



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 072 699 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.01.2001 Bulletin 2001/05

(51) Int. Cl.⁷: **D01H 1/06**, D01H 13/16,
D01H 13/10

(21) Application number: **00113714.0**

(22) Date of filing: **28.06.2000**

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

(30) Priority: **28.07.1999 JP 21376599**

(71) Applicant:
MURATA KIKAI KABUSHIKI KAISHA
Kisshoin, Minami-ku Kyoto-shi 601 (JP)

(72) Inventor: **Shiota, Takeshi**
Fushimi-ku, Kyoto-shi, Kyoto (JP)

(74) Representative:
Liedl, Christine, Dipl.-Chem. et al
Albert-Rosshaupter-Strasse 65
81369 München (DE)

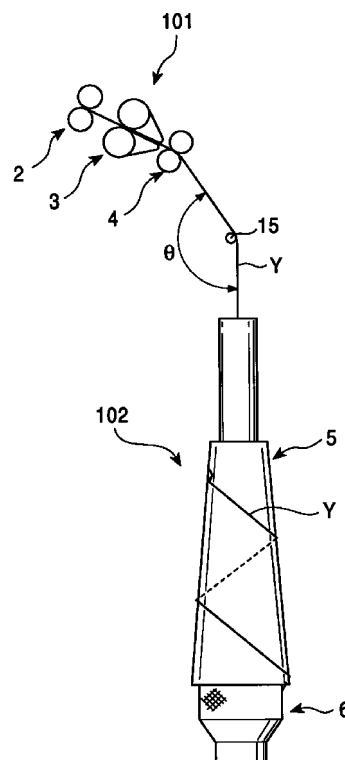
(54) **Spinning apparatus**

(57) Until now, ring spinning machines have produced the best yarn in terms of yarn strength and textural characteristics, but have been slower, less productive, and more costly than some of the newer high-speed spinning machines, such as open-end spinning and air-jet spinning.

Still, since these newer spinning machines have not been able to mimic the characteristics and benefits of ring-spun yarn, their application has been limited. One main problem has been the impossibility of measuring yarn tension during spinning.

The present invention solves the problem by providing a tension sensor 15 that detects the tension of the yarn Y between the drafting mechanism 101 and the bobbin 6. The tension sensor 15 contacts and receives pressure from the yarn Y, and a sensor main body 51 detects the yarn tension. Ideally, the angle of the bend in the yarn Y at the point where the yarn Y meets a head unit 52 is between 130 degrees and 170 degrees.

FIG. 3



EP 1 072 699 A1

Description

Field of the Invention

[0001] The present invention relates to a spinning machine that drafts a sliver, applies a twist to the drafted yarn, and winds the yarn into a rotary driven bobbin, and more particularly, to a spinning machine capable of measuring the tension of the yarn during spinning.

Background of the Invention

[0002] Currently, ring spinning machines are the most commonly employed type of spinning machine throughout the world, and can produce a yarn which has a true twist and is superior in quality to other types of yarn, both in terms of yarn strength and textural characteristics. Ring spinning machines spin yarn at maximum yarn speeds of 20 to 30 meters per minute.

[0003] Among the revolutionary advances in spinning technology over the years have been the advent of open end spinning machines and air jet spinners. These machines are typically capable of high speed yarn production rates of hundreds meters per minute (for example, 400 meters per minute). The yarn produced with these machines is generally a fasciated spun yarn that is weaker and has poorer textural characteristics than ring-spun yarn.

[0004] Thus, although ring-spun yarn affords the highest quality yarn in terms of strength and textural characteristics, it offers low yarn production rates compared to other yarn spinning methods.

[0005] Consequently, ring-spinning affords low productivity, and is more costly than the other spinning methods.

[0006] On the other hand, despite the higher yarn production rates of the new spinning machines, the yarns produced by these machines tend to have different strength and textural characteristics and so on than ring spun yarn, and the new yarn spinning technologies have been generally limited to a narrow range of applications.

[0007] One of the main obstacles of ring spinning machines is that it has been impossible to measure the tension of the yarn being produced during spinning.

[0008] It is thus an object of the present invention to provide a spinning machine that is capable of producing yarn having characteristics very similar to ring-spun yarn, but that spins yarn at a considerably higher speed than ring-spinning machines, and further, to provide a spinning machine that is capable of measuring yarn tension during spinning.

Summary of the Invention

[0009] In order to accomplish this object, the present invention is a spinning apparatus that forms a spun yarn by applying a twist to a fiber bundle that has

been drafted by a drafting mechanism, the twist applied through the rotation of a bobbin into which the spun yarn is wound, wherein the spinning apparatus is provided with a tension detection means for detecting the tension of the yarn between the drafting mechanism and the bobbin.

[0010] According to the another present invention, the spinning apparatus applies the twist to the yarn using a rotatable funnel that covers the bobbin, wherein the funnel is rotationally driven in synchronization with the bobbin.

[0011] According to the another present invention, the yarn tension detection means is comprised of a head unit that contacts and applies pressure against the yarn and a detector that determines the tension of the yarn.

[0012] According to the another present invention, the angle at which the yarn is bent at the head unit is between 130 degrees and 170 degrees.

Brief Description of the Accompanying Drawings

[0013]

Figure 1 is a side-view showing the spinning apparatus of the present invention.

Figure 2 is a side-view showing the bobbin and funnel of the spinning apparatus.

Figure 3 shows the bend of the yarn where it contacts the tension sensor.

Figure 4 is frontal view of the tension sensor.

Figure 5 is a side-view of the tension sensor.

Detailed Description of the Preferred Embodiments

[0014] The preferred embodiments of the present invention will now be explained in detail with reference to the accompanying drawings.

[0015] The spinning apparatus shown in Figures 1 and 2 processes a yarn Y by drafting a sliver S with a drafting mechanism 101, applying a twist to the drafted yarn Y with a twisting mechanism 102, and then winding the yarn Y into a bobbin 6.

[0016] The drafting mechanism 101 is comprised (in order relative to the direction in which the yarn progresses) of a pair of back rollers 2, a middle roller unit 3 including a pair of apron rollers 3a, and a pair of front rollers 4. As the sliver S passes through the various rollers 2, 3, 4, it is drafted to a predetermined thickness.

[0017] The twisting mechanism 102 includes a funnel 5 that opens out to the downstream side of the yarn path and covers the bobbin 6, and a funnel holding unit 21 that holds the funnel 5 so that the funnel 5 can rotate freely. The funnel 5 includes a funnel main body 5a. The funnel 5 is held by the bearings 22, 22 of a shaft unit 5b that extends upward, and is held so as to be freely rotatable. The funnel main body 5a is rotatable via

a funnel driving motor 23 that is arranged inside the funnel holding unit 21.

[0018] The funnel driving motor 23 is comprised of a rotary magnet 25 that is fixedly attached to shaft unit 5b, and a stator coil 24 that is arranged around the rotary magnet 25 and is fixedly attached to the casing 21a of the funnel holding unit 21.

[0019] The bobbin 6 is formed integrally with a spindle 7, and is rotatable. The spindle 7 is held by the bearings 9, 9 of a spindle holding unit 8, and is held so as to be fully rotatable.

[0020] The spindle 7 can be rotated by a spindle driving motor 10 arranged inside the spindle holding unit 8. The spindle driving motor 10 is comprised of a rotary magnet 12 fixedly attached to the spindle 7, and a stator coil 11 fixedly attached to the casing 8a of the spindle holding unit 8, the coil 11 arranged so as to face the rotary magnet 12.

[0021] The spindle 7 and the shaft 5b of the funnel 5 are arranged coaxially, and the spindle 7 and the funnel 5 are each axially rotated by their respective driving motors 10, 23.

[0022] A hole 5c is formed in the axial direction in the shaft 5b of the funnel 5. The hole 5c allows the upper circumferential surface of the shaft 5b to communicate with an opening 5d formed in the upper surface of the funnel main body 5a.

[0023] The yarn Y that has been processed by the draft mechanism 101 passes through the hole 5c at the top of the funnel 5, exits the funnel main body 5a at the opening 5d, is passed around the periphery of the funnel 5a, and is taken up into the bobbin 6.

[0024] A tension sensor 15, comprising the tension detection means, is arranged between the draft mechanism 101 and the twisting mechanism 102. The sensor 15 detects the tension of the yarn during spinning. The bobbin 6 is comprised such that it is vertically moveable relative to the funnel 5.

[0025] As bobbin 6, which rotates integrally with spindle 7 via spindle driving motor 10, is rotationally driven at the same time as the funnel 5 is driven via the funnel driving motor 23, a twist is applied to the yarn Y, and the yarn Y is taken up into the bobbin 6 as it is twisted. When the yarn Y is taken up into the bobbin 6, the bobbin 6 is moved up and down relative to the funnel 5, thus systematically winding the yarn around the bobbin 6.

[0026] The rotary speeds of the funnel driving motor 23 and the spindle driving motor 10 are individually controlled by a controller 14 that is connected to both the funnel driving motor 23 and spindle driving motor 10. The control 14 controls the rotary speeds of the funnel driving motor 23 and spindle driving motor 10 such that the rotation of the funnel 5 and bobbin 6 is synchronized.

[0027] The rotary speeds of the funnel 5 and the bobbin 6 are synchronized so that even if the rotary speed increases very quickly when rotary drive is initi-

ated, or if spinning is performed at high rotary speeds, the tension of the yarn Y between the bobbin 6 and the funnel 5 does not increase severely. This helps to prevent a yarn breakage, and allows a fine yarn to be spun at high speeds.

[0028] It should further be realized that since twists are imparted to the yarn Y by the twisting mechanism 102 that winds the yarn Y by wrapping it around the funnel 5 covering the bobbin 6, the yarn Y that is produced has the same strength and textural characteristics as a ring-spun yarn produced by the ring spinning machine.

[0029] The rotation of the bobbin 6 and the funnel 5 are driven independently by the spindle driving motor 10 and the funnel driving motor 23, respectively, thus allowing independent control of the rotary speed of the bobbin 6 and the funnel 5 during a normal operation. This allows the difference in the rotary speed between the bobbin 6 and the funnel 5 to be set arbitrarily. Consequently, this allows the type of twist imparted to the yarn Y and the textural characteristics of the yarn Y to be changed at will.

[0030] Next, the tension sensor 15 will be described in detail.

[0031] As shown in Figure 3, the tension sensor 15 is arranged between the front rollers 4 of the draft mechanism 101 and the funnel 5, which is arranged on the drafting mechanism 101 side of the bobbin 6. The tension sensor 15 contacts and receives pressure from the yarn Y, thus creating a bend in the yarn path having an angle θ .

[0032] Referring now to Figures 3 and 4, the tension sensor 15 is comprised of a head unit 52 contacting the yarn Y that is formed of a ceramic or the like, a sensor main body 51 that senses the tension of the yarn Y, and a connecting rod 53 that connects the sensor main body 51 with a head unit 52. A groove 52a is formed on a surface of the head unit 52, into which slideably fits the yarn Y.

[0033] The yarn Y contacts and applies pressure to the head unit 52, and applies force in the direction of contact (as indicated by the arrow in Figures 4 and 5), and this force is imparted through the connecting rod 53 to the sensor main body 51. A sensing instrument such as a strain gauge or the like arranged inside the sensor main body 51 then detects the force. Thus, the force applied against the head unit 52 by the contact pressure of the yarn Y is detected by the sensor main body 51, enabling the detection of the tension of the yarn Y.

[0034] The tension sensor 15 is comprised of the sensor main body 51 and the head unit 52, and by permitting the yarn Y to run freely along the head unit 52, the head unit 52 does not interfere with the transmission of the twist imparted to the yarn Y, thereby allowing accurate detection of the yarn tension.

[0035] If the angle θ at which the yarn Y bends around the tension sensor 15 is too large, the contact pressure of the yarn Y against the head unit 52 will be small and insufficient, preventing accurate detection of

the yarn tension. Alternatively, if the angle θ at which the yarn Y bends around the tension sensor 15 is too small, the contact pressure of the yarn Y against the head unit 52 will be too great, and the twist imparted to the yarn Y by the twisting mechanism 102 may not be transmitted past the head unit 52 to the drafting mechanism 101.

[0036] It is thus preferable for the tension sensor 15 to be arranged between the draft mechanism 101 and the funnel 5 such that the angle θ at which the yarn bends is between 130 degrees and 170 degrees, such that the twist imparted to the yarn Y extends to the drafting mechanism 101 side, thereby enabling the tension of the yarn Y to be accurately detected.

[0037] Thus, as explained above, the tension of the yarn Y during by spinning, in other words, the spinning tension can be detected during the high-speed spinning, thus enabling the relationship between the spinning tension and the physical characteristics of the yarn Y that is produced to be determined. Additionally, by using the tension sensor 15 to detect the tension of yarn Y at all times during spinning, and by detecting the rotary speed of the funnel 5 and the bobbin 6 (or alternatively, the spindle 7), the detected tension value can be used to perform feedback control on the rotary speeds of the funnel 5 and the bobbin 6 (or spindle 7) such that the rotary speeds are adjusted according to the tension of the yarn Y, thereby performing the equivalent of a quality control check, enabling the manufacture of yarn Y that is of uniform quality.

[0038] It should be appreciated that the tension sensor 15 in the spinning machine of the present invention need not necessarily be applied only in the funnel-type spinning apparatus disclosed in the embodiments described herein, but may also be applied in a ring spinning machine. In such case, the present invention would allow the yarn to be manufactured with less chance of yarn breakage, allow the twist to be reliably transmitted to the draft mechanism side of the yarn path, and allow the tension of the yarn Y to be accurately detected.

[0039] As per the structure disclosed above, the present invention offers the following benefits.

[0040] First, a spinning apparatus that applies a twist to a fiber bundle that has been drafted by a drafting mechanism and forms a spun yarn through the rotation of a take-up bobbin is provided with a tension detection means for detecting the tension of the yarn at a location between the drafting mechanism and the bobbin. The tension detection means does not interfere with the transmission of the twist imparted by the twisting mechanism, and thereby allows the tension of the yarn to be measured during spinning.

[0041] Consequently, this enables the relationship between the spinning tension and the physical characteristics of the spun yarn to be determined.

[0042] Additionally, by using the tension detection means to detect the tension of the yarn at all times during spinning, and by detecting the rotary speed of the funnel and the bobbin (or alternatively, the spindle), the

detected tension value can be used to perform feedback control on the rotary speeds of the funnel and the bobbin (or spindle) such that the rotary speeds are adjusted according to the tension of the yarn, thereby performing the equivalent of a quality control check, enabling the manufacture of yarn that is of uniform quality.

[0043] Furthermore, since the spinning apparatus applies a twist to the yarn using a freely rotatable funnel that covers the bobbin, and since the rotation of the funnel and the rotation of the bobbin are synchronized, the yarn can be spun at high speeds with less chance of breakage, and the spinning tension of the yarn Y can be measured without interfering with the transmission of the twist imparted to the yarn by the twisting mechanism.

[0044] Still further, the tension detection means is comprised of a head unit that contacts and receives pressure from the yarn, and a sensor main body that determines the tension of the yarn. This construction does not interfere with the transmission of twist imparted to the yarn, and allows the tension of the yarn to be detected accurately.

[0045] Further still, the angle of the yarn where it contacts the head unit is between 130 degrees and 170 degrees. This enables the twist imparted to the yarn by the twisting mechanism to reliably extend to the draft mechanism side of the detecting means, thereby enabling accurate detection of yarn tension.

Claims

1. A spinning apparatus that forms a spun yarn by applying a twist to a fiber bundle that has been drafted by a drafting mechanism, the twist applied using the rotation of a bobbin into which the yarn is wound, wherein a tension detection means for detecting the tension of the yarn between the drafting mechanism and the bobbin is provided.
2. The spinning apparatus as in claim 1 wherein the spinning apparatus applies the twist to the yarn using a freely rotatable funnel that covers the bobbin, wherein the rotary speed of the funnel and the rotary speed of the bobbin are synchronized.
3. The spinning apparatus as in claim 1 or claim 2 wherein the tension detection means is comprised of a head unit that contacts and receives pressure from the yarn, and a sensor main body that detects the tension of the yarn.
4. The spinning apparatus as in claim 3 wherein the angle at which the yarn is bent around the head unit that contacts it is between 130 degrees and 170 degrees.
5. The spinning apparatus as in claim 2 wherein the rotary drive of the bobbin and the funnel are each

controlled independently of the other.

6. The spinning apparatus as in claim 5 wherein the bobbin is vertically moveable in relation to the funnel.

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

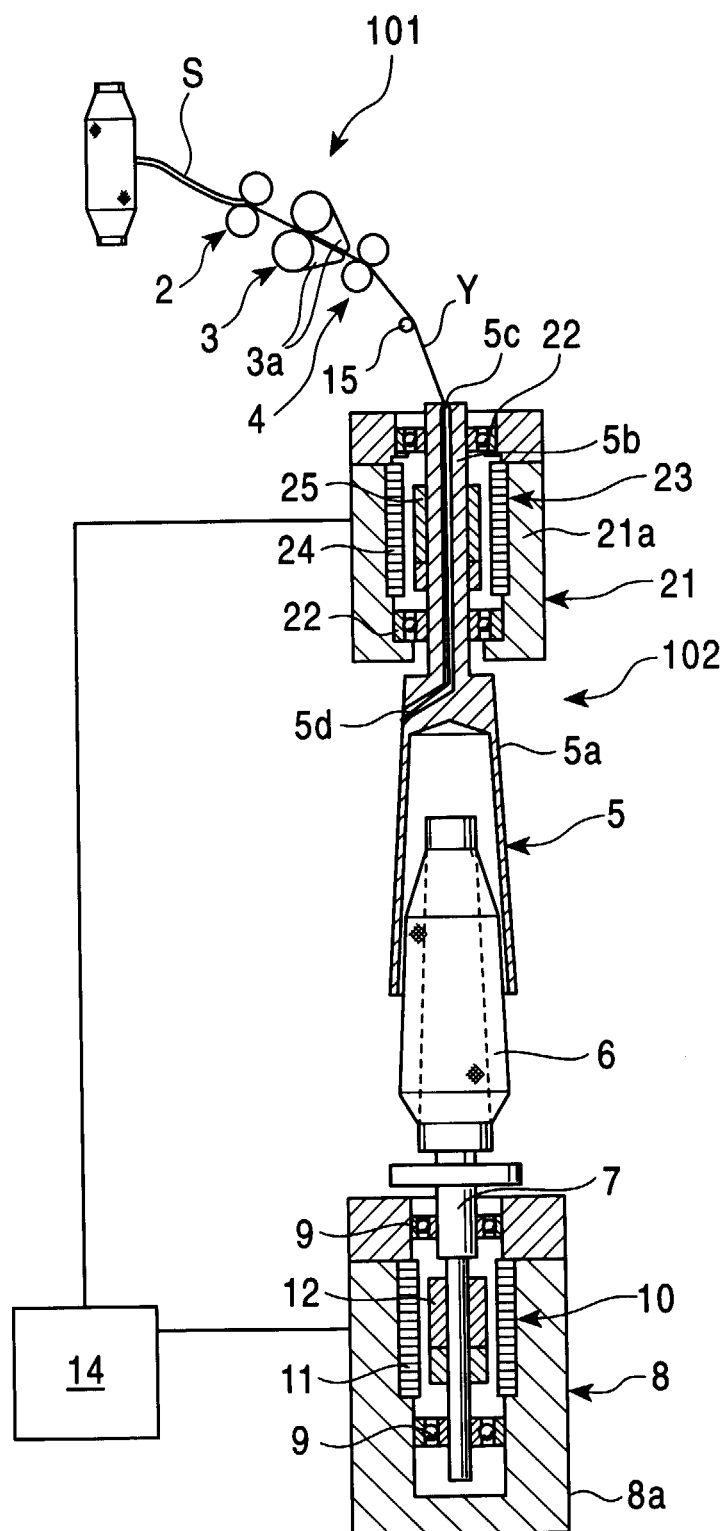


FIG. 2

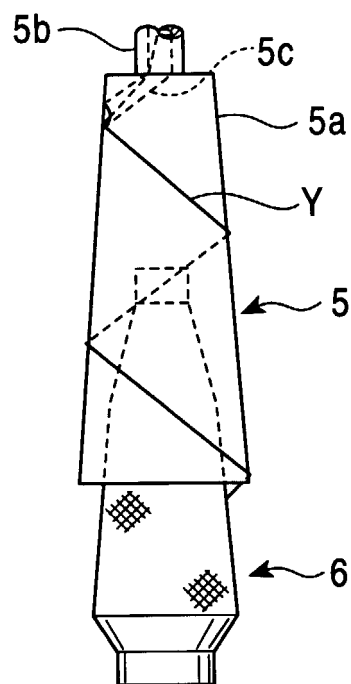


FIG. 3

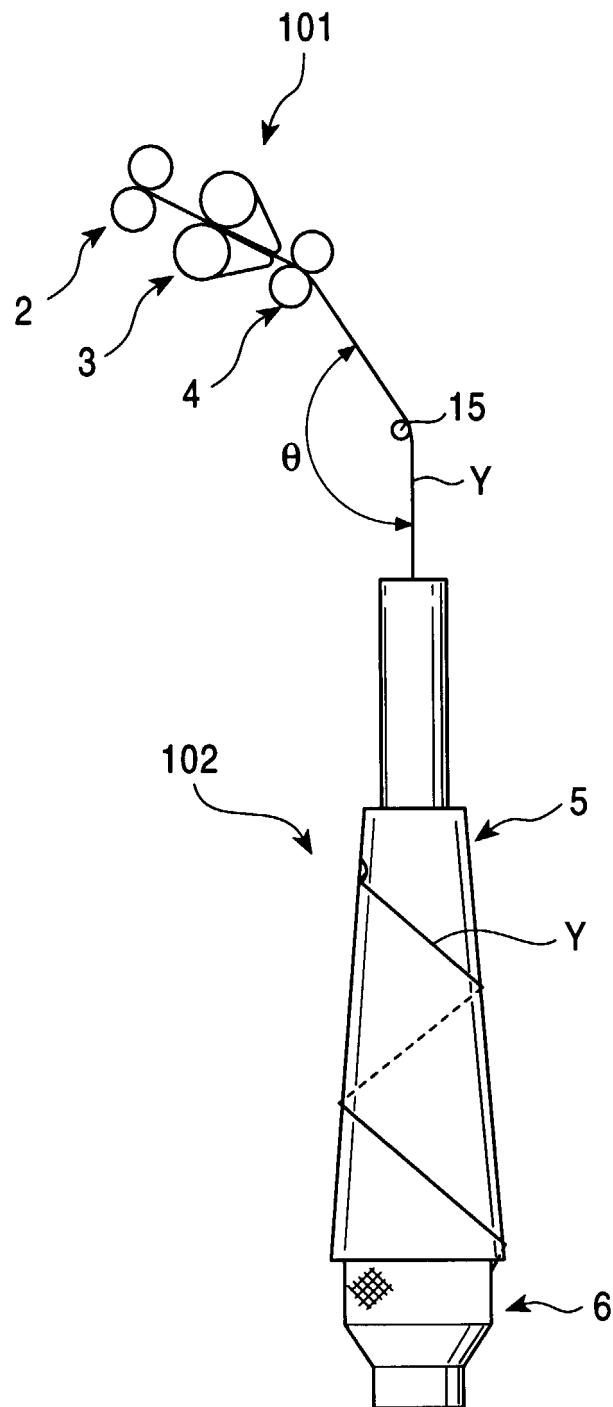


FIG. 4

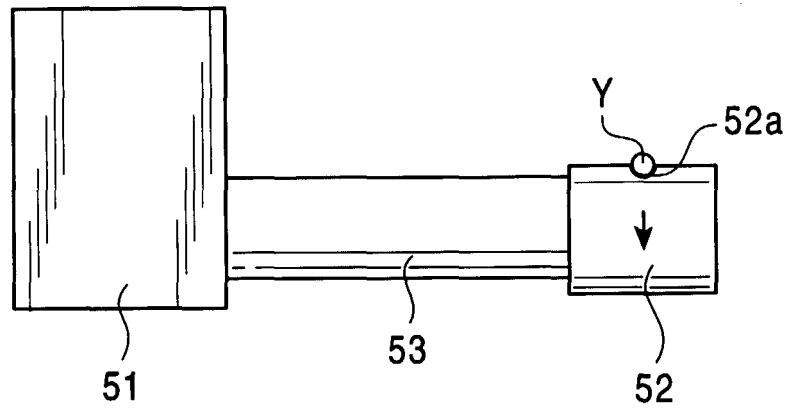
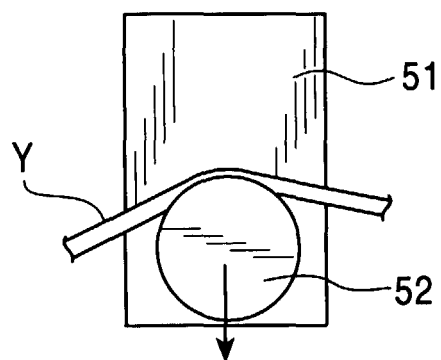


FIG. 5





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 11 3714

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 368 608 A (YAMAGUCHI HIROSHI ;KIMURA HIROSHI (JP); YAMAGUCHI MASASHI (JP)) 16 May 1990 (1990-05-16) * page 5, column 7, line 2 - line 58; figure 2 *	1	D01H1/06 D01H13/16 D01H13/10
Y	----- EP 0 319 783 A (ZINSER TEXTILMASCHINEN GMBH) 14 June 1989 (1989-06-14) * page 3, column 3, line 13 - page 4, column 5, line 34; figures 1-4 *	2-6	
Y	----- US 4 295 360 A (FOUNTAIN FRANK S) 20 October 1981 (1981-10-20) * the whole document *	2-6	
A	----- -----	1,4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			D01H G01H G01N
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 30 November 2000	Examiner Henningsen, O
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 11 3714

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-11-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0368608 A	16-05-1990	KR 9202505 B	27-03-1992
		KR 9202506 B	27-03-1992
		US 5009063 A	23-04-1991
		JP 1986116 C	08-11-1995
		JP 2229227 A	12-09-1990
		JP 6089490 B	09-11-1994
EP 0319783 A	14-06-1989	DE 3741430 A	22-06-1989
		DE 3868249 A	12-03-1992
		EP 0443632 A	28-08-1991
		JP 1192835 A	02-08-1989
		US 4918911 A	24-04-1990
US 4295360 A	20-10-1981	NONE	