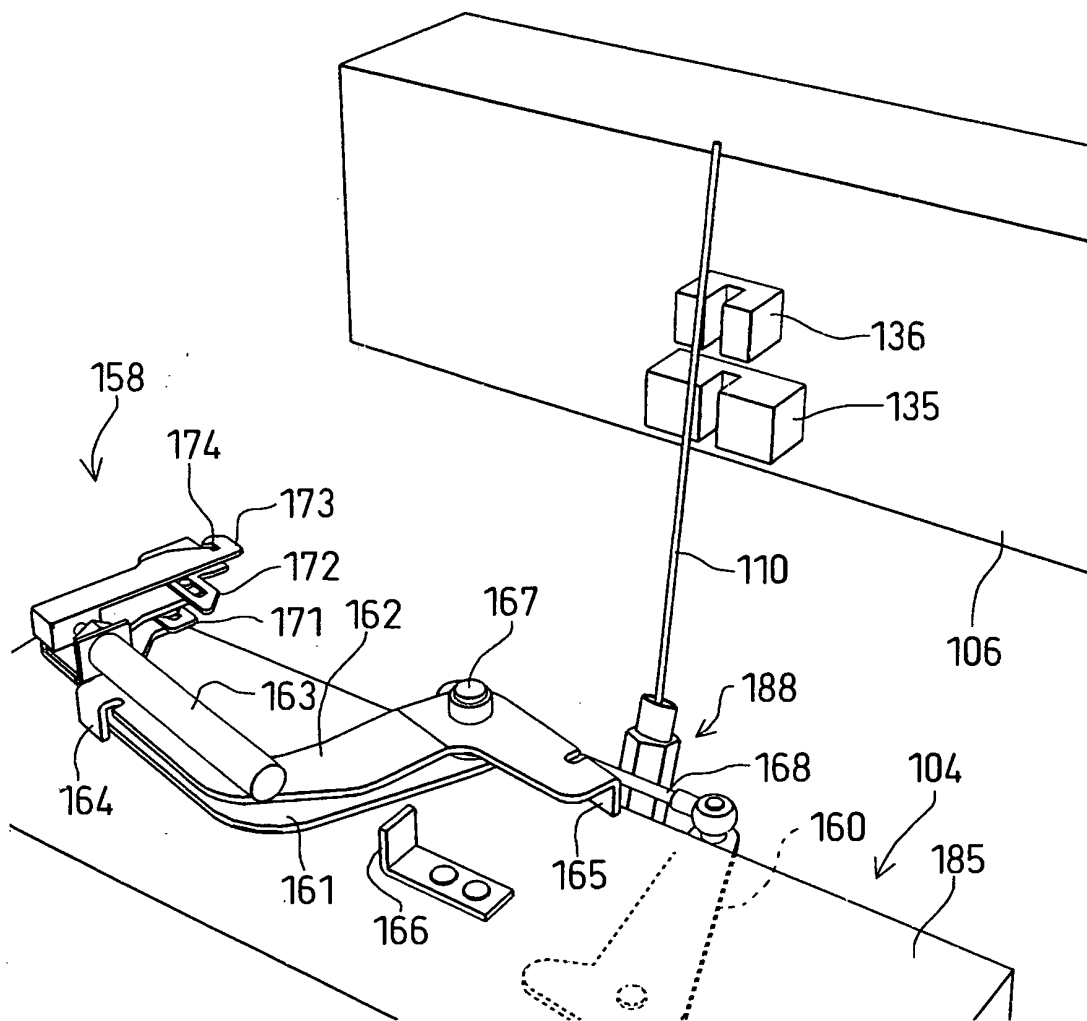


FIG. 12

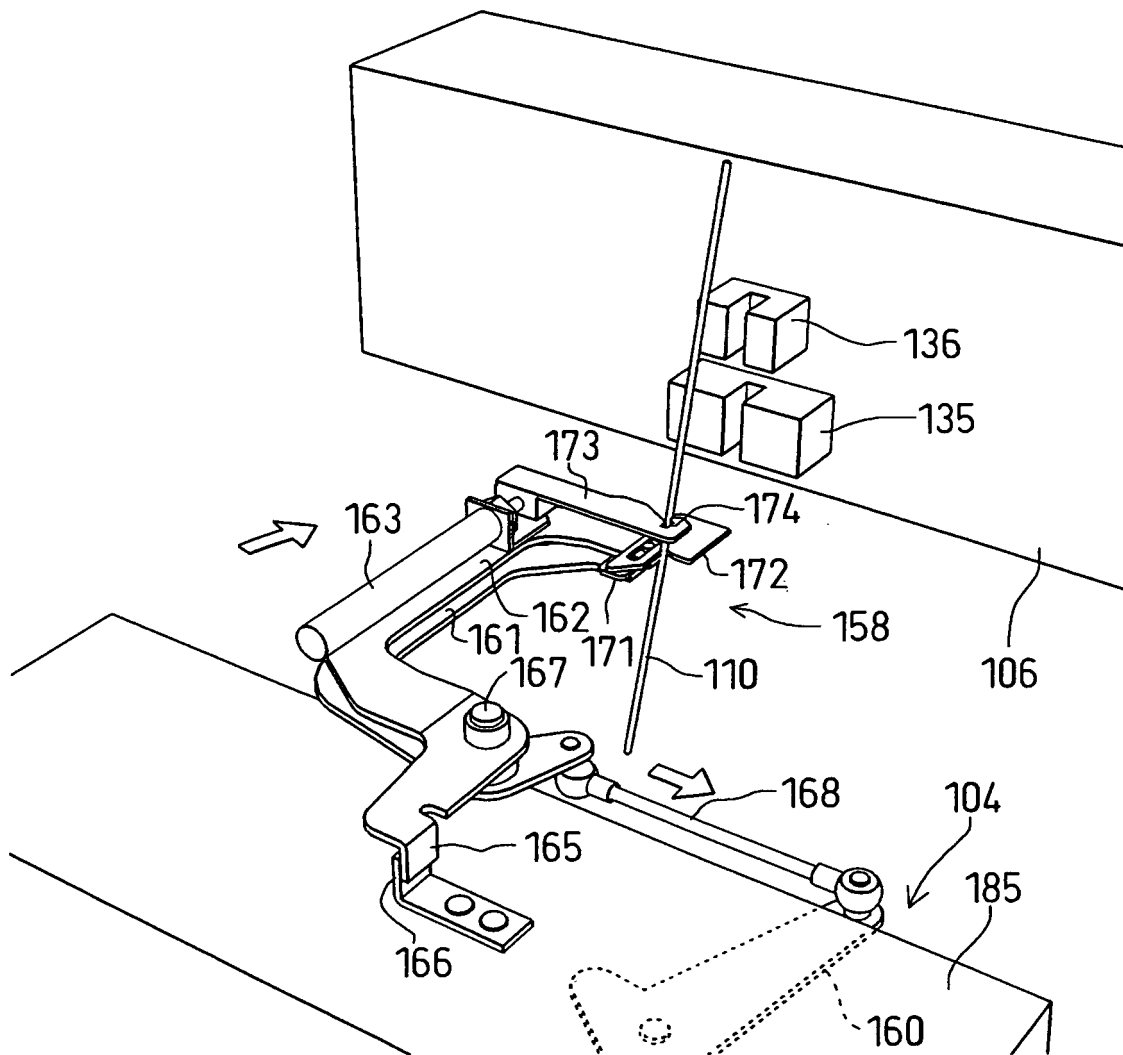


FIG. 13

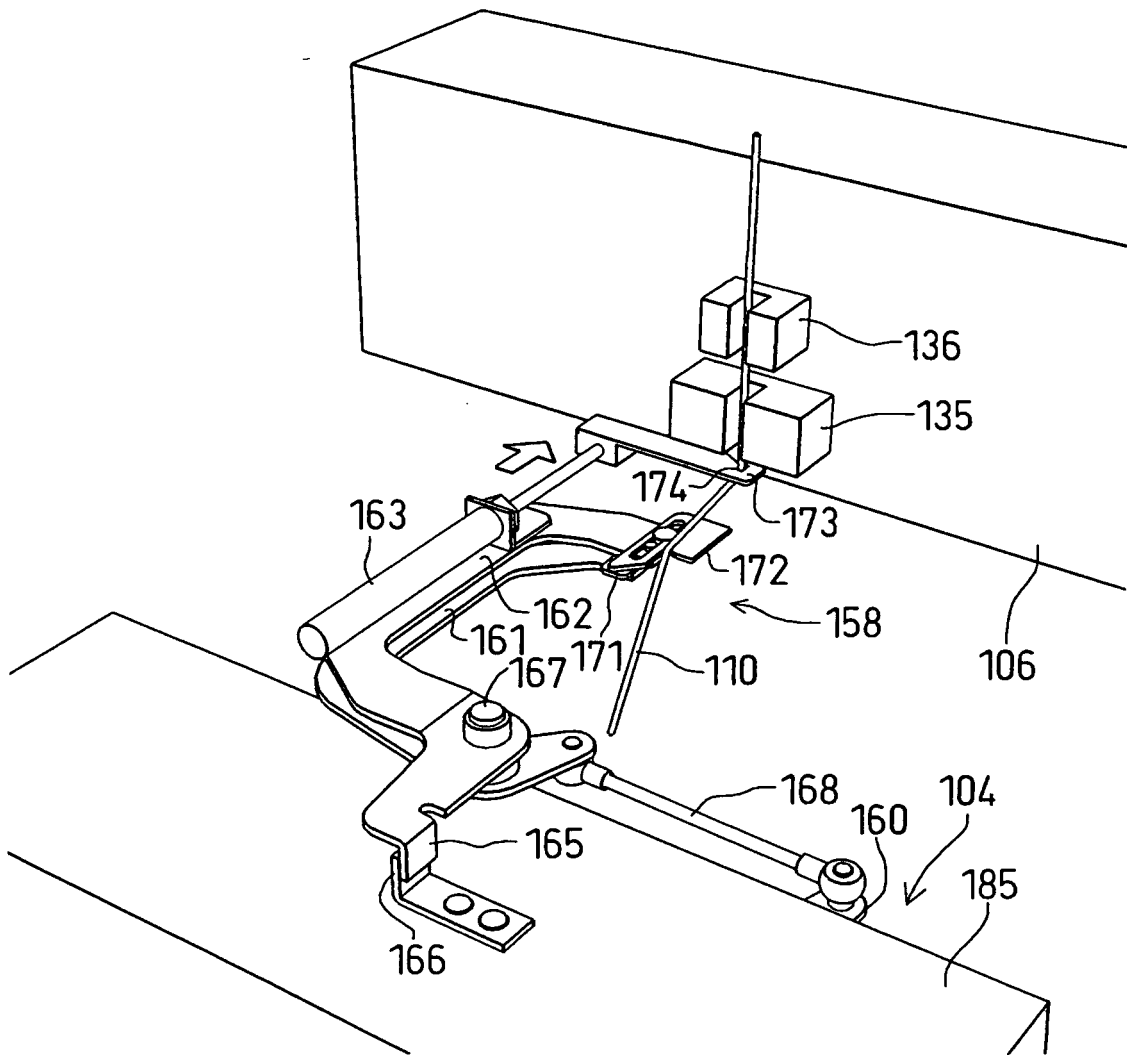


FIG. 14

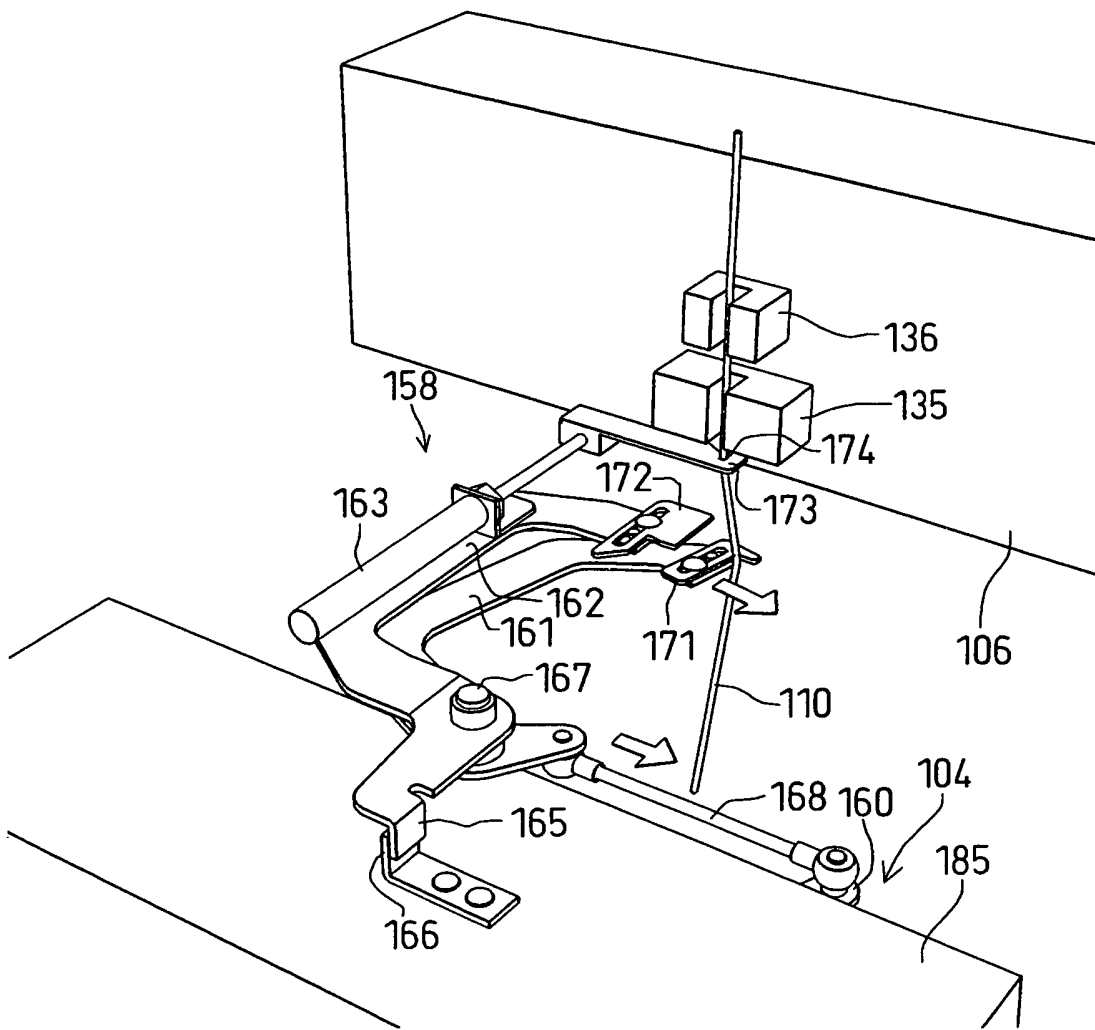
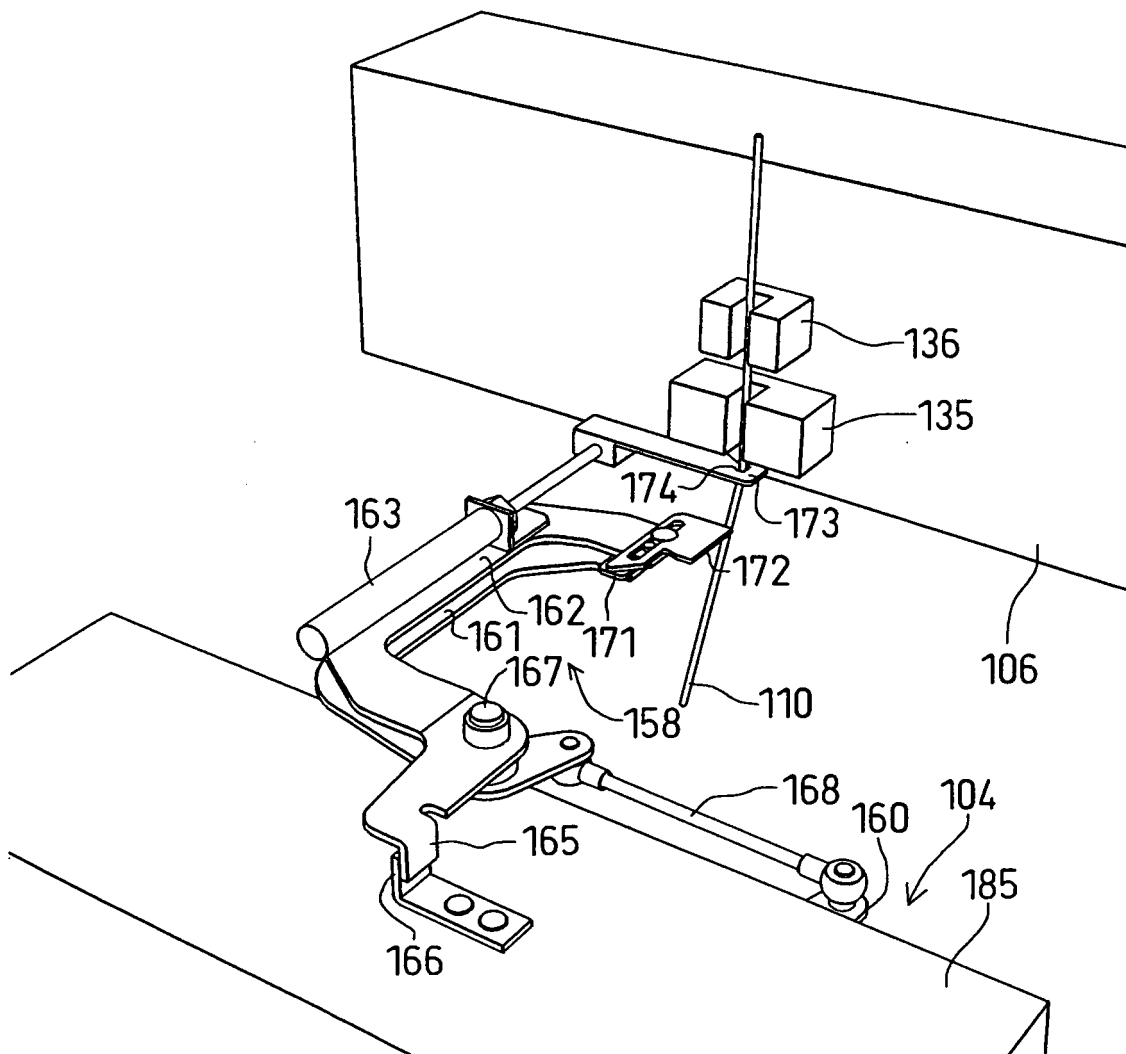


FIG. 15



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/016261

A. CLASSIFICATION OF SUBJECT MATTER

D01H13/16 (2006.01), **D01H13/26** (2006.01), **D01H4/02** (2006.01),
D02G3/32 (2006.01)

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D01H13/16 (2006.01), **D01H13/26** (2006.01), **D01H4/02** (2006.01),
D02G3/32 (2006.01)

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 1996-2005
 Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005

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.
X Y	JP 3185840 B2 (Murata Machinery Ltd.), 11 July, 2001 (11.07.01), Par. Nos. [0019] to [0025] (Family: none)	1, 7-13 4, 14, 15
Y	JP 7-107212 B2 (Toray Engineering Co., Ltd.), 15 November, 1995 (15.11.95), Column 5, line 49 to column 6, line 1 & US 5142856 A & EP 484601 A1	4, 14, 15
A	JP 2734805 B2 (Murata Machinery Ltd.), 02 April, 1998 (02.04.98), (Family: none)	1-15



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
 04 November, 2005 (04.11.05)

Date of mailing of the international search report
 22 November, 2005 (22.11.05)

Name and mailing address of the ISA/
 Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

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

- JP 2002363834 A [0002]