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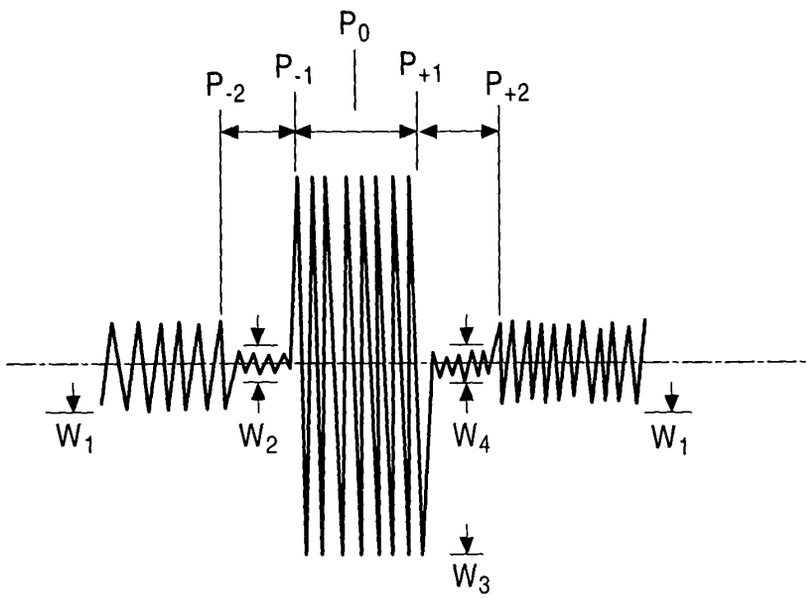
(54) Ribbon winding preventing method and apparatus

(57) The preset invention provides a ribbon winding preventing method and device which method and device more perfectly prevents ribbon winding. The method comprises a first step (P_{-2} to P_{-1}) of winding a yarn under a small disturb control based on an increase or decrease rate W2 lower than a predetermined increase or decrease rate W1 before a winding diameter is reached at which large ribbons are expected to be formed, a second step (P_{-1} to P_{+1}) of subsequently winding the yarn under a large disturb control based on an increase or decrease rate W3 higher than the predetermined increase or decrease rate W1 from immediately before the winding diameter is reached at which large ribbons are expected to be formed until immediately after the winding diameter has been passed, and a third step (P_{+1} to P_{+2}) of subsequently continuously winding the yarn with a small disturb based on an increase or decrease rate W4 lower than the predetermined increase or decrease rate W1 from immediately after the winding diameter has been passed at which large ribbons are expected to be formed.

FIG. 3



EP 1 506 933 A1

Description

Field of the Invention

[0001] The present invention relates to a ribbon winding preventing method and apparatus in an automatic winder or the like.

Background of the Invention

[0002] An automatic winder winds a yarn from a bobbin produced by a spinning machine, into a package rotated on a traverse drum. The automatic winder thus obtains a package of a predetermined yarn amount and a predetermined shape.

[0003] While the yarn is being wound into the package, the rotation speed of the traverse drum may become an integral multiple of the rotation speed of the package or the rotation speed of the package may become an integral multiple of the rotation speed of traverse drum. Then, a traverse period and a winding period for the package may synchronize with each other. Consequently, parts of the wound yarn may concentrate in the same area and overlap one another, resulting in so-called ribbon winding.

[0004] In the package in which ribbon winding has occurred, the yarns in a ribbon of layered yarn are entangled with one another. Thus, during a subsequent process when the yarn is unwound from the package, the ribbon may be unwound from the package at a time, resulting in sluffing.

[0005] A conventional ribbon winding preventing method and apparatus comprises performing a disturb control, that is, increasing or decreasing the rotation speed of the traverse drum when the diameter of the package is close to a value at which the ribbon winding is expected to occur, to cause a slip between the package and the drum to vary a yarn path of the traversed yarn, as proposed by the inventor in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-40577. This method and apparatus thus enables the ribbons in the yarn to be broken.

[0006] Specifically, even if the rotation speed of traverse drum with a wind number (Dw) is increased or decreased to a drum rotation speed (Nd), the package rotates at a substantially fixed rotation speed (Np) owing to its inertia force.

Accordingly, the ribbon can be broken by varying a package wind number (Pw) expressed as Pw = Dw x Np / Nd.

[0007] However, when the disturb control is performed by increasing or decreasing the drum rotation speed when the diameter of the package is close to the value at which the ribbon winding is expected to occur, as described above, the wind number of the yarn wound into the package may vary frequently and slightly. The variation in wind number may bring the diameter of the package into a ribbon winding area. Thus, in reality, many and small ribbons may be formed at the ribbon winding diameter. Consequently, when the yarn is unwound from the package, the yarns in the ribbon may be entangled with one another. This may result in latching and thus yarn breakage.

[0008] Thus, the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 2000-247544, proposes a method of winding the yarn under a disturb control using a reduced speed increase or decrease rate for the traverse drum after the start of winding into the package and before a winding diameter is reached at which large ribbons are expected to be formed. The method then winds the yarn without performing the disturb control from a certain time before the winding diameter is reached at which large ribbons are expected to be formed until immediately before this winding diameter is reached. The method subsequently winds the yarn under a disturb control using an increased speed increase or decrease rate for the traverse drum from immediately before the winding diameter is reached at which large ribbons are expected to be formed until this winding diameter has been passed.

[0009] Thus, the traverse drum is continuously rotated at a fixed speed without performing the disturb control from the certain time before the winding diameter at which large ribbons are expected to be formed. Then, the ribbon winding diameter can be accurately reached. Accordingly, by performing the large disturb control immediately before the ribbon winding diameter is reached, it is possible to effectively and reliably break the ribbons.

[0010] However, it has been found out that even if the disturb control is performed by changing the speed increase or decrease rate of the drum rotation speed before the ribbon winding diameter is reached, the latching, which may occur as follows, cannot be prevented: when the diameter of the package is brought into a ribbon winding area, many and small ribbons may be formed, so that when the yarn is unwound from the package, the ribbons may be entangled with one another, resulting in latching.

[0011] An unwinding operation was performed on a large number of packages to check them for latching. It has thus been found out that the latching is significant at a package wind number of about 1. 5 W at which large ribbons are expected to be formed and that latching also occurs with fine count yarn.

[0012] It is thus an object of the present invention to provide a method and apparatus for preventing ribbon winding which method and apparatus can solve the above problems to more perfectly prevent ribbon winding.

Summary of the Invention

[0013] To accomplish this object, Claim 1 of the present invention provides a ribbon winding preventing method in which when a yarn is wound while rotating a package on a traverse drum, disturb control is per-

formed to increase and decrease the speed of the traverse drum using a predetermined increase or decrease rate, characterized by comprising:

a first step of winding the yarn under a small disturb control based on an increase or decrease rate lower than the predetermined increase or decrease rate before a winding diameter is reached at which large ribbons are expected to be formed;
a second step of subsequently winding the yarn under a large disturb control based on an increase or decrease rate higher than the predetermined increase or decrease rate from immediately before the winding diameter is reached at which large ribbons are expected to be formed until immediately after the winding diameter has been passed; and
a third step of subsequently continuously winding the yarn with a small disturb based on an increase or decrease rate lower than the predetermined increase or decrease rate from immediately after the winding diameter has been passed at which large ribbons are expected to be formed.

[0014] A ribbon winding preventing method of Claim 2 according to Claim 1 of the present invention is the aspect 1 of the present invention, wherein the winding diameter is calculated by detecting a rotation speed of the traverse drum and a rotation speed of the package and calculating based on the diameter of the traverse drum and a ratio of the rotation speed of the traverse drum and the package.

[0015] A ribbon winding preventing method of Claim 3 according to Claim 1 or Claim 2 of the present invention, wherein a traverse groove formed in the traverse drum has a plurality of traverse grooves with different numbers of winds, and in the second step, the wind number of the traverse drum is changed, and in the third step, the wind number of the traverse drum is returned to the initial value.

[0016] Claim 4 of the present invention provides a ribbon winding preventing apparatus used when a yarn is wound while rotating a package on a traverse drum, characterized by comprising:

an inverter device that executes a disturb control to increase or decrease the speed of the traverse drum at a predetermined increase or decrease rate;
package diameter detecting means for continuously detecting the diameter of the package from a certain time before a winding diameter is reached at which large ribbons are expected to be formed;
first control means to which a detected value from the package diameter detecting means is inputted and which outputs, to the inverter device, a first disturb instruction signal that instructs on winding of the yarn under a small disturb control based on an increase or decrease rate lower than the predetermined increase or decrease rate before a winding diameter is reached at which large ribbons are expected to be formed;
second control means to which a detected value from the package diameter detecting means is inputted and which outputs, to the inverter device, a second disturb instruction signal that instructs on subsequent winding of the yarn under a large disturb control based on an increase or decrease rate higher than the predetermined increase or decrease rate from immediately before the winding diameter is reached at which large ribbons are expected to be formed until immediately after the winding diameter has been passed; and
third control means to which a detected value from the package diameter detecting means is inputted and which outputs, to the inverter device, a third disturb instruction signal that instructs on subsequent continuous winding of the yarn with a small disturb based on an increase or decrease rate lower than the predetermined increase or decrease rate from immediately after the winding diameter resulting the large diameter has been passed.

[0017] A ribbon winding preventing apparatus of Claim 5 according to Claim 4 of the present invention, wherein the package diameter detecting means comprises detecting means for detecting the rotation speed of the traverse drum, detecting means for detecting the rotation speed of the package, and calculating means for calculating a winding diameter on the basis of the diameter of the traverse drum and of the ratio of the rotation speed of the traverse drum to the rotation speed of the package.

[0018] Claim 6 of the present invention provides the ribbon winding preventing apparatus used when a yarn is wound while rotating a package on a traverse drum, according to Claim 4 or Claim 5, wherein the apparatus comprises an inverter device that controls rotation of the traverse drum, package diameter detecting means for continuously detecting the diameter of the package from a certain time before a winding diameter is reached at which large ribbons are expected to be formed, and a logic circuit to which a detected value from the package diameter detecting means is inputted and which outputs a disturb instruction signal to the inverter device so to perform a disturb control using a reduced speed increase or decrease rate for the traverse drum after the start of winding into the package and before a winding diameter is reached at which large ribbons are expected to be formed, not to perform the disturb control from a certain time before the winding diameter is reached at which large ribbons are expected to be formed until immediately before this winding diameter is reached, and to perform a disturb control using an increased speed increase or decrease rate for the traverse drum from immediately before the winding diameter is reached at which large ribbons are expected to be formed until this winding diameter has been passed.

[0019] According to Claim 1 or Claim 3 of the present invention, the increase or decrease rate for the disturb is changed from a small value through a large value to a small value before and after the winding diameter is reached at which large ribbons are expected to be formed. Consequently, although the disturb is executed, it is possible to minimize the number of traverses overlapping one another at a traverse position where large ribbons are expected to be formed.

[0020] According to the Claim 2 or Claim 4 of the present invention, the winding diameter of the package can be accurately detected. Accordingly, the control can be switched at accurate points in time before and after the winding diameter is reached at which large ribbons are expected to be formed.

[0021] According to Claim 3 or Claim 5 of the present invention, by changing the wind number of the traverse drum, it is possible to pass the position where large ribbons are expected to occur so as to prevent the formation of such large ribbons.

Brief Description of the Drawings

[0022]

Figure 1 is a diagram schematically showing a ribbon winding preventing apparatus according to a first embodiment of the present invention.

Figure 2 is a graph showing disturb control performed to prevent ribbon winding on the basis of a package diameter and a package wind number.

Figure 3 is a graph showing the disturb control in detail.

Figure 4 is a diagram showing a yarn path wound into a package.

Figure 5 is a diagram schematically showing a ribbon winding preventing apparatus according to a second embodiment of the present invention.

Figure 6 is a diagram schematically showing the ribbon winding preventing apparatus according to the second embodiment of the present invention.

Detailed Description of the Preferred Embodiments

[0023] A preferred embodiment of the present invention will be described below in detail with reference to the attached drawings.

[0024] First, a description will be given of the basic configuration of an automatic winder to which a method and apparatus for preventing ribbon winding according to a first embodiment of the present invention is applied.

[0025] A winding unit main body 10 is provided with a traverse drum 11. A cradle 13 is provided behind the winding unit main body 10 so as to be rotatively movable around a shaft 12. A package P is rotatably held by the cradle 13 and is guided by the traverse drum 11 in contact with it. A yarn Y from a spinning bobbin 2 (see Figure 6) is guided and traversed through a traverse groove 14 in the traverse drum 11. The yarn Y is thus wound into the package P. As shown in Figure 6, the package P is formed like a cone.

[0026] The traverse drum 11 is connected to a drive motor 16 via a transmission device 15. The drive motor 16 can be driven by an inverter device 18 so as to vary the rotation speed of the motor 16.

[0027] A bobbin holder shaft 19 of the cradle 13 is provided with a tachometer (rotation speed detecting means) 36 that detects the rotation speed of the package 19. A drive shaft 20 of the traverse drum 11 is provided with a tachometer (rotation speed detecting means) 37 to detect the rotation speed of the traverse drum 11. Each of the rotation meters 36, 37 comprises, for example, a combination of a gear provided in a rotator and a magnetic sensor. Outputs from the tachometers 36, 37 are inputted to a programmable logic circuit 21. A winding diameter calculating means (package diameter detecting means) of the logic circuit 21 calculates the winding diameter at a point in time during winding.

[0028] The inverter device 18 converts an alternating current from a commercial power source 22 into a direct current. On the basis of on/off control by a transistor, the inverter device 18 converts the direct current into an alternating current with a variable frequency.

[0029] From the beginning to end of winding into the package P, the logic circuit 21 outputs a frequency instruction signal 23 to the inverter device 18 on the basis of a control program for the rotation speed of the traverse drum 11.

[0030] The control program for the logic circuit 21 comprises first control means 32 first control means to which a detected value from the package diameter detecting means 31 is inputted and which outputs, to said inverter device, a first disturb instruction signal that instructs on winding of the yarn under a small disturb control based on an increase or decrease rate lower than the predetermined increase or decrease rate before a winding diameter is reached at which large ribbons are expected to be formed;

second control means 33 to which a detected value from the package diameter detecting means 31 is inputted and which outputs, to the inverter device, a second disturb instruction signal that instructs on subsequent winding of the yarn under a large disturb control based on an increase or decrease rate higher than the predetermined increase or decrease rate from immediately before the winding diameter is reached at which large ribbons are expected to be formed until immediately after the winding diameter has been passed; and

third control means 34 to which a detected value from the package diameter detecting means 31 is inputted and which outputs, to said inverter device, a third disturb instruction signal that instructs on subsequent continuous winding of the yarn with a small disturb based on an increase or decrease rate lower than the predetermined increase or decrease rate from immedi-

ately after the winding diameter resulting the large diameter has been passed.

[0031] Figures 2 and 3 show an example of control in which the logic circuit 21 increases or decreases the rotation speed of the traverse drum 11 in accordance with a variation in wind number with respect to the package diameter.

[0032] For the ribbon winding of the package P, the wind number of the traverse drum 11 is defined as Dw, the diameter of the traverse drum 11 is defined as Dd, the wind number of the package P is defined as Pw, and the diameter of the package P (winding diameter) is defined as Pd. Then, the relationship shown in Equation (1) is established.

$$Pw = Dw \times Dd/Pd \quad (1)$$

[0033] Further, the rotation speed of the traverse drum 11 (drum rotation speed) is defined as Nd, the rotation speed of the package P is defined as Np, and the wind number of the package P is defined as Pw. Then, the relationship shown in Equation (2) is established.

$$Pw = Dw \times Np/Nd \quad (2)$$

[0034] As shown in Figure 2, the wind number Pw of the package P decreases with increasing package diameter (Pd). As the drum rotation speed (Nd) increases or decreases, the package P rotates at a substantially fixed rotation speed (Np) owing to its inertia force. Accordingly, the package wind number (Pw), shown in Equation (2), varies to break ribbons in a zigzag manner.

[0035] With reference to Figure 4, a description will be given of how to break ribbons in a zigzag manner. Figure shows a yarn path on a larger diameter side which is wound into the package P of a certain diameter. Provided that a yarn path 27 wound during the next traverse with respect to a yarn path 26 shown by a dotted line is wound as shown by a solid line, on the larger diameter side, the yarn paths 27 are turned around to form traverse ends 26a, 27a and the circumferential positions of the traverse ends 26a, 27a "shift" from the preceding ones. In this case, the shift in each traverse can be analyzed as described below. If the traverse end 27a formed during the next traverse shifts from the traverse end 26a in the rotating direction, this shift is defined to be positive. If the traverse end 27a shifts in the opposite direction, the shift is defined to be negative.

[0036] With disturb control, traverse positions at which large ribbons are expected to be formed are passed by repeatedly varying the traverse position so that the traverse end alternates a shift in the positive direction and a shift in the negative direction.

[0037] In this case, for example, given the drum wind number Dw is 2.5 W of the traverse drum 11 and the drum diameter Dd is 105 mm, the package diameter Pd is 175 mm when the package wind number is 1.5 W at which large ribbons are expected to be formed from the above-mentioned Equation (1).

[0038] In the present invention, as shown in Figure 3, a disturb control at a standard predetermined speed increase or decrease rate, for example, at a speed increase or decrease rate of ±1.2% and a period of 0.8/0.8 sec, is performed until the package diameter reaches 169 mm (P_{-2}). In this state, with the disturb control, even with a variation in traverse position, the traverse position varies with a margin on the negative side with respect to the traverse position at which large ribbons are expected to be formed.

[0039] At a package diameter of 169 mm (P_{-2}) before a winding diameter (P_0) is reached at which large ribbons are expected to be formed, the first control means 32 performs a first disturb control with an increase or decrease rate lower than the predetermined one, for example, with an increase or decrease rate of ±0.8% and a period of 0.8/0.8 sec. This small first disturb control continues until a package diameter of 171 mm (P_{-1}) immediately before the package diameter (P_0) is reached at which large ribbons are expected to be formed.

[0040] The small first disturb, carried out by the first control means 32, reduces a positive or negative variation in traverse position. This enables the traverse position to be varied with a margin on the negative side with respect to the traverse position at which large ribbons are expected to be formed.

[0041] Thus, the increase or decrease rate (W2) and section (P_{-2} to P_{-1}) of the small first disturb, carried out by the first control means 32, are selected so that the traverse position varied by the disturb in the positive or negative direction does not align with (does not overlap) the one at which large ribbons are expected to be formed.

[0042] Then, from a package diameter of **171** mm (P_{-1}) immediately before the package diameter (P_0) is reached at which large ribbons are expected to be formed until a package diameter of **177** mm (P_{+1}) immediately after the package diameter (P_0) has been passed, the second control means 33 performs a second disturb control with an increase or decrease rate higher than the predetermined one, for example, with an increase or decrease rate of ±6% and a period of 1/1 sec.

[0043] The second disturb has a high increase or decrease rate and thus results in a larger variation in the positive or negative direction. Accordingly, the traverse position is significantly varied, while avoiding the traverse position at which large ribbons are expected to be formed. Thus, a smaller number of traverses concentrate (overlap one another) at the traverse position at which large ribbons are expected to be formed.

[0044] Thus, the section (P_{-1} to P_{+1}) of the large second disturb, carried out by the second control means 33, is selected so that even when the variation in the positive or negative direction caused by the disturb decreases,

the traverse position does not align with the one at which large ribbons are expected to be formed.

[0045] Then, from a package diameter of **177** mm (P_{+1})immediately after the package diameter (P_0) has been passed at which large ribbons are expected to be formed until a package diameter of 184 mm (P_{+2}) a certain time after the package diameter (P_0) has been passed, the second control means 33 performs a third disturb control with an increase or decrease rate higher than the predetermined one, for example, with an increase or decrease rate of ±0.8% and a period of 0.8/0.8 sec. The increase or decrease rate of the third disturb control is almost equal to that of the first disturb control.

[0046] The third disturb has a low increase or decrease rate and thus results in a smaller variation in the positive or negative direction. This enables the traverse position to be varied with a margin on the positive side with respect to the traverse position at which large ribbons are expected to be formed.

[0047] Thus, the increase or decrease rate (W4) and section (P_{+2} to P_{+1}) of the small third disturb, carried out by the third control means 34, are selected so that the traverse position varied by the disturb in the positive or negative direction does not align with (does not overlap) the one at which large ribbons are expected to be formed.

[0048] Then, after a package diameter of 184 mm (P_{+2}) after the package diameter (P_0) has been passed at which large ribbons are expected to be formed, the winding is carried out using a disturb control at the standard predetermined speed increase and decrease rate, for example, at a speed increase or decrease rate of ±1.2% and a period of 0.8/0.8 sec.

[0049] In this state, with the disturb control, even with a variation in traverse position, the traverse position varies with a margin on the positive side with respect to the traverse position at which large ribbons are expected to be formed.

[0050] The control for preventing the ribbon winding as shown in Figure 3 is performed by programming, in the logic circuit 21 in Figure 1, a pattern in which a disturb instruction signal is composed of a variation in the instruction frequency of a frequency instruction signal 24 to the inverter device 18 based on the disturb control and determining control timings on the basis of the diameter of the package P detected by the package diameter calculating means 31.

[0051] The above described control means 32 to 34 sequentially execute a first step of winding the yarn under a small disturb control based on an increase or decrease rate lower than the predetermined increase or decrease rate before the winding diameter is reached at which large ribbons are expected to be formed, a second step of subsequently winding the yarn under a large disturb control based on an increase or decrease rate higher than said predetermined increase or decrease rate from immediately before the winding diameter is reached at which large ribbons are expected to be formed until immediately after the winding diameter has been passed, and a third step of subsequently continuously winding the yarn with a small disturb based on an increase or decrease rate lower than the predetermined increase or decrease rate from immediately after the winding diameter has been passed at which large ribbons are expected to be formed.

[0052] Thus, by changing the magnitude of the disturb from a small value through a large value to a small value, it is possible to minimize the number of traverses overlapping the traverse position at which large ribbons are expected to be formed. Consequently, large ribbons can be effectively and reliably broken to enable winding into a more perfect package free from ribbons and which is unlikely to be sluffed during unwinding.

[0053] Further, the winding diameter detecting means for the package P is composed of a tachometer (rotation speed detecting means) 36 for the traverse drum 11, a tachometer (rotation speed detecting means) 37 for the package, and calculating means (winding diameter calculating means) 21 for calculating the winding diameter on the basis of the diameter of the traverse drum 11 and of the ratio of the rotation speed of the package P and the rotation speed of the traverse drum 11. Thus, the disturb can be precisely changed before and after the winding diameter is reached at which large ribbons are expected to be formed.

[0054] In the above embodiment, the first and third disturbs use the value of 0.8%, while the second disturb uses the value of 6%. However, the present invention is not limited to these values provided that the control enables ribbons to be broken. Alternatively, the disturb control may be performed by properly varying the increase or decrease rate within several percents.

[0055] The above embodiment has been mainly described in conjunction with the traverse drum 11 with a wind number of 2.5 W. However, the embodiment is of course applicable to a traverse drum with a wind number of 3, 2, or 1.5 W.

[0056] Alternatively, the winding diameter detecting means for the package P may be a package diameter transmitting means provided on the shaft 12 of the cradle so as to rotatively move with the cradle 13. Furthermore, the winding unit main body 10 may be provided with a package diameter sensor that detects the diameter of the package P on the basis of the rotatively moved position of the package diameter transmitting member, specifically, continuously detects the diameter of the package P from a certain time before the wind number reaches 1.5 W (1 W).

[0057] Now, a description will be given of the basic configuration of an automatic winder to which a method and apparatus for preventing ribbon winding according to a second embodiment of the present invention is applied.

[0058] Figure 5 differs from Figure 1 in that a plurality of traverse grooves with different wind numbers are formed in the traverse drum 110 and in that a switching

device (changing means) 111 is provided to change the traverse groove and is operated by the second control means 33. The other points are similar to those in Figure 1. Accordingly, they are denoted by the same reference numerals and their description is omitted.

[0059] In Figure 6, the winding unit main body 10 of the automatic winder winds the yarn Y from the spinning bobbin 2 into the package P. The spinning bobbin 2 is conveyed on a frame (not shown in the drawings) and placed at a predetermined position on the winding unit main body 10. The end of the yarn Y from the bobbin 2 is caught and the yarn Y is then fed upward. Then, the yarn Y is tensioned by a tension device 4 and then passes through a yarn defect detecting head 5. Then, the yarn Y is traversed by the traverse drum 110 and then fed to the package P. This configuration also applies to Figure 1.

[0060] A continuous traverse groove 140 is formed in the surface of the traverse drum 110. The traverse groove 140 is composed of a traverse forward path 141 through which the yarn is conveyed leftward in Figure 6 and a traverse backward path 142 through which the yarn is conveyed rightward in Figure 6. The yarn Y is traversed leftward through the traverse forward path 141 and subsequently rightward through the traverse backward path 142. The yarn Y then returns to the initial position. Then, the yarn Y thus sequentially traversed through the traverse groove 140 is wound into a package 3 driven by the traverse drum 110 in contact with it.

[0061] To further prevent ribbon winding, the traverse drum 110 forms two types of continuous traverse grooves 140 with different wind numbers (hereinafter denoted by W as required). One of the traverse groove 140 is used for normal operations. In this traverse groove 140, both traverse forward path 141 and traverse backward path 142 have a wind number of 2.5 W. The other traverse groove 140 is used for ribbon winding diameter operations. In this traverse groove 140, both traverse forward path 141 and traverse backward path 142 have a wind number of 2 W.

[0062] In the normal operation and ribbon winding operation, the traverse groove 140 is branched at a branching portion (not shown in the drawings). A pin cylinder **111**, yarn path changing means, switches the traverse groove **140** at the branching portion. The pin cylinder **111** is configured to be turned on and off. When turned on, the pin cylinder **111** projects to a position A in Figure 6 to bend the yarn Y. Thus, the yarn Y undergoes a normal operation at 2.5 W through both forward and backward paths. On the other hand, when turned off, the pin cylinder **111** is withdrawn to relax the tension of the yarn Y (the corresponding yarn path is shown as Y2 in Figure 6). The yarn Y then undergoes a ribbon winding operation at 2 W.

[0063] A description will be given of the ribbon winding preventing apparatus according to the present invention as well as a method of controlling the ribbon winding preventing apparatus.

[0064] From immediately before the winding diameter (P_0) is reached at which large ribbons are expected to be formed, that is, from a package diameter of **171** mm (P_{-1}), until immediately after the package diameter (P_0) has been passed, that is until a package diameter of **177** mm (P_{+1}), the second control means 33 performs a second disturb control with an increase or decrease rate higher than the predetermined one, for example, with an increase or decrease rate of ±6% and a period of 1/1 sec.

[0065] In this case, at the package diameter of **171** mm (P_{-1}) immediately before the winding diameter (P_0) is reached at which large ribbons are expected to be formed, that is, at the same time when the second control means outputs a second disturb signal, the pin cylinder (changing means) **111** is turned off (in this state, the pin cylinder outputs a change instruction signal) to switch the wind number from 2.5 W to 2 W. That is, the wind number of 1.5 W at which large ribbons are expected to be formed changes to the wind number of 1.20 W. This reduces the degree of ribbon winding when a large ribbon is passed.

[0066] At the package diameter of 177 mm (P_{+1}) immediately after the package diameter (P_0) has been passed, that is, at the same time when the third control means outputs a third disturb signal, the pin cylinder (changing means) **111** is turned on (in this state, the pin cylinder outputs a return instruction signal) to switch the wind number from 2 W to 2.5 W.

[0067] As described above, by changing the wind number of the traverse drum at the wind number at which large ribbons are expected to be formed, it is possible to prevent the formation of a large ribbon.

Claims

1. A ribbon winding preventing method in which when a yarn is wound while rotating a package on a traverse drum, disturb control is performed to increase and decrease the speed of said traverse drum using a predetermined increase or decrease rate, **characterized by** comprising:

   a first step of winding the yarn under a small disturb control based on an increase or decrease rate lower than said predetermined increase or decrease rate before a winding diameter is reached at which large ribbons are expected to be formed;
   a second step of subsequently winding the yarn under a large disturb control based on an increase or decrease rate higher than said predetermined increase or decrease rate from immediately before the winding diameter is reached at which large ribbons are expected to be formed until immediately after the winding diameter has been passed; and

a third step of subsequently continuously winding the yarn with a small disturb based on an increase or decrease rate lower than said predetermined increase or decrease rate from immediately after the winding diameter has been passed at which large ribbons are expected to be formed.

2. A ribbon winding preventing method according to Claim 1, **characterized in that** said winding diameter is calculated by detecting a rotation speed of said traverse drum and a rotation speed of said package and calculating based on the diameter of said traverse drum and a ratio of said rotation speed of said traverse drum and said package.

3. A ribbon winding preventing method according to Claim 1 or Claim 2, **characterized in that** a traverse groove formed in said traverse drum has a plurality of traverse grooves with different numbers of winds, and in said second step, the wind number of said traverse drum is changed, and in said third step, the wind number of said traverse drum is returned to the initial value.

4. A ribbon winding preventing apparatus used when a yarn is wound while rotating a package on a traverse drum, **characterized by** comprising:

an inverter device that executes a disturb control to increase or decrease the speed of the traverse drum at a predetermined increase or decrease rate;

package diameter detecting means for continuously detecting the diameter of the package from a certain time before a winding diameter is reached at which large ribbons are expected to be formed;

first control means to which a detected value from the package diameter detecting means is inputted and which outputs, to said inverter device, a first disturb instruction signal that instructs on winding of the yarn under a small disturb control based on an increase or decrease rate lower than said predetermined increase or decrease rate before a winding diameter is reached at which large ribbons are expected to be formed;

second control means to which a detected value from the package diameter detecting means is inputted and which outputs, to said inverter device, a second disturb instruction signal that instructs on subsequent winding of the yarn under a large disturb control based on an increase or decrease rate higher than said predetermined increase or decrease rate from immediately before the winding diameter is reached at which large ribbons are expected to be formed until immediately after the winding diameter has been passed; and

third control means to which a detected value from the package diameter detecting means is inputted and which outputs, to said inverter device, a third disturb instruction signal that instructs on subsequent continuous winding of the yarn with a small disturb based on an increase or decrease rate lower than said predetermined increase or decrease rate from immediately after the winding diameter resulting the large diameter has been passed.

5. A ribbon winding preventing apparatus according to Claim 4, **characterized in that** said package diameter detecting means comprises detecting means for detecting the rotation speed of said traverse drum, detecting means for detecting the rotation speed of said package, and calculating means for calculating a winding diameter on the basis of the ratio of the diameter of said traverse drum and of the ratio of said rotation speed of said traverse drum to said rotation speed of said package.

6. A ribbon winding preventing apparatus according to Claim 4 or Claim 5, **characterized in that** said traverse drum has a plurality of traverse grooves with different wind numbers and comprises changing means for changing said traverse groove,

said second control means outputs a change instruction signal to said changing means at the same time when the second disturb signal is outputted to said inverter device, and

said third control means outputs a recovery instruction signal that instructs said changing means to recover the initial traverse groove, at the same time when the third disturb signal is outputted to said inverter device.

FIG. 1

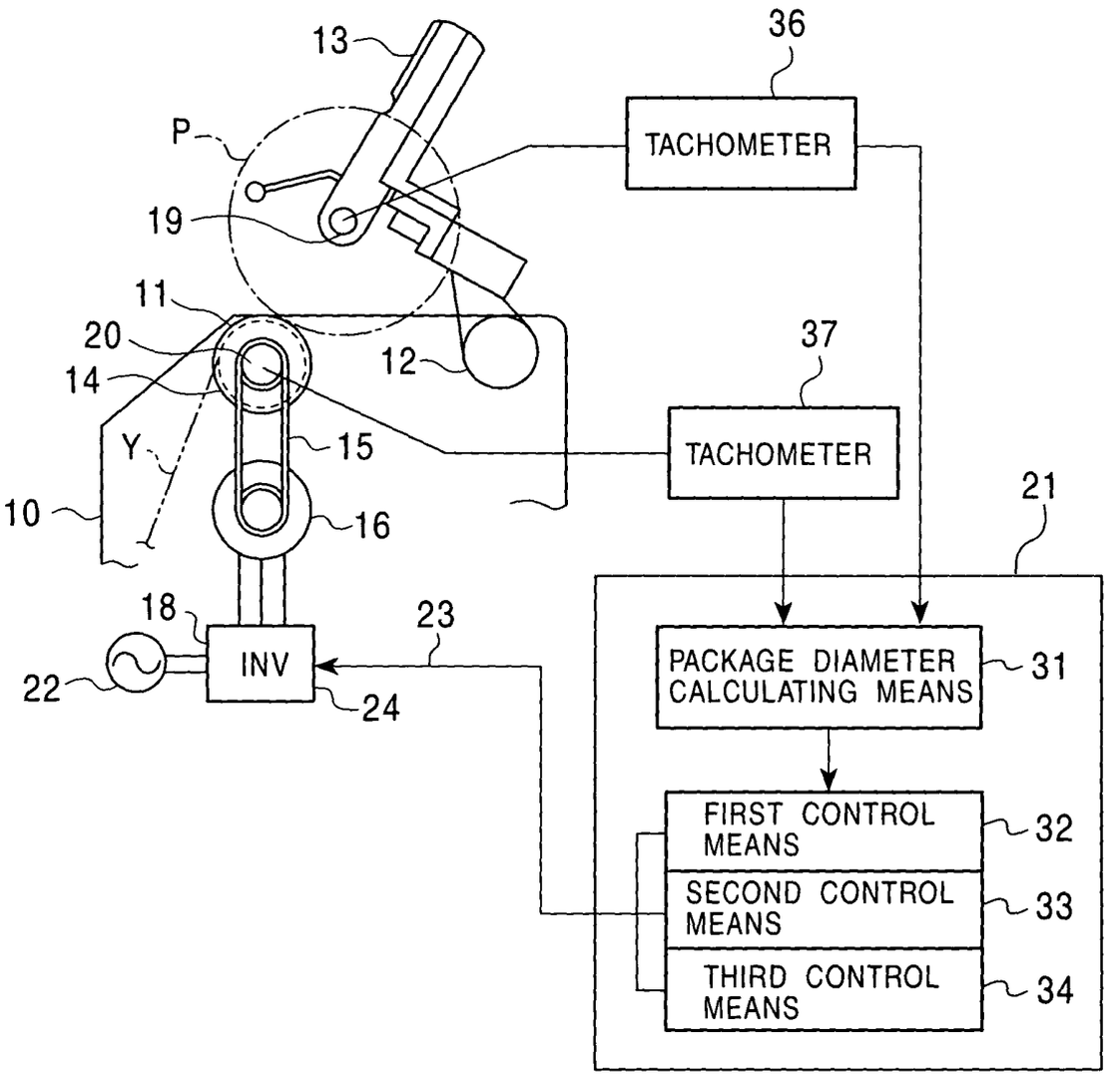

13
36
TACHOMETER
P
19
11
20
14
12
37
TACHOMETER
Y
15
10
16
21
18
23
INV
PACKAGE DIAMETER CALCULATING MEANS
31
22
24
FIRST CONTROL MEANS
32
SECOND CONTROL MEANS
33
THIRD CONTROL MEANS
34

FIG. 2

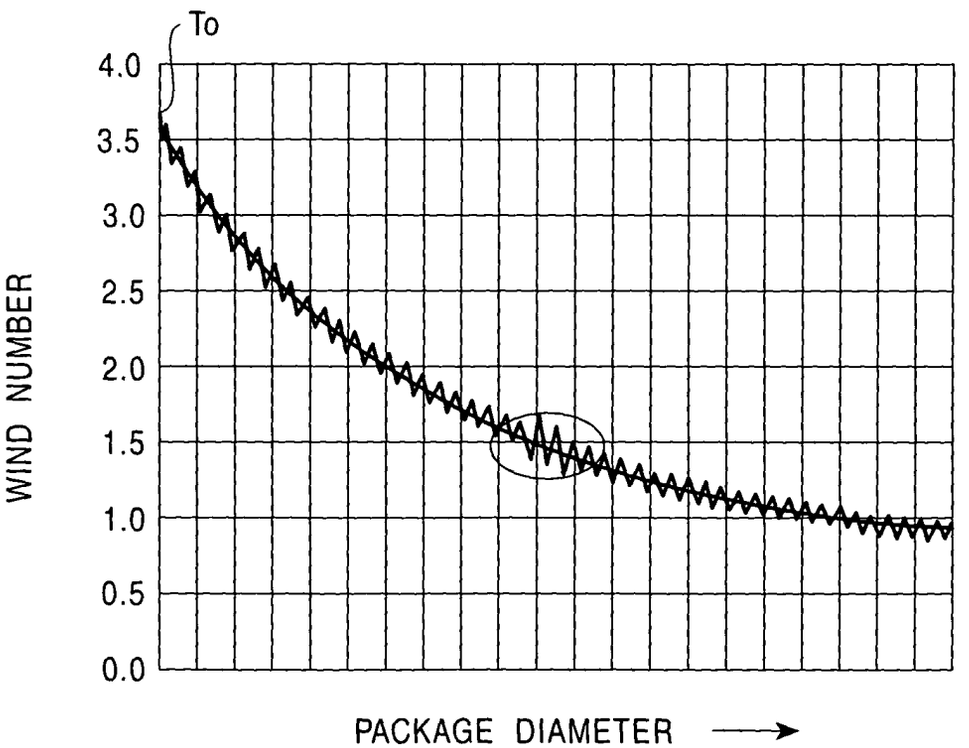


FIG. 3

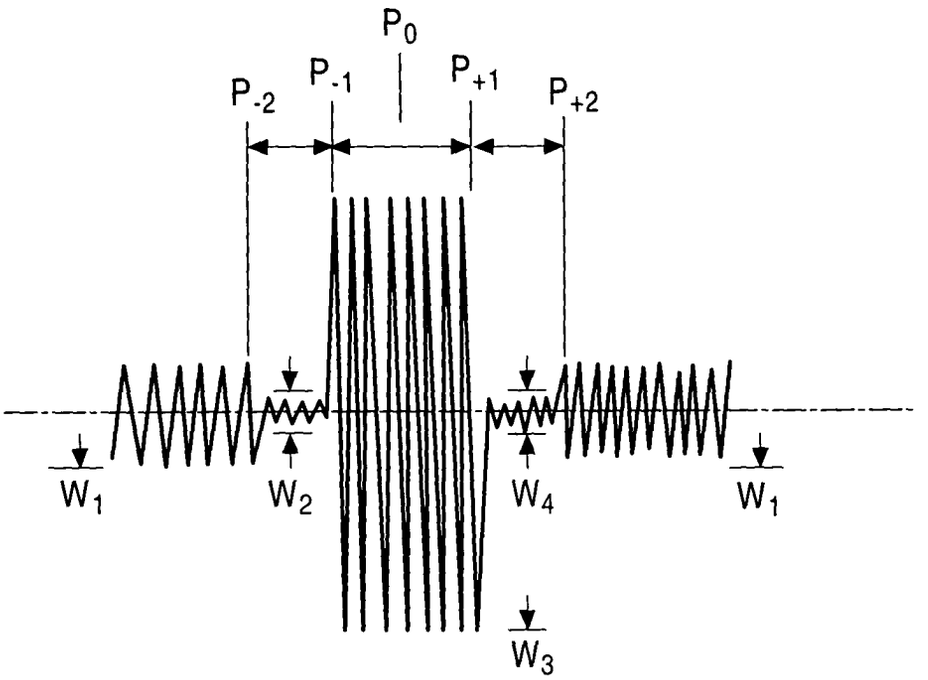

P0
P-2
P-1
P+1
P+2
W1
W2
W4
W1
W3

FIG. 4

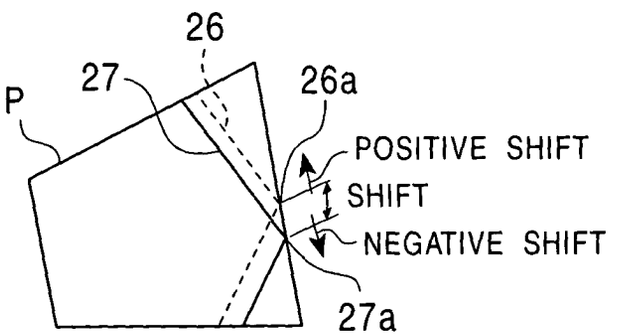
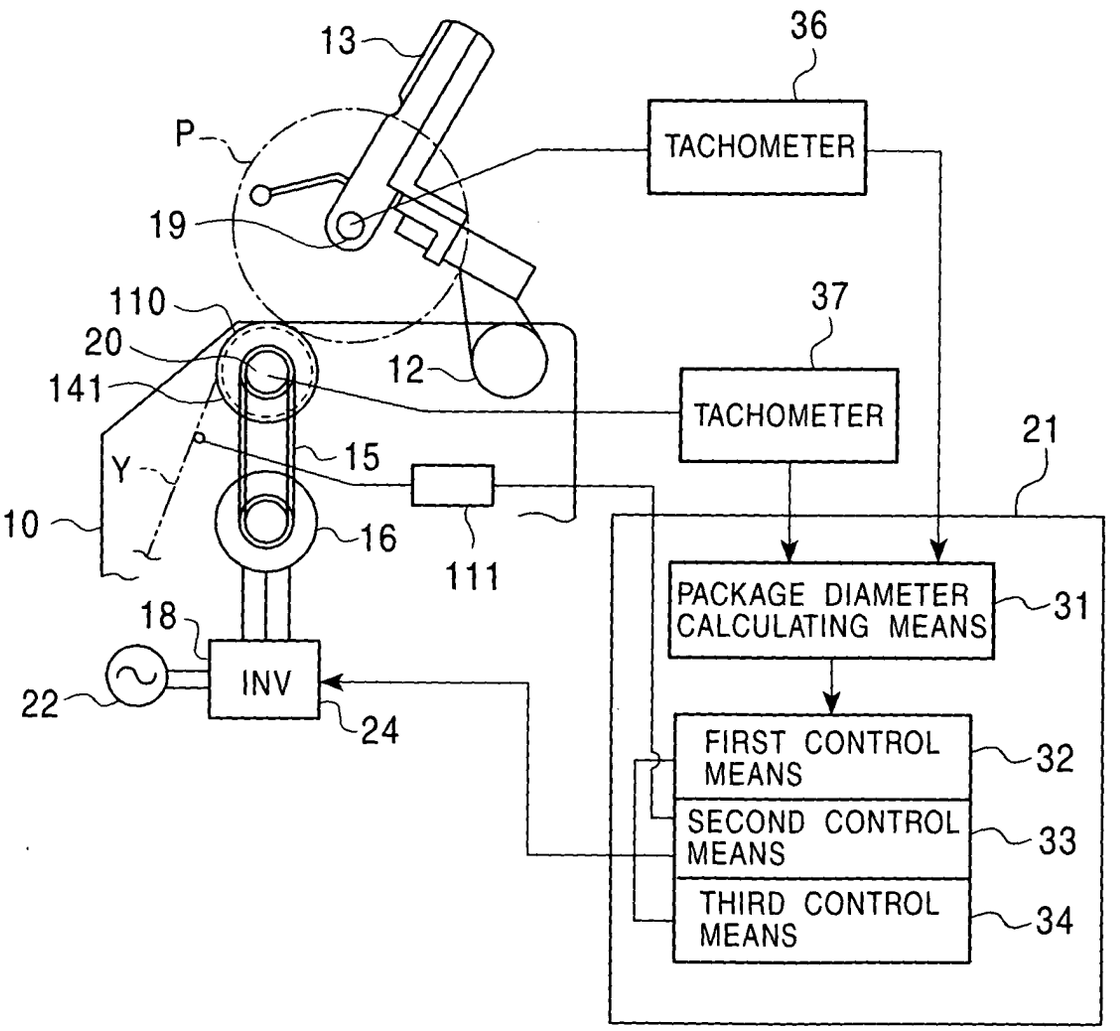

26
27
26a
P
POSITIVE SHIFT
SHIFT
NEGATIVE SHIFT
27a

FIG. 5


13
36
TACHOMETER
P
19
110
37
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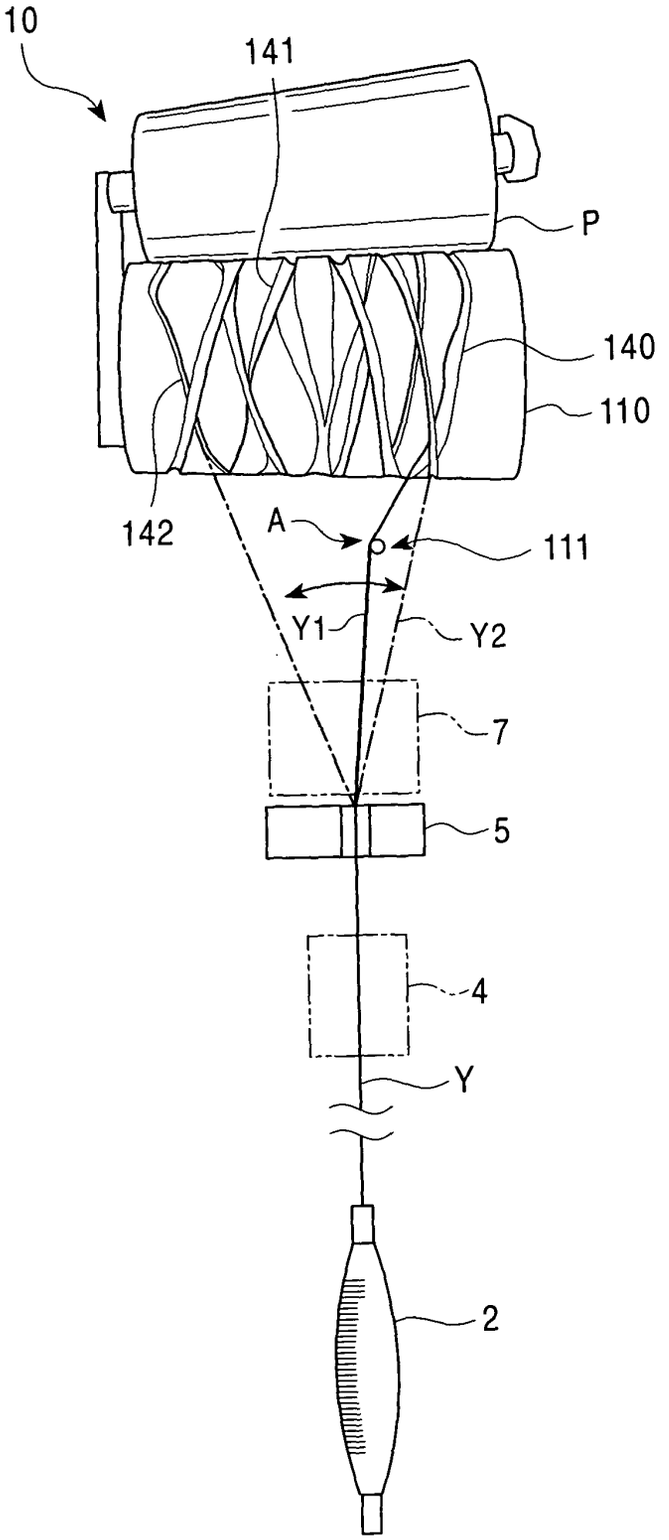
12
141
TACHOMETER
21
15
Y
10
16
111
PACKAGE DIAMETER CALCULATING MEANS
31
18
INV
22
24
FIRST CONTROL MEANS
32
SECOND CONTROL MEANS
33
THIRD CONTROL MEANS
34

FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 7896

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 0 093 258 A (BARMAG BARMER MASCHF) 9 November 1983 (1983-11-09) * the whole document *	1,4	B65H54/38 B65H54/28
X	US 5 577 676 A (BERGER HANS-PETER ET AL) 26 November 1996 (1996-11-26) * column 3, line 17 - line 30 * * column 1, line 55 - line 62; figure 1 * * column 6, line 37 - line 53 *	1,4	
X	DE 198 17 111 A (BARMAG BARMER MASCHF) 5 November 1998 (1998-11-05) * column 4, line 41 - column 7, line 60; claim 1 *	1,4	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 November 2004	Kising, A

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26-11-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0093258 A	09-11-1983	DE 3219880 A1	16-02-1984
		DE 3368253 D1	22-01-1987
		EP 0093258 A2	09-11-1983
		US 4504021 A	12-03-1985
		US 4504024 A	12-03-1985
US 5577676 A	26-11-1996	CN 1113209 A	13-12-1995
		DE 4435912 A1	20-04-1995
DE 19817111 A	05-11-1998	DE 19817111 A1	05-11-1998
		CN 1198396 A ,B	11-11-1998
		US 6027060 A	22-02-2000

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82