



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

(43) Date of publication:
03.07.2002 Bulletin 2002/27

(51) Int Cl.7: **B65H 54/44**

(21) Application number: **01912432.0**

(86) International application number:
PCT/JP01/02102

(22) Date of filing: **16.03.2001**

(87) International publication number:
WO 01/68497 (20.09.2001 Gazette 2001/38)

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

- **HAYASHI, Toshihiro**
Kyoto-shi, Kyoto 607-8088 (JP)
- **OKUMURA, Kozo, Forumu Gojo Nishidouin 802**
Shimogyo-ku, Kyoto-shi, Kyoto 600-8455 (JP)

(30) Priority: **16.03.2000 JP 2000073798**

(74) Representative: **Weber, Joachim, Dr.**
Hoefer, Schmitz, Weber & Partner
Patentanwälte,
Gabriel-Max-Strasse 29
81545 München (DE)

(71) Applicant: **TORAY INDUSTRIES, INC.**
Tokyo 103-8666 (JP)

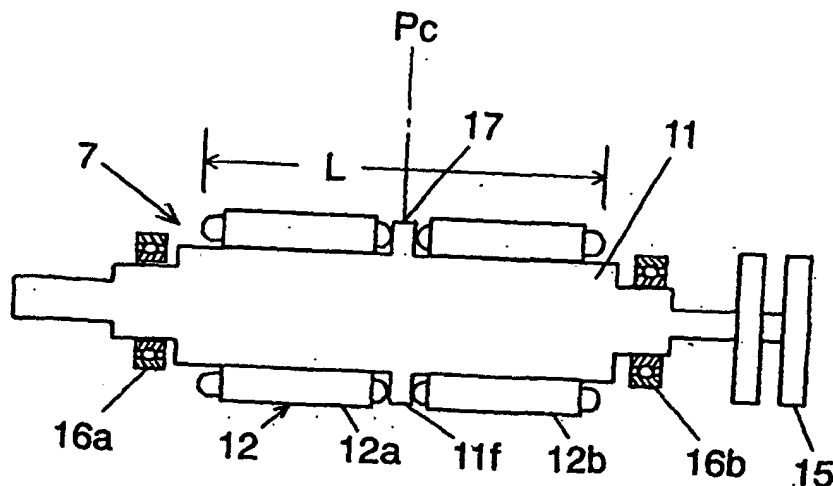
(72) Inventors:
• **MISHIMA, Kunihiro**
Otsu-shi, Shiga 520-0842 (JP)

(54) **YARN WINDER AND YARN PACKAGE PRODUCING METHOD, AND MOTOR**

(57) A motor, characterized in that a balance-correcting portion is provided within a range of $\pm L/3$ in the axial direction from the center of the overall length in the axial direction of the rotor of the motor, where L denotes the overall length; a yarn winder provided with the motor;

and a yarn package production method using the yarn winder. A long spindle capable of rotating at a high speed is used to allow yarns to be wound at a high speed in a large amount, thereby improving the productivity of yarn packages.

Fig. 3



Description

TECHNICAL FIELD

[0001] The present invention relates to a yarn winder and a method for producing a yarn package. In more detail, it relates to a yarn winder and a method for producing a yarn package that allow high speed yarn winding by reducing vibration occurred during yarn winding. Furthermore, the invention also relates to a motor preferably used for a yarn winder.

BACKGROUND ART

[0002] It is known that a yarn winder comprises a motor, a long spindle attached to a rotating shaft of the motor and a bobbin holder provided on the spindle, in which many bobbins, for example eight bobbins, are mounted on the bobbin holder and yarns are wound around the respective bobbins at high speed.

[0003] The yarn winder may have a touch roller that contacts the surfaces of yarn packages wound around the respective bobbins, to give a face pressure to the packages while rotating. The touch roller may also be positively driven to rotate by a motor.

[0004] A yarn winder of such type is disclosed, for example, in JP-B-7-33206 and EP-B-234844 or US-A-4852819 corresponding thereto, respectively.

[0005] The document proposes to form balance-correcting faces at both ends of the bobbin holder in the axial direction and at a position between both ends, for field balance correction to allow high speed yarn winding. The correction allows the primary critical speed of the bobbin holder to be passed with small vibration and allows vibration in a working speed region between the primary critical speed and the secondary critical speed to be kept at a low level, for allowing yarn winding at a yarn winding speed of 6,000 m/min.

[0006] If the yarn winding speed becomes high, the touch roller also rotates at a correspondingly high speed. Also for the touch roller, unbalance of rotation must be corrected, and the field balance is corrected at the end faces and at a position not kept in contact with the yarn packages.

[0007] For the purpose of improving productivity of yarn packages, the inventors attempted to use a yarn winder of such type for winding yarns at a higher speed or winding yarns using a longer bobbin holder.

[0008] To raise the rotating speed of the bobbin holder and touch roller or to use a longer bobbin holder and touch roller, the motors used for driving them must also be made higher in speed and larger-sized. It was found that if a higher-speed larger motor is used, the unbalance of the motor, particularly the unbalance of the rotor of the motor is not negligible when the yarns are wound.

[0009] If the speed of a motor is raised, the centrifugal force caused by rotation increases, and the working speed (the rotating speed in the steady yarn winding

condition reached with the speed raised from the stand-still condition) becomes close to the natural frequency. Especially when the winding speed exceeds 6,000 m/min and reaches 7,000 m/min or higher, it goes beyond the secondary critical speed of the bobbin holder to be close to the tertiary critical speed. In this condition, if the motor is vitally unbalanced, the vibration becomes too large to actually allow the winding speed to be raised to a desired level.

[0010] If the size of a motor is increased, the natural frequency of the motor declines and the centrifugal force increases by the increase of the diameter. The increase of centrifugal force further makes the high speed winding of yarns difficult.

[0011] As conventional practice, the unbalance of a motor is corrected at the ends of the rotor mainly causing the unbalance, or at the motor shaft portions close to the ends of the rotor.

[0012] In the case of a motor used for a yarn winder relatively low in yarn winding speed, the unbalance of the motor can be corrected by the conventional method, but in the case of a larger motor, it is difficult to correct the unbalance distributed in the axial direction of the motor only at the ends of the rotor or at the motor shaft portions close to the ends of the rotor.

[0013] It was found that it is necessary to use any particular technical means for solving this problem, in developing especially an ultrahigh speed yarn winder in which the yarn winding speed reaches 7,000 m/min or higher.

[0014] The object of the invention is to solve the problem by providing a yarn winder having a yarn winding speed of not less than 7,000 m/min, and a method for producing a yarn package based on the yarn winder, and also providing a motor useful for them.

DISCLOSURE OF THE INVENTION

[0015] The yarn winder of the invention to achieve the object comprises a bobbin holder to be mounted with bobbins, a spindle for rotating the bobbin holder and a motor for rotating the spindle, wherein a balance-correcting portion is provided within a range of $\pm L/3$ in the axial direction from the center of the overall length in the axial direction of a rotor of the motor, where L denotes the overall length.

[0016] The yarn winder of the invention to achieve the object comprises a bobbin holder to be mounted with bobbins, a touch roller for giving a face pressure to yarn packages formed around the bobbins and a motor for rotating the touch roller, wherein a balance-correcting portion is provided within a range of $\pm L/3$ in the axial direction from the center of the overall length in the axial direction of a rotor of the motor, where L denotes the overall length.

[0017] In the yarn winder of the invention, the rotor may be split into plural rotor members in the axial direction on the overall length.

[0018] In the yarn winder of the invention, the balance-correcting portion may be provided between the plural rotor members.

[0019] The balance correction in the balance-correcting portion may be achieved by drilling the rotor if the rotor can be drilled or by attaching a weight to the rotor if a weight can be attached thereto. On the other hand, if there is any clearance between plural rotor members to expose the motor shaft, a similar method can also be used on the motor shaft portion for achieving the balance correction.

[0020] In the case where the rotor per se is processed, there is the possibility of changing of the electric characteristics of the rotor. In that case, it is preferable to split the rotor into plural rotor members and to correct the balance on the motor shaft portion exposed in the gap between the rotor members.

[0021] As the motor, an induction motor is preferable in view of the easiness of balance correction at the rotor or motor shaft and the controllability of yarn winding.

[0022] A method for producing a yarn package of the invention to achieve the object, comprising the steps of mounting bobbins on the bobbin holder of the yarn winder according to the yarn winder of the invention, rotating a rotational driving shaft by the motor, winding a running yarn coming from a yarn supply source on the bobbins rotated by rotation of the driving shaft, and forming a yarn package on each of the bobbins.

[0023] The method for producing a yarn package of the invention is especially remarkable in the working effect in the case where a running speed of the running yarn is not less than 7,000 m/min.

[0024] A motor of the invention to achieve the object is a motor comprises a stator, a rotor and a motor shaft mounted with the rotor, wherein a balance-correcting portion is provided within a range of $\pm L/3$ in the axial direction from the center of the overall length in the axial direction of the rotor of the motor, where L denotes the overall length.

[0025] In the motor of the invention, the rotor can also be split into plural rotor members in the axial direction on the overall length.

[0026] In the motor of the invention, the balance-correcting portion can also be provided between the plural rotor members.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

Fig. 1 is a perspective view showing an embodiment of the yarn winder of the invention.

Fig. 2 is a front view of the winder of Fig. 1, in which the portion of the bobbin holder drive motor is shown as a sectional view.

Fig. 3 is a vertical sectional front view showing the bobbin holder drive motor and the vicinity thereof of the winder of Fig. 2.

Fig. 4 is a front view showing the winder of Fig. 1, in which the portion of the touch roller drive motor is shown as a sectional view.

Fig. 5 is a vertical sectional front view showing the touch roller and the drive motor thereof of the winder of Fig. 4.

Fig. 6 is a graph showing the relation between spindle speed and vibration amplitude in Example 1.

Fig. 7 is a graph showing the relation between spindle speed and vibration amplitude in Comparative Example 1

Fig. 8 is a graph showing the relation between touch roller speed and vibration amplitude.

Fig. 9 is a graph showing the relation between touch roller speed and vibration amplitude in Comparative Example 2.

Fig. 10 is a vertical sectional front view showing an example of conventional yarn winders.

Fig. 11 is a vertical sectional front view showing the bobbin holder drive motor and the vicinity thereof of the conventional winder of Fig. 10.

Fig. 12 is a front view showing another example of conventional winders different from the conventional winder of Fig. 10, in which some are shown as a sectional view.

Fig. 13 is a front view of the touch roller and the drive motor thereof of the conventional winder of Fig. 12, in which some are shown as a sectional view.

Meanings of symbols:

[0028]

1: yarn winder, 2: bobbin, 3: yarn, 4: yarn package, 5: bobbin holder, 6: spindle, 7: bobbin holder drive motor, 8: housing (base), 9: touch roller, 10: traverse device, 11: motor shaft, 11f: flange portion, 12, 12a, 12b: rotor or rotor member, 13: motor housing, 14: stator, 15: brake disc, 16a, 16b: bearing, 17: balance-correcting portion, 21: touch roller shaft, 22a, 22b: bearing, 23: touch roller drive motor, 24: motor shaft, 24f: flange portion, 25, 25a, 25b: rotor or rotor member, 26: housing (base), 27: stator, 28: balance-correcting portion, 100: yarn winder, 101: bobbin, 102: bobbin holder, 103: spindle, 104: bobbin holder drive motor, 105: motor shaft, 106: rotor, 107: housing (base), 108: stator, 109: brake disc, 110: tubular support, 111: bobbin, 112: yarn package, 113: touch roller, 114: touch roller shaft, 115: touch roller drive motor, 116: rotor, 120: yarn winder

THE BEST MODES FOR CARRYING OUT THE INVENTION

[0029] At first, conventional yarn winders and problems thereof are described below in reference to Figs. 10 through 13.

[0030] In Figs. 10 and 11, a yarn winder 100 has a housing (base) 107, and the housing 107 contains a motor 104 for driving to rotate a spindle 103. The motor 104 has a motor shaft 105, a rotor 106 mounted around the motor shaft 105 and a stator 108 corresponding to the rotor 106. Both ends of the motor shaft 105 extend outside the housing 107 respectively. A brake disc 109 is provided at one of the ends and a spindle 103 is connected at the other end through a coupling.

[0031] On the other hand, on a lateral face of the housing 107, a tubular support 110 for rotatably supporting the spindle 103 is fixedly provided, and bearings are interposed between the outer circumferential face of the spindle 103 and the inner circumferential face of the tubular support 110.

[0032] The tip of the spindle 103 is fastened to an inside boss of a bobbin holder 102. Around the bobbin holder 102, bobbins 101 are mounted through a bobbin engaging and disengaging mechanism. In Fig. 10, eight bobbins 101 are shown. Yarn packages are formed on the bobbins 101 by rotation of the bobbin holder 102 which is accomplished by the motor 104.

[0033] For improving productivity of yarn packages based on use of a conventional yarn winder, there is a method using higher yarn winding speed obtained by making rotation of the bobbin holder 102 in higher or a method increasing the number of bobbins 101 mounted on the bobbin holder 102 by making it longer.

[0034] To meet the requirement of enhancing the speed of the bobbin holder 102 or using a longer bobbin holder 102, how to reduce the vibration of the bobbin holder 102 caused in this case is a problem.

[0035] Substantially the same yarn winder as the winder of Fig. 10 is disclosed in JP-B-7-33206 (EP-B-234844 or US-A-4852819).

[0036] In the known apparatus, balance-correcting faces are provided at three positions (A, B and C of Fig. 10) corresponding to both ends and the central portion of the bobbin holder 102 in the axial direction, for field balance correction, in order to pass the primary critical speed at small vibration and to keep the vibration level low in the working speed range between the primary critical speed and the secondary critical speed. It is described in the document that with this constitution, yarns can be wound at a yarn winding speed of 6,000 m/min.

[0037] In addition to the above balance-correcting faces, in the known apparatus, it is also proposed to form a balance-correcting face in the brake disc 109 attached to the motor shaft 105 of the motor 104 driving the bobbin holder 102, for field balancing.

[0038] Figs. 12 and 13 show a yarn winder 120 known in public in which a touch roller for giving a face pressure to the yarn packages is provided.

[0039] In the winder 120, the bobbin holder mounted with eight bobbins 111, the spindle for rotating the bobbin holder and the motor for rotating the spindle exist but are not illustrated. They are substantially the same as those illustrated in Figs. 10 and 11.

[0040] In the winder 120, yarn packages 112 are formed around the bobbins 111. A touch roller 113 is provided to rotate in contact with the outer circumferential faces of the yarn packages 112. The touch roller 113 has a touch roller shaft 114, and is rotatably supported by bearings 121 and 122. The bearings 121 and 122 are attached to a base (not illustrated).

[0041] A motor 115 drives the touch roller shaft 114 for rotating it. In Fig. 12, the rotor 116 of the motor 115 connected to the touch roller shaft 114 is shown, and the stator of the motor 115 is omitted to show.

[0042] When the yarns are wound at a higher speed, the touch roller 113 is also rotated at a higher speed. When a longer bobbin holder is used, the touch roller 113 used is also longer. To meet the requirement of raising the speed of the touch roller 113 or using a longer touch roller 113, how to reduce the vibration of the touch roller 113 caused in this case is a problem.

[0043] An example of the invention to solve the problem is described below in reference to drawings.

[0044] In Figs. 1 and 2, a yarn winder 1 includes a bobbin holder 5 to be mounted with bobbins 2, a spindle 6 connected with the bobbin holder 5 for rotating the bobbin holder 5 and a motor 7 connected with the spindle 6 for rotating the spindle 6. The motor 7 is provided in a housing (base) 8. Yarns 3 are wound around the bobbins 2 mounted on the bobbin holder 5 by means of rotation of the bobbin holder 5 and a yarn traverse device 10, and yarn packages 4 are formed thereon.

[0045] The yarn winder 1 of this example is provided with a touch roller 9 for giving a face pressure to the yarn packages 4.

[0046] The motor 7 comprises a motor shaft 11 as shown in Fig. 2, a rotor 12 integrally rotating with the motor shaft 11 and a stator 14 fixed in a motor housing 13. At one end of the motor shaft 11, a brake disc 15 for the motor 7 is provided.

[0047] In Fig. 3, the motor shaft 11 is rotatably supported by the bearings 16a and 16b installed in the motor housing 13 at both ends of the motor shaft 11 in the axial direction. The motor shaft 11 is connected with the spindle 6 at the shaft end on the bearing 16a side.

[0048] The rotor 12 of the motor 7 shown in Fig. 3 is split into two rotor members 12a and 12b in the axial direction. The overall length L of the rotor 12 in the axial direction is the maximum width in the axial direction of the rotor members constituting the rotor 12 necessary for functioning as a rotor.

[0049] A balance-correcting portion 17 is located within a range of $\pm L/3$ in the axial direction from the center Pc of the overall length L of the rotor 12. At the balance-correcting portion 17, the balance is corrected.

[0050] In this example, the balance-correcting portion 17 is provided on the outer circumferential face of the flange portion 11f formed around the motor shaft 11 between the rotor members 12a and 12b, and the balance is corrected there. The balance is corrected by a method of partially removing the outer circumferential face of the

flange portion 11f, or building up on the outer circumferential face of the flange portion 11f, or attaching a weight to it.

[0051] The balance-correcting portion 17 is selected at the position corresponding to the center P_c of the overall length L , but the position can be changed within a range of $\pm L/3$ from the center P_c in the axial direction. If the position is within this range, a desired balance correction effect can be obtained.

[0052] Figs. 4 and 5 show the touch roller portion of a yarn winder. In Figs. 4 and 5, the touch roller 9 has a rotating shaft 21, and one end of the rotating shaft 21 is rotatably supported by a bearing 22b, while the other end is connected with one end of the motor shaft 24 of a touch roller drive motor 23. The other end of the motor shaft 24 is rotatably supported by a bearing 22a. A motor 23 and the bearing 22a are contained in a housing 26. The motor shaft 24 is mounted with a rotor 25 integrally rotating with the motor shaft 24, and a stator 27 positioned to oppose the rotor 25 is fixed in the housing 26.

[0053] The rotor 25 of the motor 23 is split into two rotor members 25a and 25b in the axial direction as shown in Fig. 5. The overall length L of the rotor 25 in the axial direction is the maximum width in the axial direction of the rotor members constituting the rotor necessary for the rotor 25 to function as a rotor.

[0054] A balance-correcting portion 28 is positioned in a range of $\pm L/3$ in the axial direction from the center P_c of the overall length L of the rotor 25. At the balance-correcting portion 28, the balance is corrected.

[0055] In this example, the balance-correcting portion 28 is provided at the outer circumferential face of the flange portion 24f formed around the motor shaft 24 between the rotor members 25a and 25b, and at this portion, the balance is corrected. The balance can be corrected by a method of partially removing the outer circumferential face of the flange portion 24f, or building up on the outer circumferential face of the flange portion 24f, or attaching a weight to it.

[0056] The balance-correcting portion 28 is selected at the position corresponding to the center P_c of the overall length L , but the position can be changed within a range of $\pm L/3$ from the center P_c in the axial direction. If the position is within this range, a desired balance correction effect can be obtained.

Example 1

[0057] Eight bobbins 2, each having an inner diameter of 110 mm, an outer diameter of 126 mm and a length of 150 mm, were mounted around the bobbin holder 5, and while a face pressure was applied to the yarn packages 4 using the touch roller 9 with an outer diameter of 65 mm, the yarn packages 4 were formed around the bobbins. The rotating speed of the motor 7 was raised from the standstill condition to the rotating speed corresponding to a yarn winding speed of 7,000 m/min at which the yarns were wound around the bobbins 2. At

this point of time, the speed of the spindle 6 was 17,700 rpm and the speed of the touch roller 9 was 34,300 rpm.

[0058] The vibration in this period of time was measured at near the bearings 16a and 16b of the motor shaft 11. The measured results are shown in Fig. 6. The speed (rpm) of the spindle 6 is chosen as the abscissa (X), and the measured vibration amplitude (μm), as the ordinate (Y).

[0059] As shown in Fig. 6, the spindle 6 was raised in speed to pass the low speed region of the primary and the secondary critical speeds at small vibration amplitudes and could be raised up to a spindle speed of 17,700 rpm corresponding to a yarn winding speed of 7,000 m/min without any problem.

Comparative Example 1

[0060] The conventional yarn winder free from the balance-correcting portion 17 shown in Fig. 3 was used to raise the spindle speed as described for Example 1. The results are shown in Fig. 7. In Fig. 7, the spindle speed (rpm) is chosen as the abscissa (X), and the measured vibration amplitude (μm), as the ordinate (Y)

[0061] As shown in Fig. 7, the vibration level was generally high, and after the spindle speed reached about 16,000 rpm, the vibration amplitude began to rise. So, the spindle speed could not be raised up to 17,700 rpm.

Example 2

[0062] Under the same conditions as described for Example 1, the speed of the touch roller 9 was raised. During this period of time, the vibration of the touch roller 9 was measured at near the bearings 22a and 22b of the touch roller 9. The measured results are shown in Fig. 8. In Fig. 8, the speed (rpm) of the touch roller 9 is chosen as the abscissa (X), and the measured vibration amplitude (μm), as the ordinate (Y).

[0063] As shown in Fig. 8, the speed of the touch roller 9 could be raised up to 34,300 rpm corresponding to a yarn winding speed of 7,000 m/min without any problem. During the speedup, even at the primary, secondary and tertiary critical speeds, no especially large vibration occurred.

Comparative Example 2

[0064] The conventional yarn winder free from the balance-correcting portion 28 shown in Fig. 5 was used to raise the speed of the touch roller as described for Example 2. The results are shown in Fig. 9. In Fig. 9, the speed (rpm) of the touch roller is chosen as the abscissa (X), and the measured vibration amplitude (μm), as the ordinate (Y).

[0065] As shown in Fig. 9, the critical speeds of low orders could be passed with the balance corrected by means of the touch roller body. However, in modes of higher orders, the vibration caused by the unbalance of

the rotor became remarkable to reach the base of the quaternary critical speed curve. So, the winder could not be tested up to a touch roller speed of 34,300 rpm corresponding to a yarn winding speed of 7,000 m/min.

INDUSTRIAL APPLICABILITY

[0066] The yarn winder, the method for producing a yarn package and the motor of the invention solve the vibration problem of a motor caused when the yarn winding speed is higher, for example, when yarns are wound at a speed of 7,000 m/min or higher, by correcting the balance at a specific position of the rotor per se of the motor or at a motor shaft portion between rotor members, for allowing high speed yarn winding, thereby enhancing yarn productivity.

Claims

1. A yarn winder comprises a bobbin holder to be mounted with bobbins, a spindle for rotating said bobbin holder and a motor for rotating said spindle, wherein a balance-correcting portion is provided within a range of $\pm L/3$ in the axial direction from the center of the overall length in the axial direction of a rotor of said motor, where L denotes the overall length.
2. A yarn winder comprises a bobbin holder to be mounted with bobbins, a touch roller for giving a face pressure to yarn packages formed around said bobbins and a motor for rotating said touch roller, wherein a balance-correcting portion is provided within a range of $\pm L/3$ in the axial direction from the center of the overall length in the axial direction of a rotor of said motor, where L denotes the overall length.
3. The yarn winder according to claim 1 or 2, wherein said rotor is split into plural rotor members in the axial direction on the overall length.
4. The yarn winder according to claim 3, wherein said balance-correcting portion is provided between said plural rotor members.
5. The yarn winder according to any one of claims 1 through 4, wherein said motor is an induction motor.
6. A method for producing a yarn package comprising the steps of mounting bobbins on the bobbin holder of the yarn winder defined in any one of claims 1 through 5, rotating a rotational driving shaft by the motor, winding a running yarn coming from a yarn supply source on the bobbins rotated by rotation of the driving shaft, and forming a yarn package on each of the bobbins.
7. The method for producing a yarn package according to claim 6, wherein a running speed of the running yarn is not less than 7,000 m/min.
8. A motor comprises a stator, a rotor and a motor shaft mounted with the rotor, wherein a balance-correcting portion is provided within a range of $\pm L/3$ in the axial direction from the center of the overall length in the axial direction of said rotor of said motor, where L denotes the overall length.
9. The motor according to claim 8, wherein said rotor is split into plural rotor members in the axial direction on the overall length.
10. The motor according to claim 9, wherein said balance-correcting portion is provided between said plural rotor members.
11. The motor according to any one of claims 8 through 10, wherein said motor is an induction motor.

Fig. 1

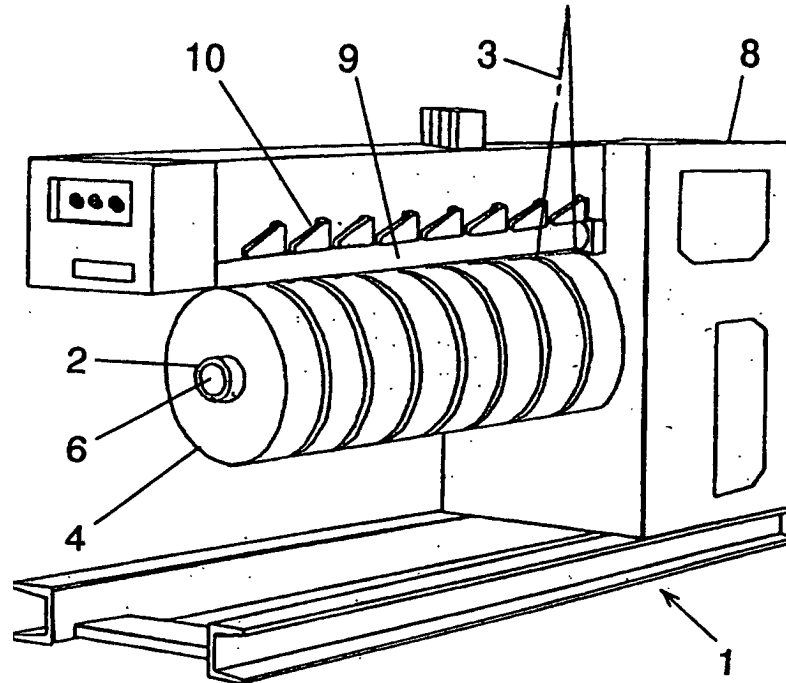


Fig. 2

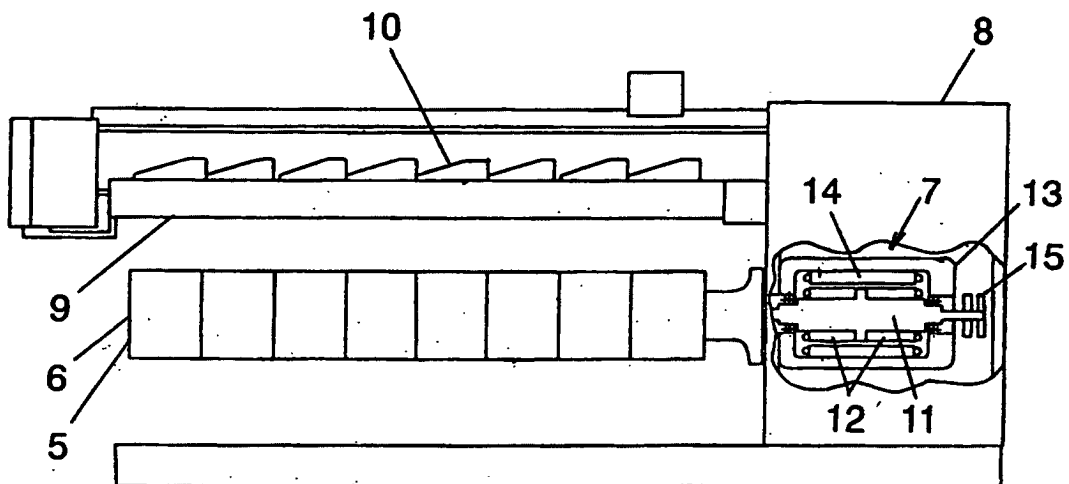


Fig. 3

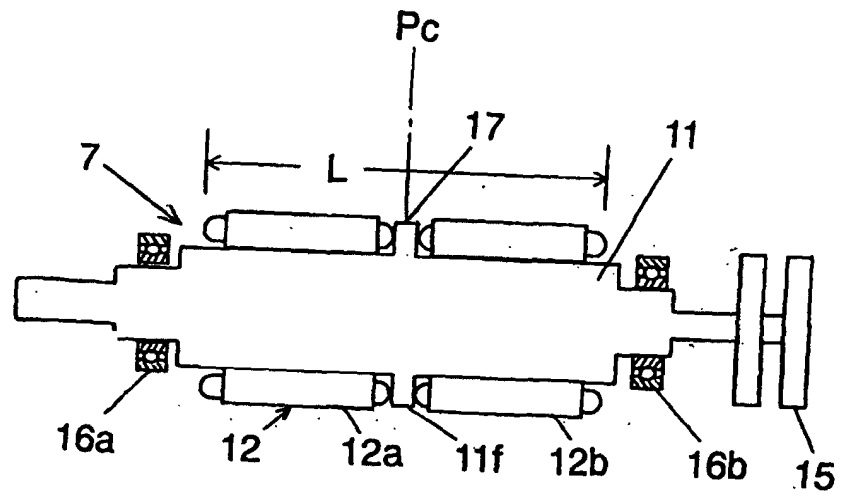


Fig. 4

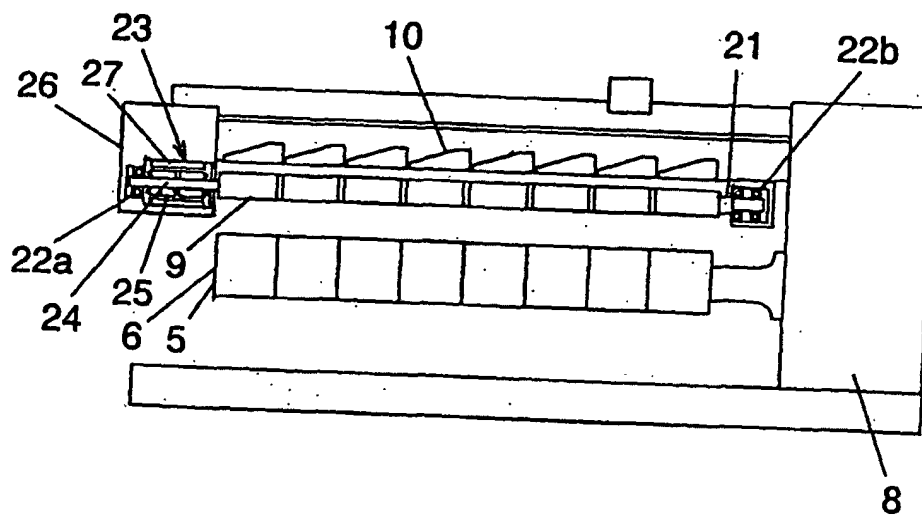


Fig. 5

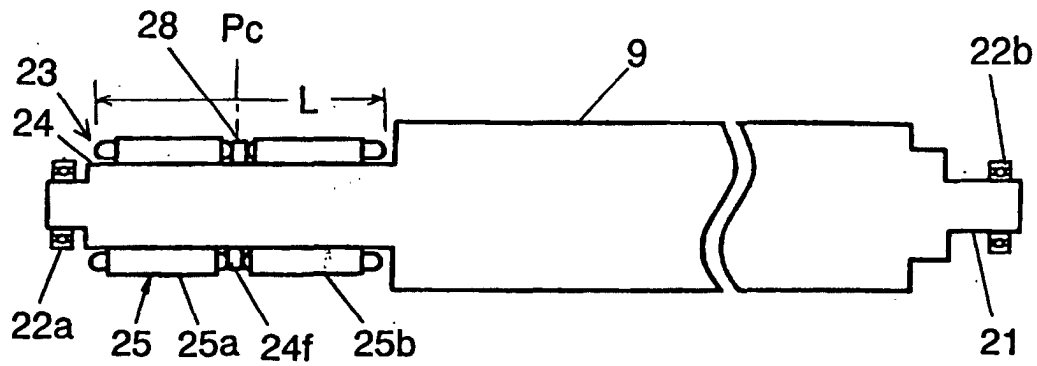


Fig. 6

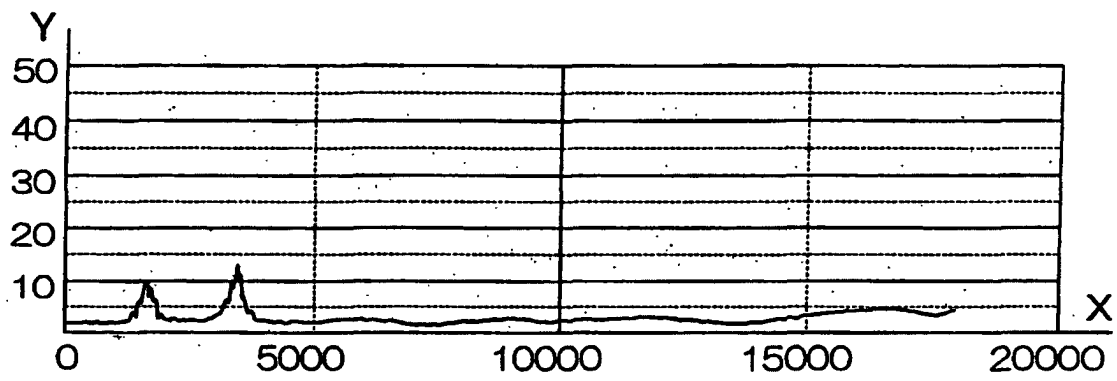


Fig. 7

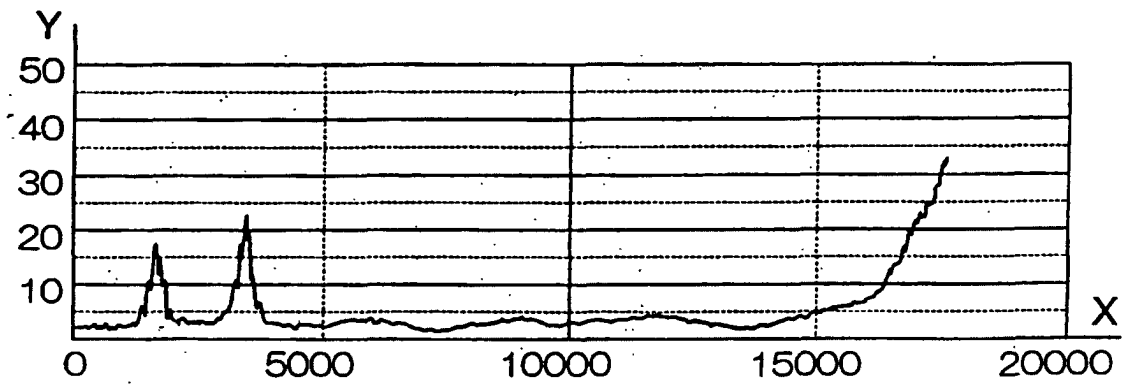


Fig. 8

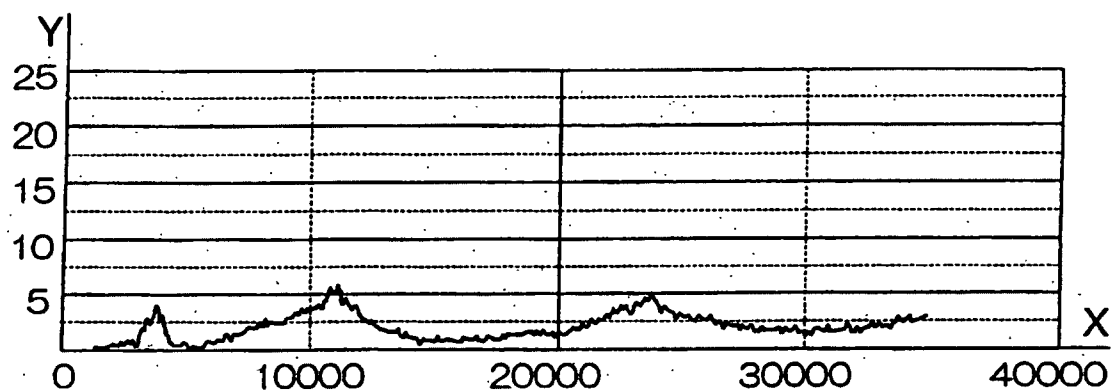


Fig. 9

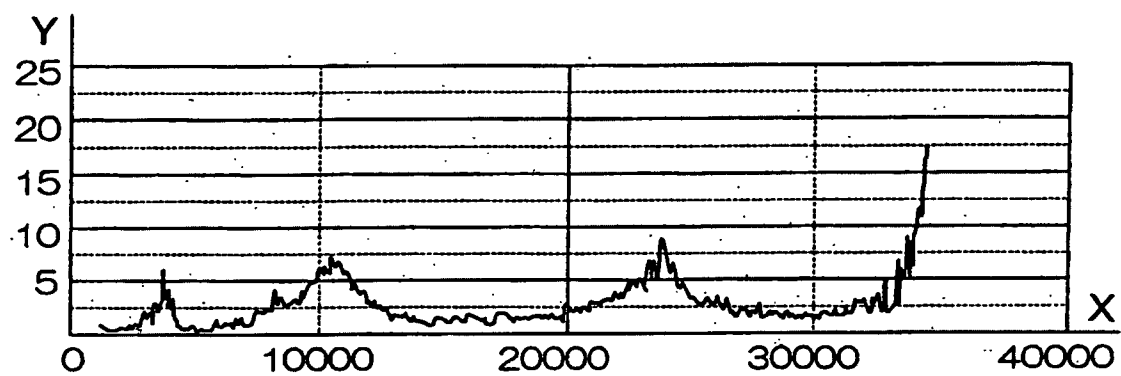


Fig. 10

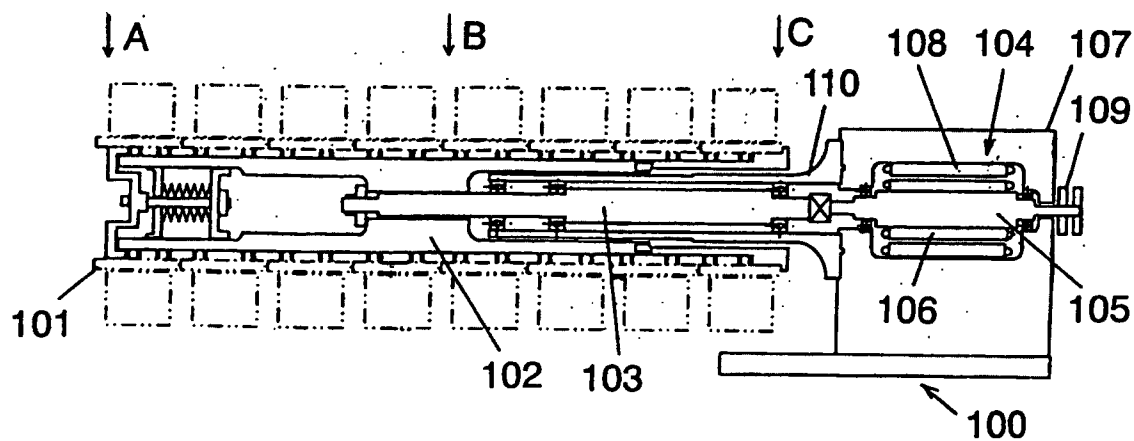


Fig. 11

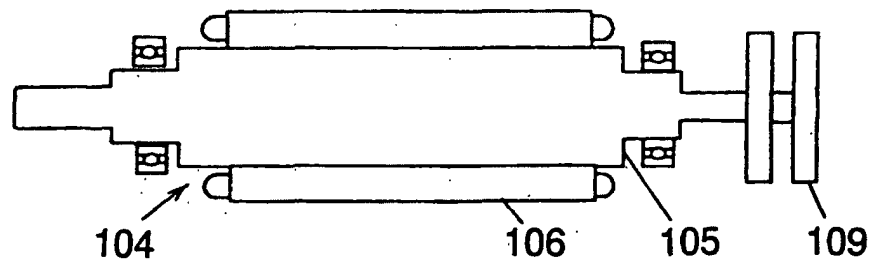


Fig. 12

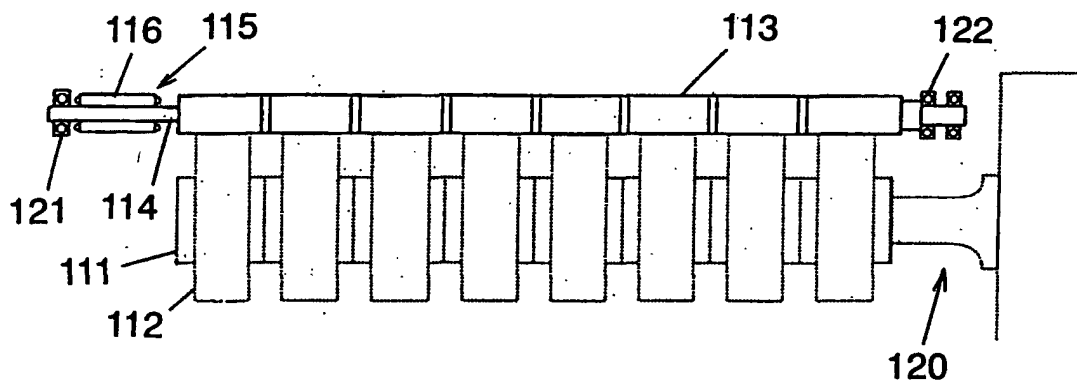
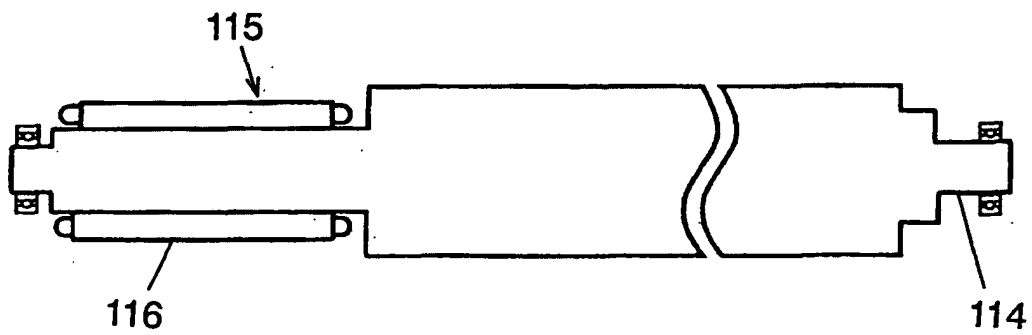


Fig. 13



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP01/02102

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ B65H 54/44		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁷ B65H 54/44		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2001 Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001		
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.
A	US, 5967453, A1 (Maschinenfabrik Rieter AG), 19 October, 1999 (19.10.99) & JP, 10-236730, A & IT, OM1980167, A & IT, OM1980167, A1 & DE, 19804893, A & IT, OM1980167, U	1-11
A	US, 4932598, A (Barmag AG), 12 June, 1990 (12.06.90) & DE, 68904623, D & EP, 362836, A1 & JP, 02-221071, A & DE, 68904623, T	1-11
A	JP, 11-32464, A (Hitachi, Ltd.), 02 February, 1999 (02.02.99) (Family: none)	1-11
☐ 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 document 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 06 April, 2001 (06.04.01)		Date of mailing of the international search report 17 April, 2001 (17.04.01)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (Julv 1992)