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(54) METHOD FOR ELIMINATING A LOOP OF YARN WHEN WINDING YARN ON A CROSS-WOUND BOBBIN ON A SPINNING MACHINE AT A CONSTANT SPEED OF THE YARN BEING PRODUCED AND A DEVICE FOR PERFORMING IT

(57) The invention relates to a method and a device for eliminating a yarn (0) loop when winding yarn (0) on a cross-wound bobbin (A2) on a spinning machine at a constant speed of the yarn (0) being produced, in which the length of the working path of the yarn (0) varies in the space between a draw-off mechanism (1) of yarn (0) and a winding device (A) of yarn (0) by deflecting the yarn (0) by a capturing and guiding means (7) of a movable compensatory arm (6). The yarn (0) is acted upon in a controlled manner by the capturing and guiding means (7), which is deflected by a reversible two-way controlled means (4), whereby the position and/or direction and/or speed and/or force applied by the reversible two-way controlled means(4) according to the operation which is being carried out at the operating unit.

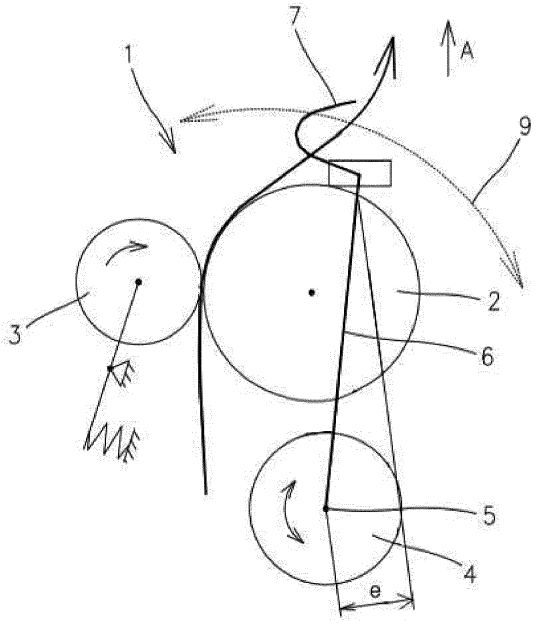

Fig. 1

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Description

Technical field

[0001] The invention relates to a method for eliminating a loop of yarn when winding yarn on a cross-wound bobbin on a spinning machine at a constant speed of the yarn being produced, in which the length of the working path of the yarn between a draw-off mechanism and a winding device varies by deflecting the yarn by a capturing and guiding means of a compensatory arm.

[0002] The invention also relates to a device for eliminating a loop of yarn when winding yarn on a cross-wound bobbin on a spinning machine at a constant speed of the yarn being produced, which comprises a movable compensatory arm with a capturing and guiding means of yarn, whose path intersects the path of the yarn between the draw-off mechanism and the yarn winding device.

Background art

[0003] During the winding of the yarn on a cross-wound bobbin on a spinning machine at a constant speed of the yarn being produced, for example on an open-end spinning machine or on an air-jet spinning machine, due to the distribution of the yarn over the bobbin width, the yarn is periodically slackened. As a result, owing to the constant speed of the yarn production and the constant speed of drawing off the yarn from the spinning unit, it is necessary to compensate for this slackening by lengthening and shortening the length of the yarn travel path between the draw-off mechanism and the yarn winding device For this purpose, various compensators are used, comprising a compensatory arm, which by one of its ends acts upon the yarn, lengthening or shortening the working path of the yarn at the operating unit in the relevant section between the draw-off mechanism of yarn and the winding device of yarn as required. In this manner, the compensatory arm also maintains a constant tension in the yarn, which is essential for the correct bobbin winding.

[0004] Known compensators comprise a reciprocating compensatory arm, which is swingingly mounted and coupled to a spring, which acts upon the arm in such a manner that the compensatory arm with its free end intersects transversely the working path of the yarn, acting upon the yarn by a defined force in a springloaded manner, by which means not only is the required tension in the yarn created, but at the same time the yarn, which is being slackened as a result of winding, is periodically and reversibly deflected from the straight-line working path, thereby eliminating the loop of yarn, which is periodically formed. Known are solutions involving various springs, which are due to their strength and properties "tuned into" a force progress presumed during the operation of the compensatory arm, as well as solutions which enable to set/adjust the preload of the spring additionally, by which means it is possible to readjust the setting of the compensator according to the new parameters, for example when the type of the yarn or the dimensions of the yarn is changed, etc.

[0005] However, as has become obvious especially recently, existing solutions for spring-operated compensators have their limitations which worsen meeting technological requirements for the formation of a cross-wound bobbin, while maintaining simplicity in construction and enabling to set individual parts of the device or the device itself quickly and easily, taking into account specific needs of activities and manual handling operations carried out during a transient state at the operating unit, such spinning-in yarn, a yarn rupture, replacement of the bobbins, etc.

[0006] The goal of the invention is primarily to improve the elimination of a yarn loop when winding yarn on a cross-wound bobbin on a spinning machine at a constant speed of the yarn being produced and improve the parameters of the device used for eliminating a yarn loop.

Principle of the invention

[0007] The aim of the invention is achieved by a method for eliminating a yarn loop when winding the yarn on a cross-wound bobbin on a spinning machine at a constant speed of the yarn being produced, whose principle consists in that the yarn is acted upon by a capturing and guiding means, which is deflected by a reversible two-way controlled means, whereby the position and/or direction and/or speed of the reversible two-way controlled means and/or the force applied by this means is regulated with regard to the operation that is being carried out at the operating unit.

[0008] The principle of the device for eliminating a yarn loop when winding yarn on a cross-wound bobbin on a spinning machine at a constant speed of the yarn being produced consists in that a compensatory arm is fixedly mounted on an output element of the reversible two-way controlled means, which is connected to a control mechanism for controlling the position and/or direction and/or speed and/or force application of the output element of the reversible two-way controlled means.

[0009] The advantage of this solution is the fact that the compensatory arm is driven by an independent means which is controlled via the control system in such a manner that the speed of the compensatory arm and the torque generated by it are, in case of need, controlled independently of the speed of the yarn motion and the bobbin speed, which broadens the possibilities of using the device for eliminating a loop not only during the process of the continuous winding of a cross-wound bobbin, but also for the automation of attending operations at a operating unit of a textile machine producing cross-wound bobbins at a constant speed of the yarn being produced. The angular momentum of the compensatory arm by means of its own independent two-way controllable reversible means is set according to the required tension in the yarn and at the same time it is also slightly

regulated, for example with the aid of a sensor located close to the middle of the working path of the compensatory arm or with the aid of a detector of the reversible two-way controllable means, whereby during transition from continuous spinning to a transient state and vice versa the speed and momentum of the compensatory arm depend on the requirements of the automating operations at a particular operating unit.

[0010] If the device for eliminating a loop of yarn comprises a magnetic means, the compensatory arm is deflected so that a compensatory momentum is created by the magnetic field of a permanent magnet, whose basic compensatory activity does not have to be controlled, since the compensatory arm is at its base driven solely by the tensile force of the yarn, a coil with a power source and the control system serving to modify the resulting compensatory momentum which counteracts the tensile force of the yarn, thus making the whole device substantially universal for different types of yarn and different working conditions.

[0011] The common advantage of the individual embodiments is the fact that it is possible to set the characteristics of these compensators according to the type of the yarn being produced automatically in the whole machine, without having to perform correcting operations at different operating units.

Description of drawings

[0012] The invention is schematically represented in the drawing, where Fig. 1 shows a schematic arrangement of a compensator at the outlet from a draw-off mechanism of yarn from a side view, Fig. 1a is a front view of a schematic arrangement of the compensator at the outlet from the draw-off mechanism of yarn from a front view, Fig. 2 shows a schematic arrangement of the compensator in the travel path of the yarn between the draw-off mechanism of yarn and the yarn winding device, in Fig. 3 there is a block diagram of a magnetic or electromagnetic means for eliminating a yarn loop.

Specific description

[0013] The invention will become apparent from the description of examples of embodiment and from the description of the operation of the device for eliminating a yarn loop at an operating unit of a spinning machine in the space between a draw-off mechanism **1** of yarn **0** from a spinning unit and a winding device **A** of yarn **0** on a cross-wound bobbin.

[0014] The spinning machine comprises at least one row of identical operating units arranged next to each other, wherein each operating unit comprises a spinning unit, in which yarn is created. A draw-off mechanism **1** of yarn **0** is situated above the spinning unit. The draw-off mechanism **1** of yarn **0** comprises a known pair of draw-off rollers **2**, **3**, between which the yarn **0** passes and which are rotatably mounted in the framework of the machine. One of the draw-off rollers **2, 3** is coupled to an unillustrated drive and constitutes a driven draw-off roller **2,** whereby the other draw-off roller **3** is a pressure draw-off roller **3,** which is rotatably mounted on a spring-loaded arm **30,** by which it is pressed against the driven draw-off roller **2**.

[0015] A winding device **A** of yarn **0** on a cross-wound bobbin is located in the path of the yarn **0** behind the draw-off mechanism**1**. The winding device **A** of yarn **0** comprises a distribution device **A1** of yarn **0**, by which the yarn **0** being wound is distributed over the width of the bobbin **A2**.

[0016] A device for eliminating a loop of yarn is arranged at an operating unit in the path of the yarn **0** between the draw-off mechanism **1** and the winding device **A**.

[0017] The device for eliminating a yarn loop comprises a reversible two-way controlled means **4**, such as an electrical, magnetic or pneumatic rotary means **4**, on whose output shaft **5** is fixedly mounted at one of its end a compensatory arm **6**, or an electrical or pneumatic or magnetic linear means **4**, on whose output rod is mounted the compensatory arm **6**.

[0018] In the examples of embodiment in Fig. 1, 1 a and 2, the compensatory arm **6** is mounted on the shaft **5** transversely to the longitudinal axis of the shaft **5**, i.e. transversely to the axis of the rotation of the shaft **5.** In an unillustrated example of embodiment, the compensatory arm **6** is situated skew in relation to the shaft **5.** At the free end of the compensatory arm **6** is fixedly mounted a capturing and guiding means **7** of yarn **0**, which when eliminating a loop of yarn **0** transversely intersects the working path of the yarn **0** in the space between the draw-off mechanism **1** and the winding device **A**, which enables the capturing and guiding means **7** of yarn **0** to act upon the yarn **0** during the process of eliminating the yarn loop **0**.

[0019] When eliminating the yarn loop **0**, the capturing and guiding means **7** of yarn **0** performs a two-way controlled reciprocating motion along a circular path **9**, which is in the embodiment in Fig. 1 indicated by a dashed line. In this example of embodiment, the capturing and guiding means **7** of yarn **0** is arranged directly at the outlet of the yarn **0** from the draw-off mechanism **1** of yarn **0** and thus the circular path **9** of the capturing and guiding means **7** of yarn **0** passes along a part of the circumference of the driven draw-off roller **2**.

[0020] In the example of embodiment illustrated in Fig. 2, the capturing and guiding means **7** of yarn **0** is arranged in the space between a pair of mutually spaced support guides **10** of yarn **0**, which permit controlled yarn loop formation as well as the control of the loop **in** the space between the draw-off mechanism **1** yarn and the winding device **A** of yarn **0**. In this embodiment, too, the capturing and guiding means **7** of yarn **0** performs a two-way controlled reciprocating motion along the circular path **9** during the process of eliminating the yarn loop **0**.

[0021] In an unillustrated example of embodiment,

which is a modification to the embodiment according to Fig. 2, the capturing and guiding means **7** of yarn **0** is arranged in the space between the two mutually spaced support guides **10** of yarn **0**, which allow controlled loop formation and the control of the loop of yarn **0** in the path of the yarn **0** in the space between the draw-off mechanism **1** of yarn **0** and the winding device **A** of yarn **0**. In this unillustrated example of embodiment, the capturing and guiding means **7** of yarn **0** is mounted at the end of a linear reversible two-way controlled means **4** and performs a two-way controlled reciprocating motion along a linear path during eliminating the yarn **0** loop.

[0022] In yet another unillustrated example of embodiment, which is substantially a modification to the embodiment according to Fig. 1, the reversible two-way controlled means **4** is turned by 90° and its output shaft **5** has a vertical longitudinal axis. The capturing and guiding means **7** of yarn **0** on the compensatory arm **6** transversely intersects the working path of the yarn **0** in the space between the draw-off mechanism **1** and the winding device **A**, thus moving substantially along a circular path situated in a horizontal plane. In another unillustrated example of embodiment, the reversible two-way controlled means **4** is set skew in respect to both the horizontal and vertical directions. The longitudinal axis of its output shaft **5** is also situated skew and the capturing and guiding means **7** of yarn **0** on the compensatory arm **6** transversely intersects the working path of the yarn **0** in the space between the draw-off mechanism **1** and the winding device **A**, moving substantially along a circular path situated in an inclined (skew) plane.

[0023] In an illustrated example of embodiment, the device for eliminating the loop of yarn **0** further comprises a detector **8** of the position of the compensatory arm **6**, which is in the illustrated example of embodiment located in the central part of the compensatory arm **6** path under consideration during the reciprocating motion during the operation of eliminating the loop of yarn **0**. In this example of embodiment, the detector **8** is excentrically positioned, the excentricity **e** being oriented in relation to the line joining the axis of the rotation of the shaft **5** of the reversible two-way controlled means **4** and the axis of the rotation of the driven draw-off roller **2**. In an unillustrated example of embodiment, the detector **8** is mounted in the framework of the device at a point opposite a suitable detecting element located directly on the output member of the means **4**, the detecting element being formed by a transverse protrusion on the shaft **5** etc. The detector **8** of the position of the compensatory arm **6** enables to monitor the passing of the compensatory arm **6** through the specific section being monitored and adjust the activity of the reversible two-way controlled means **4** accordingly, as will be described hereinafter. In yet another unillustrated example of embodiment, the device for eliminating a loop of yarn **0** comprises a pair of mutually spaced detectors **8** which are aligned with the compensatory arm **6**, for example, in the end positions of the swinging motion of the compensatory arm **6** or which are aligned with the path of the compensatory arm **6**, being mutually spaced outside of the end positions of the swinging motion of the compensatory arm **6**, or also in other suitable positions.

[0024] In another example of embodiment, the reversible two-way controlled means **4** is aligned with a detector of the position and/or speed of the output element of the reversible two-way controlled means **4,** such as the shaft **5** of the rotary means **4**, or the output rod of the linear means **4**.

[0025] For example, by the position of the shaft **5** we understand the displacement, or, more specifically, the displacement angle, the number of the revolutions, etc., of the shaft **5**. The detector of the position and/or speed of the motion either constitutes a part of the reversible two-way controlled means **4**, or it is composed of an external device aligned in a suitable place with the output element of the particular means **4**, for example, with the shaft **5** of the reversible two-way controlled means **4**. The detector of the position and/or speed of the motion allows accurate reversible two-way controlled active motion, the accelerating, decelerating, halting etc. of the output means **4** consisting of the compensatory arm **6** and the capturing and guiding means **7** of yarn **0** according to the directions of the control mechanism and according to instantaneous needs of the technological processes at a particular operating unit.

[0026] In another example of embodiment, the device for eliminating a loop of yarn **0** comprises both the detector **8** of the position of the compensatory arm **6**, and the detector of the position and/or speed of the reversible two-way controlled means **4**.

[0027] In the illustrated examples of embodiment with a rotary means **4**, the reversible two-way controlled means **4** is composed of a brushless rotary electric drive with permanent magnets, the so-called BLDC motor, which has already been provided with a detector of the position and/or speed of the rotation of its shaft **5**. In an unillustrated example of embodiment, the reversible two-way controlled means **4** is formed by a pneumatic rotary motor or by another suitable drive, such as a drive having only a limited range of straight-line reciprocating motion or bi-directional angular displacement or turning. An example of a magnetic, or, more specifically, electromagnetic means **4** with a limited range of bi-directional angular displacement is, for example, a device called a rotary solenoid.

[0028] Another example of a magnetic, or, more specifically, electromagnetic reversible two-way controlled means **4** of the device for eliminating a loop of yarn is represented in Fig. 3 and 4, which show a cylindrical two-pole magnet **9**, rotatably mounted about its longitudinal axis in a magnetic circuit, such as in a magnetically conductive stirrup **90**, which is aligned with a coil **91** connected to a source of electrical energy for the excitation of the coil according to the instructions of the control mechanism. Due to its polarity, the magnet **9** creates a magnetic flux in the stirrup **90**. The magnet **9** is connected

to the compensatory arm **6** and at standstill its displacement is such that the north pole of the magnet **9** is situated opposite one pole extension of the stirrup **90**, whereas the south pole of the magnet **9** is positioned opposite the other extension of the stirrup **90**, and therefore the lines of force of the magnetic field pass through the stirrup **90**, taking the shortest distance. This embodiment of the means **4** has an important function, namely that when the yarn **0** tries to turn the magnet **9** by means of the compensatory arm **6**, a torque is generated on the compensatory arm **6** by the magnetic forces, being proportionate to the displacement of the compensatory arm **6**, in other words, the system itself counteracts this displacement by the action of the yarn **0** and stretches the yarn **0**, thus compensating for the loop of yarn. The connected coil **91** due to being excited by the electric current **I** (or by a change in the electric current **I**) generates another magnetic flux, which is combined with the magnetic field of the rotating magnet (according to the polarity it is added to it or subtracted from it), by which means the compensatory characteristics of this embodiment of the means **4** is modified, and therefore it is possible to change the character of the compensator from the point of view of the force **F** acting on it, this being carried out automatically according to the textile parameters, and, what is more, it is even possible to optimize the course of the compensation during one swing of the compensatory arm **6** if the current **I** running through the coil **91** properly changes over time, for example, by using the method PWM. As for the suitable material, it has been found out that it is advantageous to make the compensatory arm **6** from a material enabling achieving sufficient firmness and resistance while maintaining a minimal moment of inertia. It is, for example, advisable to use carbon composites, etc. Also, as far as the material is concerned, it is favourable if the stirrup **90** is made of a magnetically soft steel.

[0029] The control mechanism controls the illustrated rotary reversible two-way controlled means **4** and its controlled action on the yarn **0**, for instance in the so-called torque-speed mode, whereby the control mechanism is either composed of an independent control mechanism for one operating unit, or it is formed by means of a control mechanism of the operating unit or it is composed of a control mechanism common to more operating units, for example, to a section of the machine or it consists of a control unit common to all the operating units of the machine or it consists of means of the control mechanism of the whole machine, etc.

[0030] The above mentioned torque-speed mode of control of the reversible two-way controlled means **4** enables, if required, to control mutually independently the speed of the motion of the compensatory arm **6**, and, therefore, also the speed of the motion of its capturing and guiding means **7**, and, in addition, it allows to control the size of the torque on the shaft **5**, i.e. to control the force applied by the compensatory arm **6**, or, more specifically, by its capturing and guiding means **7**, on the yarn **0.** Furthermore, this is all achieved regardless the speed of the motion of the drawn-off yarn **0** and the speed of the rotation of the bobbin **A2** during the winding of the yarn **0**.

[0031] The torque of the shaft 5, which is converted by the compensatory arm **6** and its capturing and guiding means **7** into a force acting on the yarn **0** being produced and wound, is set during the continuous spinning of the yarn **0** according to the required tension in the yarn **0** and is further more slightly regulated either by means of the detector **8** of the position of the compensatory arm **6**, or, more specifically, by means of its capturing and guiding means **7**, and/or by means of the detector of the position and/or speed of the rotation of the shaft **5** of the reversible two-way controlled means **4**. During the transition from the continuous spinning of the yarn **0** to a transient state and, vice versa, during the transition from a transient state to the state of the continuous spinning of the yarn **0**, the control of the speed and/or torque of the shaft **5** and, consequently, the control of the force applied by the capturing and guiding means **7** of the compensatory arm **6** on the yarn **0** being produced and wound, is currently adjusted and is carried out according to the particular requirements of the automation operations being performed at the operating unit, for example as a result of the occurrence of a transient state at the operating unit.

[0032] In the mode of continuous spinning, the torque of the shaft **5** of the reversible two-way controlled means **4** is controlled, for example, by using a method for a modified vector control, in which there are two separate regulator circuits, wherein one regulator circuit is intended to monitor and control the torque of the compensatory arm **6**, or, more specifically, of the shaft **5** of the controlled means **4**. For example, if the controlled means **4** is composed of an electric motor, then it is a case of controlling the magnetic flux of this electric motor. Moreover, both regulator circuits are made in such a manner that they do not influence each other. The principle of the modified vector control of an electric motor consists in converting the space vector of the stator current into two perpendicular components in a rotating coordinate system, which may be oriented to the space vector of the stator or rotor magnetic flux, or, as the case may be, to the space vector of the resulting magnetic flux. The components of the stator motor current space vector then define the torque and the magnetization of the electric motor constituting the means **4**. The torque of the motor is defined by a torque forming component of the stator current vector, as well as by a respective vector of the magnetic flux. The method for the vector control of electrical motors is described in literature, e.g. in the scientific publication: Chiasson, John Nelson, Modeling and high performance control of electric machines, ISBN 0-471-68449-X.

Claims

1. A method for eliminating a yarn loop (0) when wind-

ing yarn (0) on a cross-wound bobbin (A2) on a spinning machine at a constant speed of the yarn (0) being produced, in which the length of the working path of the yarn (0) between a draw-off mechanism (1) of yarn (0) and a winding device (A) of yarn (0) varies as a result of the yarn (0) being deflected by a capturing and guiding means (7) of the compensatory arm (6), **characterized in that** the yarn (0) is acted on in a controlled manner by the capturing and guiding means (7), which is deflected by a reversible two-way controlled means (4), whereby the position and/or direction and/or speed and/or force application of the reversible two-way controlled means (4) varies according to the particular operation that is being carried out at an operating unit.

2. The method according to Claim 1, **characterized in that** the control of the reversible two-way controlled means (4) is performed according to the instantaneous position of the capturing and guiding means (7).

3. The method according to Claim 1 or 2, **characterized in that** the force applied by the reversible two-way controlled means (4), which acts on the yarn, is controlled in order to maintain a constant tension in the yarn (0) due to the capturing and guiding means (7), which acts on the yarn (0) during the continuous spinning of the yarn (0) at the operating unit.

4. A device for eliminating a loop of yarn (0) when winding yarn (0) on a cross-wound bobbin (A2) on a spinning machine at a constant speed of the yarn being produced, which comprises a movable compensatory arm (6) with a capturing and guiding means (7) of yarn (0), whose path intersects the path of the yarn (0) between a draw-off mechanism (1) of yarn (0) and a winding device (A) of yarn (0), **characterized in that** the compensatory arm (6) is fixedly mounted on an output element of a reversible two-way controlled means (4), which is connected to a control mechanism controlling the position and/or direction and/or speed and/or the force applied by the output element of the reversible two-way controlled means (4).

5. The device according to Claim 4, **characterized in that** the output element of the reversible two-way controlled means (4) is aligned with a detector of its position.

6. The device according to Claim 4 or 5, **characterized in that** the compensatory arm (6) and/or the output element of the reversible two-way controlled means (4) is aligned with at least one detector of the position of the compensatory arm (6).

7. The device according to Claim 6, **characterized in that** the detector of the position of the compensatory arm (6) is positioned in the middle of the path of the compensatory arm (6) during the reciprocating motion when eliminating a loop of yarn (0), or it is aligned with a detecting element located directly on the output member of the reversible two-way controlled means (4).

8. The device according to any of the Claims 4 to 7, **characterized in that** the compensatory arm (6) is with its capturing and guiding means (7) of the yarn (0) arranged transversely to the path of the yarn (0) at the outlet of the yarn (0) from the draw-off mechanism (1) of yarn (0), whereby the working path of the capturing and guiding means (7) of yarn (0) is formed by a radial circular pathway (9), which runs past a part of the circumference of the driven draw-off roller (2).

9. The device according to any of the Claims 4 to 7, **characterized in that** the compensatory arm (6) is with its capturing and guiding means (7) of yarn (0) arranged transversely to the path of the yarn (0) in the space between the two mutually spaced support guides (10) of yarn (0), whereby the support guides (10) are arranged between the draw-off mechanism (1) of yarn (0) and the winding device (A) of yarn (0), and the working path of the capturing and guiding means (7) of the yarn (0) is formed by a radial circular path (9) or it constitutes a straight-line path.

10. The device according to any of the Claims 4 to 9, **characterized in that** the reversible two-way controlled means (4) consists of a rotary brushless electric motor with permanent magnets and a built-in detector of the position of its shaft (5).

11. The device according to any of the Claims 4 to 9, **characterized in that** the reversible two-way controlled means (4) is composed of a rotary solenoid.

12. The device according to any of the Claims 4 to 9, **characterized in that** the reversible two-way controlled means (4) comprises a cylindrical two-pole magnet (9), on which the compensatory arm (6) is mounted and which is mounted rotatably about its longitudinal axis in a magnetic circuit with a coil (91) connected to a source of electrical energy for the excitation of the coil (91) according to the instructions of the control mechanism.

13. The device according to Claim 12, **characterized in that** the magnetic circuit with a coil (91) comprises a stirrup (90), wherein at standstill the position of the cylindrical two-pole magnet (9) is such that the north pole of the magnet (9) is located opposite one pole extension of the stirrup (90), whereas the south pole of the magnet (9) is situated opposite the other pole extension of the stirrup (90).

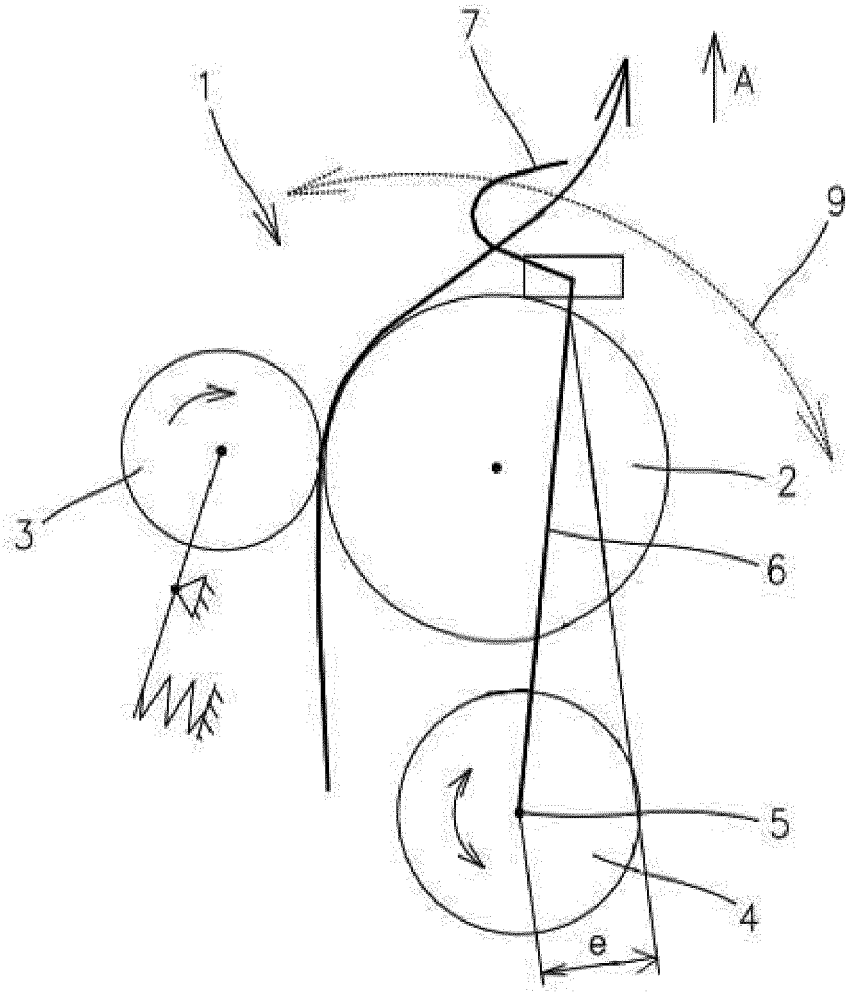

Fig. 1

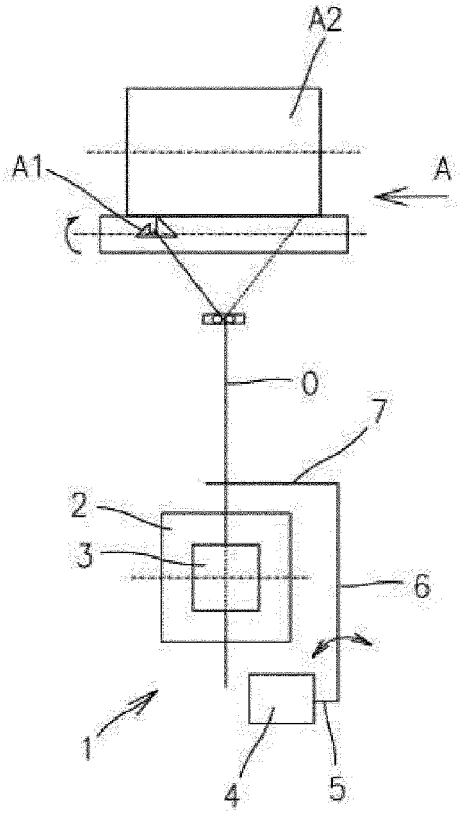

Fig. 1a

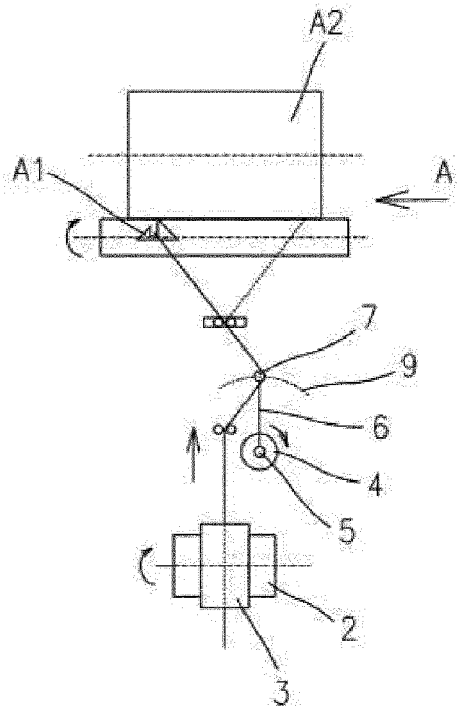

Fig. 2

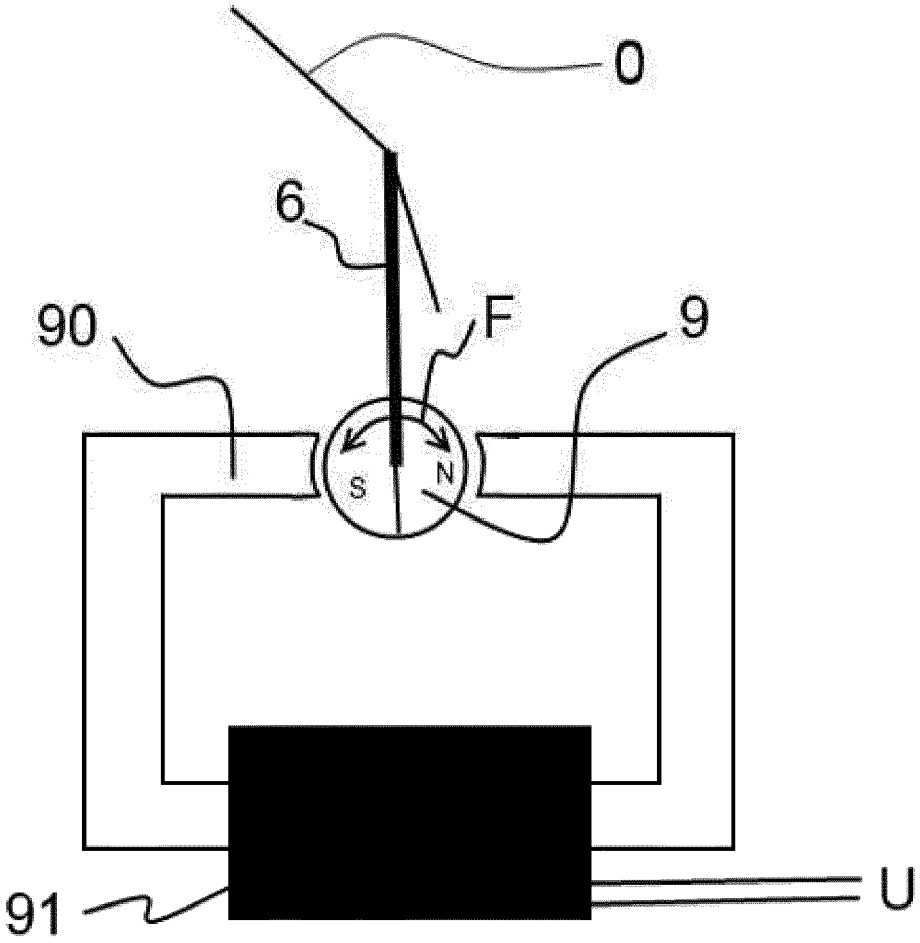

Fig. 3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 16 4865

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 375 112 B1 (ENGELHARDT DIETMAR [DE]) 23 April 2002 (2002-04-23) * column 4, line 49 - column 7, line 15; figures 2,3,4 *	1-13	INV. B65H59/00
X	CN 103 451 783 A (RIETER CZ S R O) 18 December 2013 (2013-12-18) * abstract; figure 1 *	1,2,4-7	
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