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(54) **Spinning Machine Having Yarn Slack Elimination Device**

Spinnmaschine mit Vorrichtung zur Beseitigung von Fadenlockerungen

Fileuse dotée d'un dispositif d'élimination du relâchement des fils

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## Description

BACKGROUND OF THE INVENTION

(1) Field of the Invention

**[0001]** In a textile machine of a spinning machine, the present invention relates to a spinning machine having yarn slack eliminating device for eliminating slacks of a yarn that may occur between a spinning device and a package winding device.

(2) Description of the Related Art

**[0002]** In a conventional high speed spinning machine such as an air type spinning machine for winding a spun yarn to form a package, if a yarn defect is detected, the tread defect is cut away by cutting means such as a cutter, and yarn tips which are sequentially sent from the spinning device and yarn ends on the side of the package are pieced by a piecing device. The piecing operation is carried out in a state where the winding operation of yarn is stopped. Therefore, it is necessary to eliminate slacks in the yarn between the spinning device and the package winding device.

**[0003]** As such a technique for eliminating slack in a yarn, there is proposed yarn slack eliminating device of a spinning machine as described, for example, in Japanese Patent Application Laid-open No.2004-277946 (Fig. 18, paragraphs [0024] to [0026]). The yarn slack eliminating device described in this Japanese Patent Application includes a yarn slack eliminating roller 21 which is rotated, and a rotary yarn hooking member 22. The yarn hooking member 22 is mounted on the yarn slack eliminating roller 21 such that the yarn hooking member 22 can relatively rotate concentrically with respect to the yarn slack eliminating roller 21, and a resistance of appropriate strength can be applied to the relative rotation by a pressing force (friction force) of a transmission force applying member 22f comprising biasing means such as a spring. The pressing force (friction force) can be adjusted in a stepless manner by a fastening operation of a transmission force adjusting section 22g having a yarning portion.

**[0004]** According to the technique of the above-mentioned Japanese Patent Application, since the relative rotation resistance of the yarn hooking member 22 is realized by the pressing force (friction force) of the transmission force applying member 22f, the relative rotation resistance can not be obtained stably in many cases due to unintentional factor such as flaw on a friction surface or change over time factor such as wear on the friction surface.

**[0005]** According to the technique of this Japanese Patent Application, when a yarn Y is released from the yarn slack eliminating roller 21, the relative rotation resistance is one of factors which determines a yarn winding tension, and if appropriate winding tension can not stably be obtained in accordance with a kind of yarn and a thickness of a yarn, a shape off the package 16 and the yarn releasing properties in subsequent steps are adversely influenced.

**[0006]** To solve this problem, the present assignee have already proposed a magnetic tensor device as shown in Figs. 5 and 6 as yarn slack eliminating device of a spinning machine, etc. capable of applying stable arbitrary winding tension, and have filed an patent application of this magnetic tensor device. As shown in Figs. 5 and 6, the magnetic tensor device generates a constant rotation torque between the yarn slack eliminating roller 71 and the rotatable yarn hooking member 72 in combination with a hysteresis material 87 and a permanent magnet 86, and changes an area where the hysteresis material 87 and the permanent magnet 86 are superposed (displacement by rotation operation of the adjusting bolt 82 as shown in Figs. 5 and 6), thereby adjusting the torque to an arbitrary rotation torque.

**[0007]** In the magnetic tensor device shown in Figs. 5 and 6, however, when a lot is changed, or rotation torques of many spindles are to be changed, it is necessary to adjust the spindles one by one, and much labor is required. Further, it is difficult to change a rotation torque while keeping the winding operation of a yarn due to its mechanism, and it is impossible to finely adjust during spinning and to positively change a rotation torque.

**[0008]** EP 1 457 448 A2 discloses a spinning machine with a slack eliminating device. The slack eliminating device comprises a slack eliminating roller and a bar-like member, which can be rotated synchronously or independently from each other. The bar like-member is mounted on a wheel member and is in frictional contact with a friction assembly comprising a nut, a presser member and a force applying member. By adjusting the frictional force between the wheel member and the friction assembly the threshold value of the rotation torque for independent rotation of the slack eliminating roller and the bar-like member is determined. Alternatively the threshold value of the rotation torque is adjusted on the basis of an electromagnetic force. A tension sensor is proposed, to monitor the tension of the yarn being unwound. EP'448 does not teach to positively change the rotation torque during spinning out operation, and to control the rotation torque based on the measurement signal of the tension measurement device.

**[0009]** US 6 244 395 B1 discloses an electromagnetic hysteresis brake consisting of a stationary brake magnet, inner and outer pole ring parts, an electromagnet, a rotating armature, a permanent magnet and a hysteresis ring projecting into an annular air gap which is formed between the inner and the outer pole ring parts. The electromagnet is controlled by an external controller, to adjust the magnetic friction force acting on the rotating armature. This document does not disclose to control the rotation torque between a yarn slack eliminating roller and a yarn hooking member by feedback control based on a tension measurement signal.

## SUMMARY OF THE INVENTION

**[0010]** Hence, the present invention has been accomplished to solve all of the problems in the conventional technique, and an especially important element is to provide yarn slack eliminating device provided therein with an electromagnetic tensor capable of realizing a stable rotation resistance with respect to a yarn slack eliminating roller of the yarn hooking member, and capable of forming a package of stable quality.

**[0011]** To achieve the above object, according to a first aspect of the present invention, yarn slack eliminating device in which an electromagnetic tensor is incorporated includes a rotating and driving source, a yarn slack eliminating roller which is rotated and driven by the rotating and driving source, and a yarn hooking member which is mounted on the yarn slack eliminating roller such that the yarn hooking member can relatively rotate concentrically with the yarn slack eliminating roller, the yarn slack eliminating roller is provided with magnetic field forming means by electromagnet so that a magnetic field is applied to the yarn hooking member, a rotation torque is generated between the yarn slack eliminating roller and the yarn hooking member by the magnetic field generated by the magnetic field forming means, and the rotation torque is controlled by input control to the electromagnet.

**[0012]** The rotation torque is set between the yarn slack eliminating roller and the yarn hooking member in unison from a control device with respect to the yarn slack eliminating device of each spinning unit.

**[0013]** Each of the spinning units includes yarn tension measuring means for measuring an actual yarn tension at the time of a spinning out operation, and a rotation torque between the yarn slack eliminating roller and the yarn hooking member is feedback controlled based on a tension measurement signal.

**[0014]** According to a second aspect of the invention, the yarn slack eliminating device in which the electromagnetic tensor is incorporated in the first aspect of the invention is provided, wherein the magnetic field forming means includes a stationary annular exciting coil, an outer magnetic pole member having an outer magnetic pole is disposed outside the exciting coil, an inner magnetic pole member having an inner magnetic pole is disposed inside the exciting coil, the outer and inner magnetic pole members and the yarn slack eliminating roller are integrally rotated, a magnetic field is generated between the outer magnetic pole and the inner magnetic pole, and an annular member of hysteresis material is disposed integrally with the yarn hooking member so as to intersect with the magnetic field generated between the outer magnetic pole and the inner magnetic pole.

**[0015]** According to the yarn slack eliminating device in which the electromagnetic tensor of the invention is incorporated, the magnetic field forming means by the electromagnet is provided in the yarn slack eliminating roller, the rotation torque is generated between the yarn slack eliminating roller and the yarn hooking member by the magnetic field generated by the magnetic field forming means, and the rotation torque is controlled by the input control to the electromagnet. With this, it is possible to realize a stable rotation resistance against the yarn slack eliminating roller of the yarn hooking member, and to form a package of stable quality.

**[0016]** Further, according to this invention, the magnetic field forming means includes a stationary annular exciting coil, an outer magnetic pole member having an outer magnetic pole is disposed outside the exciting coil, an inner magnetic pole member having an inner magnetic pole is disposed inside the exciting coil, the outer and inner magnetic pole members and the yarn slack eliminating roller are integrally rotated, a magnetic field is generated between the outer magnetic pole and the inner magnetic pole, and an annular member of hysteresis material is disposed integrally with the yarn hooking member so as to intersect with the magnetic field generated between the outer magnetic pole and the inner magnetic pole. With this, if current flows through the exciting coil, the magnetic field rotates together with the yarn slack eliminating roller, and a relative rotation torque is obtained in the yarn hooking member with respect to the rotating yarn slack eliminating roller. This rotation torque is varied depending upon the magnitude of the magnetic field and thus, if voltage or current applied to the coil is varied, an arbitrary rotation torque can be obtained. As a result, if a predetermined control value is input, an arbitrary rotation torque can be set with a simple operation.

**[0017]** In this invention, with the above-described structure, if high-end control device is provided, torques of the plurality of spindles can be changed at a time. It is also possible to change a rotation torque during the spinning out operation and thus, it is possible to positively change the tension during the winding operation. If means for measuring an actual yarn tension at the time of the spinning out operation is provided, feedback control based on its signal can be performed. Therefore, even if the tension is varied due to some reason such as disturbance, it is possible to change the magnetic field in real time and the tension can be returned to any tension.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0018]**

Fig. 1 is a schematic front view showing one example of the entire spinning machine to which the present invention is applied;

Fig. 2 is a schematic partial sectional side view of the spinning machine shown in Fig. 1;

Fig. 3 shows a concrete example of yarn slack eliminating device, and is a schematic half sectional perspective view showing an internal structure thereof;

Fig. 4A is a schematic vertical sectional view of the yarn slack eliminating device 7, and Fig. 4B is a schematic transverse sectional view taken along the line 4B-4B as viewed from the arrow in Fig. 4A;

Fig. 5 is a schematic side sectional view showing an example of a conventional magnetic sensor which is a combination of a permanent magnet and a hysteresis material; and

Fig. 6 is a schematic side sectional view showing the conventional magnetic sensor shown in Fig. 5 in which an adjusting bolt is displaced.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0019]** Yarn slack eliminating device provided therein with an electromagnetic tensor of the invention will be explained in detail based on a concrete embodiment shown in the drawings.

**[0020]** Fig. 1 is a schematic front view showing one example of the entire spinning machine to which the present invention is applied. Fig. 2 is a schematic partial sectional side view of the spinning machine shown in Fig. 1.

**[0021]** First, a spinning machine 1 to which the present invention is applied will be explained. As shown in Fig. 1, in the spinning machine 1, many spinning units U are arranged in a longitudinal direction of the spinning machine 1 between a motor box MB and a dust box DB. The spinning machine 1 is provided with rails R running along a direction in which the spinning units U are arranged, and a piecing truck 3 can reciprocate in the lateral direction on the rails R. The piecing truck 3 runs to the spinning unit U which requires piecing, stops at a position of the corresponding spinning unit U, and carries out the piecing operation.

**[0022]** As shown in Figs. 1 and 2, each spinning unit U includes a draft device 4, a spinning device 5, a yarn feeding device 6, a slack eliminating device 7 and a winding device 8 as main constituent elements disposed from upstream to downstream. The draft device 4 is for drawing a sliver SL to obtain a fiber bundle Y. Each draft device 4 includes four pairs of rollers, i.e., a pair of back rollers 9 including a top roller and a bottom roller, a pair of side rollers 10, a pair of middle rollers 12 around which an apron belt 11 is wound, and a pair of front rollers 13.

**[0023]** A detailed structure of the spinning device 5 is not illustrated but in this embodiment, an air type structure is employed in which a turning wind current from an air injection nozzle is utilized and a spun yarn SY is produced from a draught fiber bundle Y.

**[0024]** The yarn feeding device 6 includes a delivery roller 14 and a nip roller 15 provided such that it comes into contact with the delivery roller 14. A spun yarn SY sent out from the spinning device 5 is sandwiched between the delivery roller 14 and the nip roller 15 and is sent downward by rotation of the delivery roller 14.

**[0025]** The spun yarn SY sent out from the spinning device 5 is fed downstream by the yarn feeding device 6, and is winding around a winding package WP by the winding device 8 through a cutter device 16 which removes a defect of a yarn, a yarn clearer 17 and yarn slack eliminating device 7.

**[0026]** The yarn clearer 17 monitors a thickness of the running spun yarn SY, and when the yarn clearer 17 detects a yarn defect of the spun yarn SY, the yarn clearer 17 sends a yarn defect detection signal to a unit controller (not shown). If the unit controller receives the yarn defect detection signal, the unit controller immediately operates the cutter device 16 to cut the yarn, stops the draft device 4 and the spinning device 5, and allows the piecing truck 3 to run in front of that spinning unit U. Then, the spinning device 5 and the like are again driven, and the piecing truck 3 is allowed to piece, and the spinning and winding operations are restarted.

**[0027]** As shown in Fig. 1, the piecing truck 3 is provided such that it run along the rails R provided on a casing 2 of a main body of the spinning machine 1. The piecing truck 3 includes a suction pipe (supply side yarn end capturing means) 18 for sucking and capturing a spun yarn SY which is continuously supplied from the supply side spinning device 5, a suction mouth (winding side yarn end capturing means) 19 for sucking and capturing a spun yarn SY on the winding package WP side, and a piecing device 20 for piecing a spun yarn SY captured by the suction pipe 18 and a spun yarn SY captured by the suction mouth 19 to each other.

**[0028]** A suction air flow is generated at ends of the suction pipe 18 and the suction mouth 19 by a suction flow generating source (not shown), and the yarn end is sucked and captured. The piecing device 20 includes a clamp section, a cutter section and a splicer or a knotter (not shown). A spun yarn SY which is draught and spun by the spinning machine 1 is formed as a winding package WP by the winding device 8.

**[0029]** In this invention, the yarn slack eliminating devices 7 respectively provided in the plurality of spinning units U can engage or do not engage the spun yarn SY.

**[0030]** In this invention, as shown in Figs. 3 and 4, the yarn slack eliminating device 7 includes the yarn slack eliminating roller 21 for winding a spun yarn SY around its outer periphery and stores the same, the yarn hooking member 22 which coaxially rotates integrally with or independently from the yarn slack eliminating roller 21 in accordance with a condition, an upstream guide 23 disposed slightly upstream from the yarn slack eliminating roller 21, advancing and retreating means (e.g., air cylinder 24) which advances or retreat the upstream guide 23, a rotating and driving source 25 such as an electric motor for rotating the yarn slack eliminating roller 21, and a downstream guide 26 provided downstream from the yarn slack eliminating roller 21.

**[0031]** The upstream guide 23 is moved forward and backward by the air cylinder 24. When the upstream guide 23 is in the advance position, the yarn road is held by the upstream guide 23 so that the spun yarn SY is not engaged with the yarn hooking member 22 in the yarn slack eliminating device 7. When the upstream guide 23 is the retreat position, the spun yarn SY moves on the yarn road to a position where the spun yarn SY is engaged with the yarn hooking member 22 in the yarn slack

eliminating device 7 and wound around the yarn slack eliminating roller 21.

**[0032]** Of constituent members of the yarn slack eliminating device 7, the yarn slack eliminating roller 21, the upstream guide 23, the air cylinder 24, the rotating and driving source 25 and the downstream guide 26 are supported by the spinning unit U through a fixing member such as a bracket 27.

**[0033]** Fig. 3 shows a concrete example of the yarn slack eliminating device 7, and is a schematic half sectional perspective view showing an internal structure thereof. Fig. 4A is a schematic vertical sectional view of the yarn slack eliminating device 7. 4B is a schematic transverse sectional view taken along the line 4B-4B as viewed from the arrow in Fig. 4A.

**[0034]** As shown in Figs. 3 and 4, the yarn slack eliminating roller 21 is constituted by a rotary structure RS which is integrally rotated by the rotating and driving source 25. The rotary structure RS includes an inner magnetic pole member 29 connected to a rotation shaft 28 of the rotating and driving source 25, an outer magnetic pole member 32 connected to the inner magnetic pole member 29 through a non-magnetic member 31 mounted by a mounting screw 30, and a yarn slack eliminating roller main body 33 fixed to the outer magnetic pole member 32. These members are integrally rotated by rotation of the rotating and driving source 25.

**[0035]** If a side of an outer peripheral surface 33a of the yarn slack eliminating roller main body 33 having the yarn hooking member 22 is defined as a tip end and a side of the outer peripheral surface 33a of the yarn slack eliminating roller main body 33 connected to the rotating and driving source 25 is defined as a base end, a base end side tapered portion a, a cylindrical portion b and a tip end side tapered portion c are arranged from the base end toward the tip end. The base end side tapered portion a and the tip end side tapered portion c have the largest diameters and are gently tapered toward the other ends. The cylindrical portion b is tapered to its tip end, and is continuously connected to both tapered portions seamlessly.

**[0036]** At the time of the piecing operation by the piecing truck 3, the yarn slack eliminating device 7 winding the spun yarn SY from the spinning device 5 from the base end of the yarn slack eliminating roller main body 33 around the outer peripheral surface 33a of the yarn slack eliminating roller main body 33 by the yarn hooking member 22. After the piecing operation is completed, the spun yarn SY wound and stored around the outer peripheral surface 33a is released from the tip end of the yarn slack eliminating roller main body 33 toward the winding device 8 through the yarn hooking member 22.

**[0037]** In the outer peripheral surface 33a of the yarn slack eliminating roller main body 33, the base end side tapered portion a smoothly moves the supplied and wound spun yarn SY from a large diameter portion toward a small diameter portion of the base end side tapered portion a, and the spun yarn SY reaches the intermediate cylindrical portion b, thereby regularly winding the spun yarn SY around the surface of the intermediate cylindrical portion b. When releasing the spun yarn SY, the tip end side tapered portion c prevents the wound spun yarn SY from coming out at a time, and winding the spun yarn SY from the small diameter portion to the end surface side large diameter portion sequentially to reliably pull out the spun yarn SY smoothly.

**[0038]** A magnetic field forming means 34 by an electromagnet includes a stationary annular exciting coil 35 fixed to the bracket 27 or the like. The inner magnetic pole member 29 is disposed inside 35a of the annular exciting coil 35, and the outer magnetic pole member 32 is disposed outside 35b of the exciting coil 35.

**[0039]** The inner magnetic pole member 29 includes an opposed portion 36 which is opposed along the inside 35a of the annular exciting coil 35, and an inner magnetic pole 37 extending in the axial direction from the opposed portion 36. The outer magnetic pole member 32 includes an opposed portion 38 opposed along the outside 35b of the exciting coil 35, and an outer magnetic pole 39 extending in the axial direction from the opposed portion 38.

**[0040]** As shown in Fig. 4B, the inner magnetic pole 37 includes eight outward convex portions 40 extending radially outward at equal distances from each other. The outer magnetic pole 39 includes, for example, eight inward convex portions 41 extending radially inward at equal distances from each other. Magnetic field forming spaces 42 are formed between the outward convex portions 40 of the inner magnetic pole 37 and the inward convex portions 41 of the outer magnetic pole 39.

**[0041]** The yarn hooking member 22 in the yarn slack eliminating device 7 is assembled such that the yarn hooking member 22 can rotate independently from a rotation system of the yarn slack eliminating roller 21. More specifically, the yarn hooking member 22 is integrally provided with a flier shaft 44 which is supported by a bearing means 43 such that the flier shaft 44 can relatively coaxially rotate with the inner magnetic pole member 29, a flier 45 fixed to the outer end 44a of the flier shaft 44, and an annular member 46 of hysteresis material extending and positioned in the magnetic field forming space 42.

**[0042]** The flier 45 has such a shape that the flier 45 is engaged with the spun yarn SY (caught on the spun yarn SY) to appropriately curve the spun yarn SY toward the outer peripheral surface 33a of the yarn slack eliminating roller main body 33.

**[0043]** In such a structure, the yarn slack eliminating device 7 is operated as follows. That is, when current is supplied to the exciting coil 35 in the magnetic field forming means 34, the inner magnetic pole member 29 an and the outer magnetic pole member 31 are excited. A hysteresis annular member 46 which is integrally assembled to the yarn hooking member 22 such that the hysteresis annular member 46 intersects with the magnetic field is disposed in a magnetic field forming space 42 formed between the inner magnetic pole 37 in the inner

magnetic pole member 29 and the outer magnetic pole 39 in the outer magnetic pole member 31. A rotation torque can be generated between the yarn slack eliminating roller 21 and the rotatable yarn hooking member 22 by the electromagnet with respect to the yarn slack eliminating roller 21 and the hysteresis annular member with respect to the yarn hooking member 22.

**[0044]** Like the concrete embodiment shown in Figs. 3 and 4, the exciting coil 35 is handled as a stationary system, the inner magnetic pole member 29 and the outer magnetic pole member 31 are disposed with respect to the exciting coil 35, and they are rotated integrally with the yarn slack eliminating roller 21. If current flows through the exciting coil 35 in such a state, the magnetic field rotates together with the yarn slack eliminating roller 21. If the hysteresis annular member which is integral with the yarn hooking member 22 is disposed in the magnetic field, a relative rotation torque is obtained in the yarn hooking member 22 with respect to the rotating yarn slack eliminating roller 21.

**[0045]** This rotation torque is varied depending upon the magnitude of the magnetic field. Thus, if voltage or current given to the exciting coil 35 is varied, an arbitrary rotation torque can be obtained. As a result, if a preset control value is input, an arbitrary rotation torque can be set with a simple operation.

**[0046]** In the above structure, if a high-end control device is provided, torques of a plurality of spindles can be changed in unison. Further, it is possible to change the rotation torque during spinning out operation and thus, it is possible to positively change tension during the winding operation. If means for measuring the actual yarn tension during the spinning out operation, a feedback control based on a signal of the means can be performed, Thus, when the tension is varied due to some reason such as disturbance, it is possible to change the magnetic field in real time, and to return the tension to any tension.

**[0047]** The operation of the spinning machine 1 having the above-described structure will be explained. Each spinning unit U of the spinning machine 1 sends out the fiber bundle Y to the spinning device 5 by the draft device 4. The spun yarn SY spun and produced in the spinning device 5 is supplied to the downstream by the yarn feeding device 6, passes through the cutter device 16 and the yarn clearer 17, and finally feed the winding device 8 through the yarn slack eliminating device 7, and is winding as the package WP.

**[0048]** When the yarn clearer 17 of any of the spinning units U detects a defect of the spun yarn SY, the unit controller (not shown) of that spinning unit U cut the spun yarn SY using the cutter device 16, and substantially at the same time, rotations of the pair of back rollers 9 and the pair of side rollers 10 of the draft device 4 are stopped. The fiber bundle Y is yanked and cut between the stopped pair of third rollers 10 and the rotating pair of middle rollers 12, and the spun yarn SY downstream from the cut portion are sucked and removed by the suction means (not shown).

**[0049]** The unit controller of the spinning unit U sends a yarn piecing request signal to the piecing truck 3, and the piecing truck 3 moves to a position opposed to that spinning unit U and stops. Then, the unit controller starts rotating the yarn slack eliminating roller 21 of the yarn slack eliminating device 7 at appropriate timing. At the same time, the unit controller moves the upstream guide 23 of the yarn slack eliminating device 7 forward by the air cylinder 24, and holds the yarn road so that a spun yarn SY which is spun next is not engaged with the yarn hooking member 22 of the yarn slack eliminating device 7 when it is unnecessary.

**[0050]** If the suction pipe 18 of the piecing truck 3 is turned upward, the driving operations of the draft device 4 and the spinning device 5 are started substantially in synchronization with the upward turning, and the spun yarn SY which is spun out from the spinning device 5 is sucked and captured by the suction pipe 18. The suction mouth 19 of the piecing truck 3 is turned downward on the side of the winding device 7, and the yarn end wound around the package WP is sucked and captured. The suction pipe 18 and the suction mouth 19 guide the sucked yarn ends to the piecing device 20 and carry out the piecing operation.

**[0051]** Immediately before the piecing operation is started by the piecing device 20, the air cylinder 24 retreats in the yarn slack eliminating device 7, and the upstream guide 23 is moved to the retreat position. The yarn road of the spun yarn SY is changed such that the yarn road is superposed on the rotation locus of the flier 45 in the yarn hooking member 22. As a result, the spun yarn SY is wound around the outer peripheral surface 33a of the yarn slack eliminating roller 21 by the flier 45.

**[0052]** That is, the spinning out operation of the spun yarn SY from the spinning device 5 is continued also during the piecing operation at the piecing device 20. Thus, if it is left as it is, a large amount of spun yarn SY stays upstream of the piecing device 20. The yarn slack eliminating device 7 winds the spun yarn SY around the yarn slack eliminating roller 21 during the piecing operation by the piecing device 20, thereby preventing the slack and residence of the spun yarn SY, and realizing smooth piecing operation and spinning resuming operation.

**[0053]** As described above, the flier 45 and the flier shaft 44 can rotate independently from the yarn slack eliminating roller 21, but the flier 45 rotates integrally with the yarn slack eliminating roller 21 unless a load greater than a given magnification (load overcoming a hysteresis torque acting on the electromagnet and the hysteresis annular member) is applied by a mechanism comprising the electromagnet and the hysteresis annular member 46. During the piecing operation, downstream side of the spun yarn SY is stopped, and a load applied to the flier 45 is small. Thus, the flier 45 rotates integral with the yarn slack eliminating roller 21 and winds the spun yarn SY around the outer periphery of the yarn slack eliminating roller 21.

**[0054]** After the piecing operation by the piecing device 20 is completed, the package WP is rotated by a winding drum in the winding device 8, and the winding operation of the spun yarn SY is resumed.

**[0055]** The spun yarn SY which is spun out from the spinning device 5 is wound around the outer peripheral surface 33a of the yarn slack eliminating roller 21 which keeps rotating while the winding operation is resumed from the start of the piecing operation by the piecing device 20. If the winding operation by the winding device 8 is resumed, since a ratio of a feeding out speed of the yarn feeding device 6 and a winding speed of the winding device 8 is set such that appropriate tension is given to the spun yarn SY, a speed of yarn pulled out from the yarn slack eliminating roller 21 is faster than a speed of yarn wound around the yarn slack eliminating roller 21. Therefore, the flier 45 of the yarn slack eliminating device 7 rotates independently from the yarn slack eliminating roller 21 which keeps rotating in the winding direction, and the spun yarn SY wound and stored around the yarn slack eliminating roller 21 is gradually released. The tension given to the spun yarn SY at that time is determined by the relative rotation torque between the yarn hooking member 22 and the yarn slack eliminating roller 21 of the invention.

## Claims

1. A spinning machine comprising a plurality of spinning units arranged side by side, in which each spinning unit has a draft device (4), a spinning device (5), a yarn feeding device (6), yarn slack eliminating device (7) and a winding device (8) arranged on a yarn road in this order from upstream to downstream of the yarn road, the yarn slack eliminating device (7) includes a rotating and driving source (25), a yarn slack eliminating roller (21) which is rotated and driven by the rotating and driving source (25), and a yarn hooking member (22) which is mounted on the yarn slack eliminating roller (21) such that the yarn hooking member (22) can relatively rotate concentrically with the yarn slack eliminating roller (21),
   wherein the yarn slack eliminating roller (21) is provided with magnetic field forming means (34) by electromagnet so that a magnetic field is applied to the yarn hooking member (22), a rotation torque is generated between the yarn slack eliminating roller (21) and the yarn hooking member (22) by the magnetic field generated by the magnetic field forming means (34), and
   each of the spinning units includes yarn tension measuring means for measuring an actual yarn tension at the time of a spinning out operation,
   **characterized in that**
   the rotation torque is controlled by input control to the electromagnet,
   the rotation torque is set between the yarn slack eliminating roller (21) and the yarn hooking member (22) in unison from a high-end control device with respect to the yarn slack eliminating device (7) of each spinning unit, and
   the rotation torque between the yarn slack eliminating roller (21) and the yarn hooking member (22) is feedback controlled based on the tension measurement signal.

2. The spinning machine according to claim 1, wherein the magnetic field forming means (34) includes a stationary annular exciting coil (35), an outer magnetic pole member (38) having an outer magnetic pole (39) is disposed outside the exciting coil (35), an inner magnetic pole member (36) having an inner magnetic pole (37) is disposed inside the exciting coil (35), the outer and inner magnetic pole members (38, 36) and the yarn slack eliminating roller (21) are integrally rotated, a magnetic field is generated between the outer magnetic pole (39) and the inner magnetic pole (37), and an annular member (46) of hysteresis material is disposed integrally with the yarn hooking member (22) so as to intersect with the magnetic field generated between the outer magnetic pole (39) and the inner magnetic pole (37).

## Patentansprüche

1. Spinnmaschine, umfassend eine Mehrzahl von Spinneinheiten, die nebeneinander angeordnet sind, wobei jede Spinneinheit ein Streckwerk (4), eine Spinnvorrichtung (5), eine Garnzufuhrvorrichtung (6), eine Garndurchhangbeseitigungsvorrichtung (7) und eine Aufspulvorrichtung (8), die auf einer Garnstraße in dieser Reihenfolge von stromaufwärts zu stromabwärts der Garnstraße angeordnet sind, aufweist, wobei die Garndurchhangbeseitigungsvorrichtung (7) eine Rotations- und Antriebsquelle (25), eine Garndurchhangbeseitigungswalze (21), die durch die Rotations- und Antriebsquelle (25) gedreht und angetrieben wird, und ein Garneinhakelement (22) umfasst, das auf der Garndurchhangbeseitigungswalze (21) montiert ist, so dass sich das Garneinhakelement (22) zur Garndurchhangbeseitigungswalze (21) in Bezug dazu konzentrisch drehen kann,
   wobei die Garndurchhangbeseitigungswalze (21) mit einer Magnetfeldbildungseinrichtung (34) durch Elektromagnet versehen ist, so dass ein Magnetfeld an das Garneinhakelement (22) angelegt wird, ein Drehmoment zwischen der Garndurchhangbeseitigungswalze (21) und dem Garneinhakelement (22) durch das durch die Magnetfeldbildungseinrichtung (34) erzeugte Magnetfeld erzeugt wird, und
   jede der Spinneinheiten eine Garnspannungsmesseinrichtung zum Messen einer Ist-Garnspannung zum Zeitpunkt eines Spinngarnabgabebetriebs um-

fasst,
**dadurch gekennzeichnet, dass**
das Drehmoment durch eine Eingabesteuerung zum Elektromagneten gesteuert wird,
das Drehmoment zwischen der Garndurchhangbeseitigungswalze (21) und dem Garneinhakelement (22) von einem High-End-Steuergerät bezüglich der Garndurchhangbeseitigungsvorrichtung (7) jeder Spinneinheit unisono eingestellt wird, und
das Drehmoment zwischen der Garndurchhangbeseitigungswalze (21) und dem Garneinhakelement (22) auf Grundlage des Spannungsmesssignals rückkopplungsgeregelt wird.

**2.** Spinnmaschine nach Anspruch 1, bei der die Magnetfeldbildungseinrichtung (34) eine stationäre ringförmige Erregerspule (35) umfasst, ein äußeres Magnetpolelement (38) mit einem äußeren Magnetpol (39) außerhalb der Erregerspule (35) angeordnet ist, ein inneres Magnetpolelement (36) mit einem inneren Magnetpol (37) im Innern der Erregerspule (35) angeordnet ist, das äußere und innere Magnetpolelement (38, 36) und die Garndurchhangbeseitigungswalze (21) als Einheit gedreht werden, ein Magnetfeld zwischen dem äußeren Magnetpol (39) und dem inneren Magnetpol (37) erzeugt wird, und ein ringförmiges Element (46) aus Hysteresematerial mit dem Garneinhakelement (22) als Einheit angeordnet ist, um sich mit dem Magnetfeld zu schneiden, das zwischen dem äußeren Magnetpol (39) und dem inneren Magnetpol (37) erzeugt wird.

## Revendications

**1.** Métier à filer comprenant une pluralité d'unités de filage agencées côte à côte, dans laquelle chaque unité de filage comporte un dispositif d'étirage (4), un dispositif de filage (5), un dispositif d'appel du fil (6), un dispositif d'élimination de mou de fil (7) et un dispositif d'enroulement (8) agencés sur une route de fil dans cet ordre d'amont en aval de la route de fil, le dispositif d'élimination de mou de fil (7) comporte une source de rotation et d'entraînement (25), un rouleau d'élimination de mou de fil (21) qui est tourné et entraîné par la source de rotation et d'entraînement (25), et un élément d'accrochage de fil (22) qui est monté sur le rouleau d'élimination de mou de fil (21) de telle sorte que l'élément d'accrochage de fil (22) puisse tourner relativement concentriquement avec le rouleau d'élimination de mou de fil (21),
dans lequel le rouleau d'élimination de mou de fil (21) est doté d'un moyen de formation de champ magnétique (34) par électro-aimant de telle sorte qu'un champ magnétique soit appliqué à l'élément d'accrochage de fil (22), un couple de rotation est généré entre le rouleau d'élimination de mou de fil (21) et l'élément d'accrochage de fil (22) par le champ magnétique généré par le moyen de formation de champ magnétique (34), et
chacune des unités de filage comporte un moyen de mesure de tension de fil pour mesurer une tension de fil effective au moment d'une opération de filage,
**caractérisé en ce que**
le couple de rotation est commandé par une commande d'entrée de l'électroaimant,
le couple de rotation est établi entre le rouleau d'élimination de mou de fil (21) et l'élément d'accrochage de fil (22) à l'unisson depuis un dispositif de commande amont relativement au dispositif d'élimination de mou de fil (7) de chaque unité de filage, et
le couple de rotation entre le rouleau d'élimination de mou de fil (21) et l'élément d'accrochage de fil (22) est commandé par rétroaction en fonction du signal de mesure de tension.

**2.** Métier à filer selon la revendication 1, dans laquelle le moyen de formation de champ magnétique (34) comporte une bobine d'excitation annulaire fixe (35), un élément de pôle magnétique externe (38) ayant un pôle magnétique externe (39) est disposé en dehors de la bobine d'excitation (35), un élément de pôle magnétique interne (36) ayant un pôle magnétique interne (37) est disposé à l'intérieur de la bobine d'excitation (35), les éléments de pôles magnétiques externe et interne (38, 36) et le rouleau d'élimination de mou de fil (21) sont tournés en tant que tout, un champ magnétique est généré entre le pôle magnétique externe (39) et le pôle magnétique interne (37), et un élément annulaire (46) de matériau d'hystérésis est disposé en tant que tout avec l'élément d'accrochage de fil (22) de façon à intersecter le champ magnétique généré entre le pôle magnétique externe (39) et le pôle magnétique interne (37).

Fig. 1

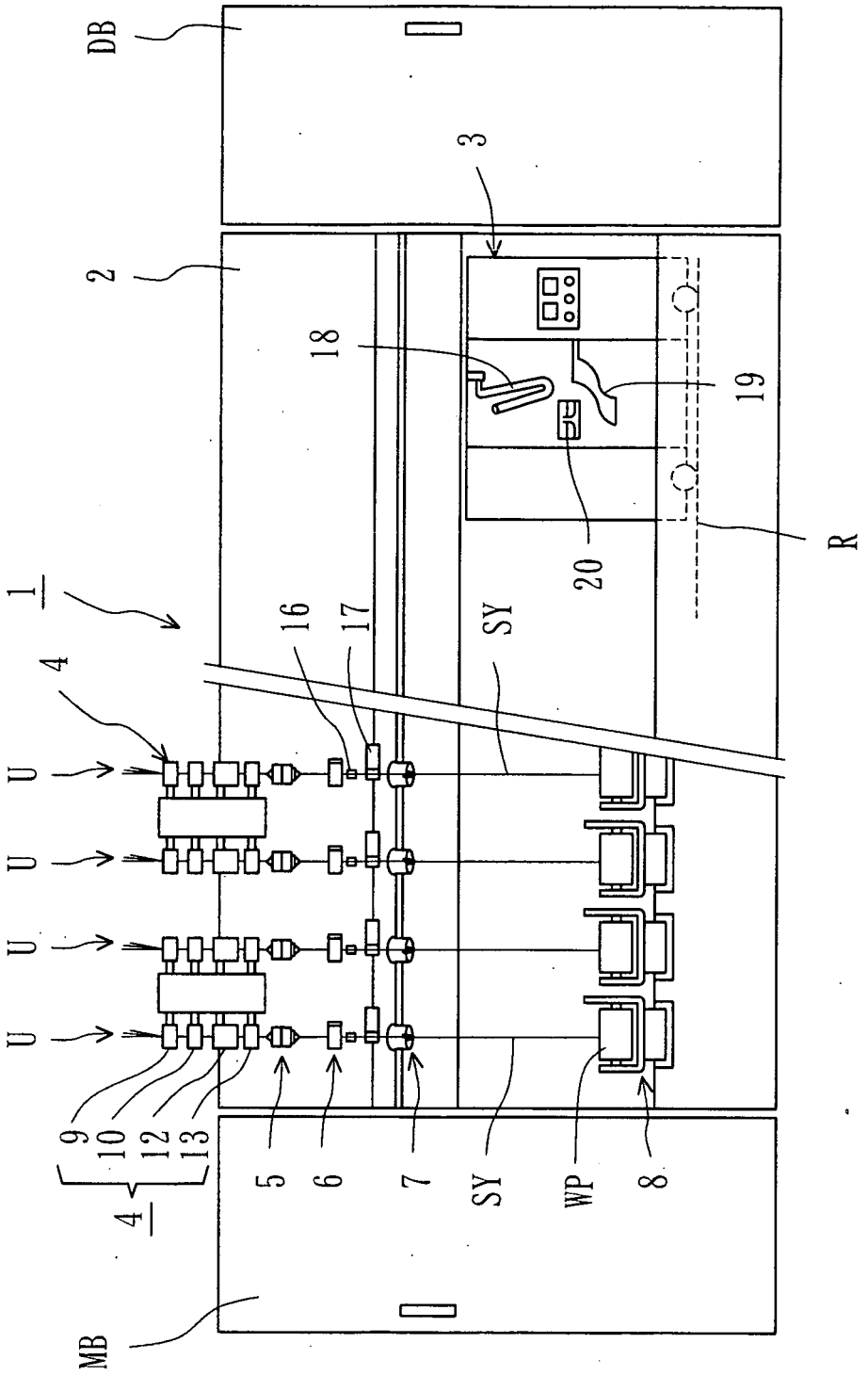


Fig. 2

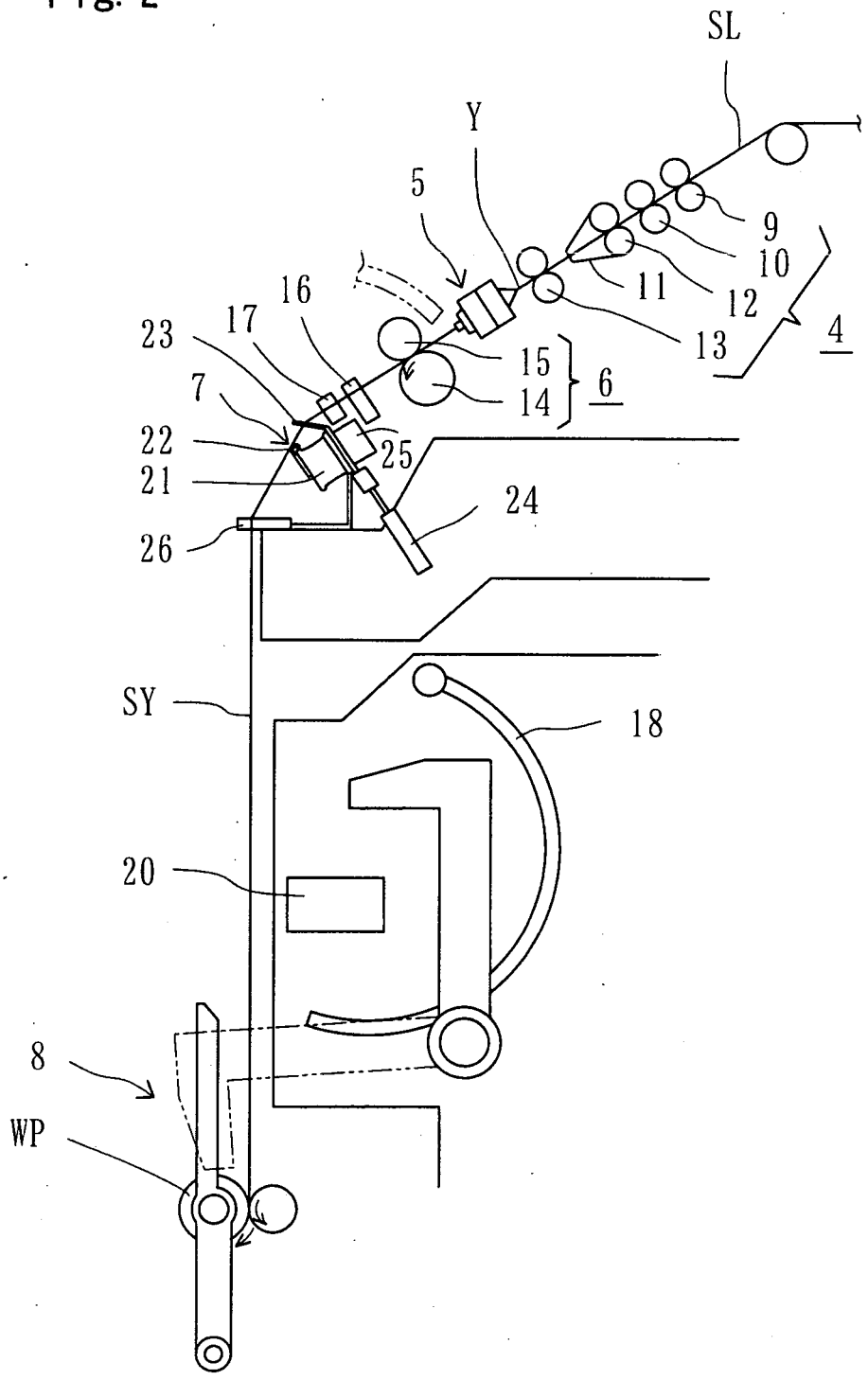


Fig. 3

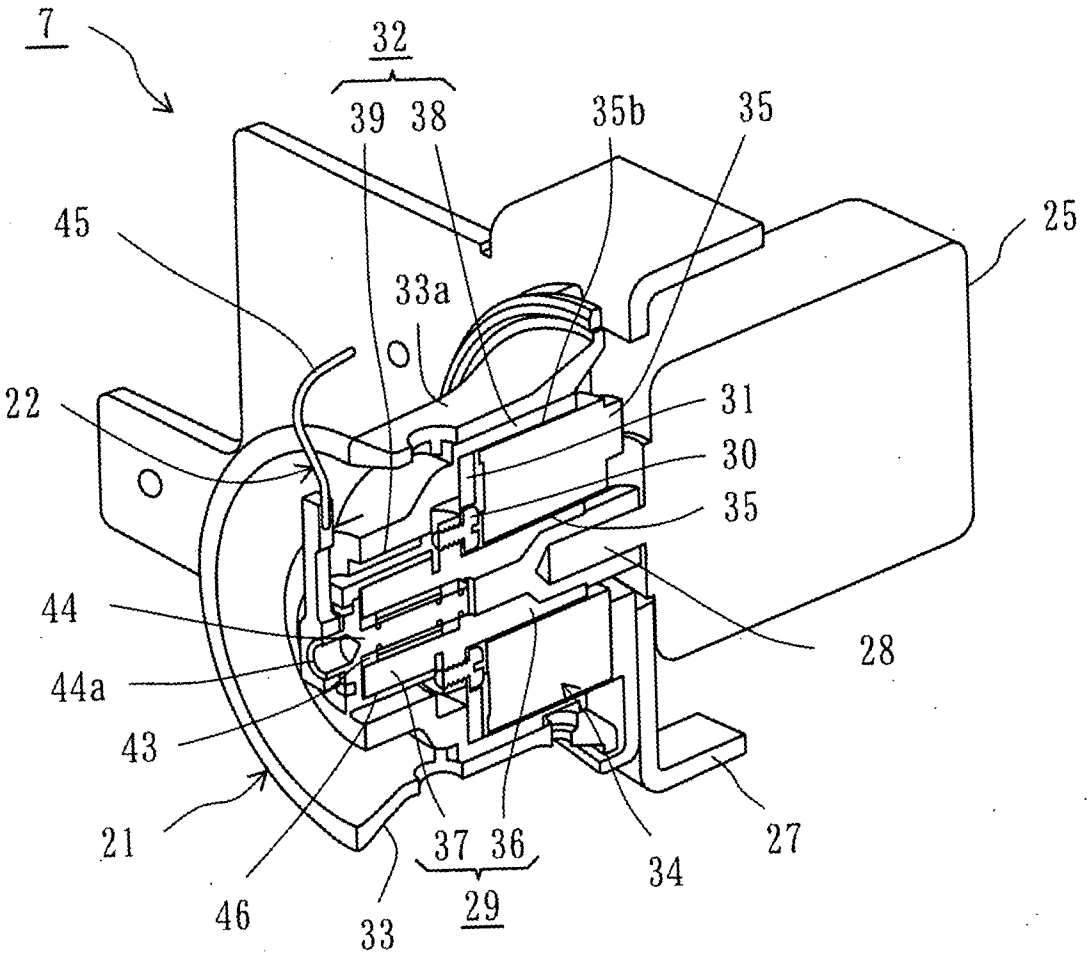
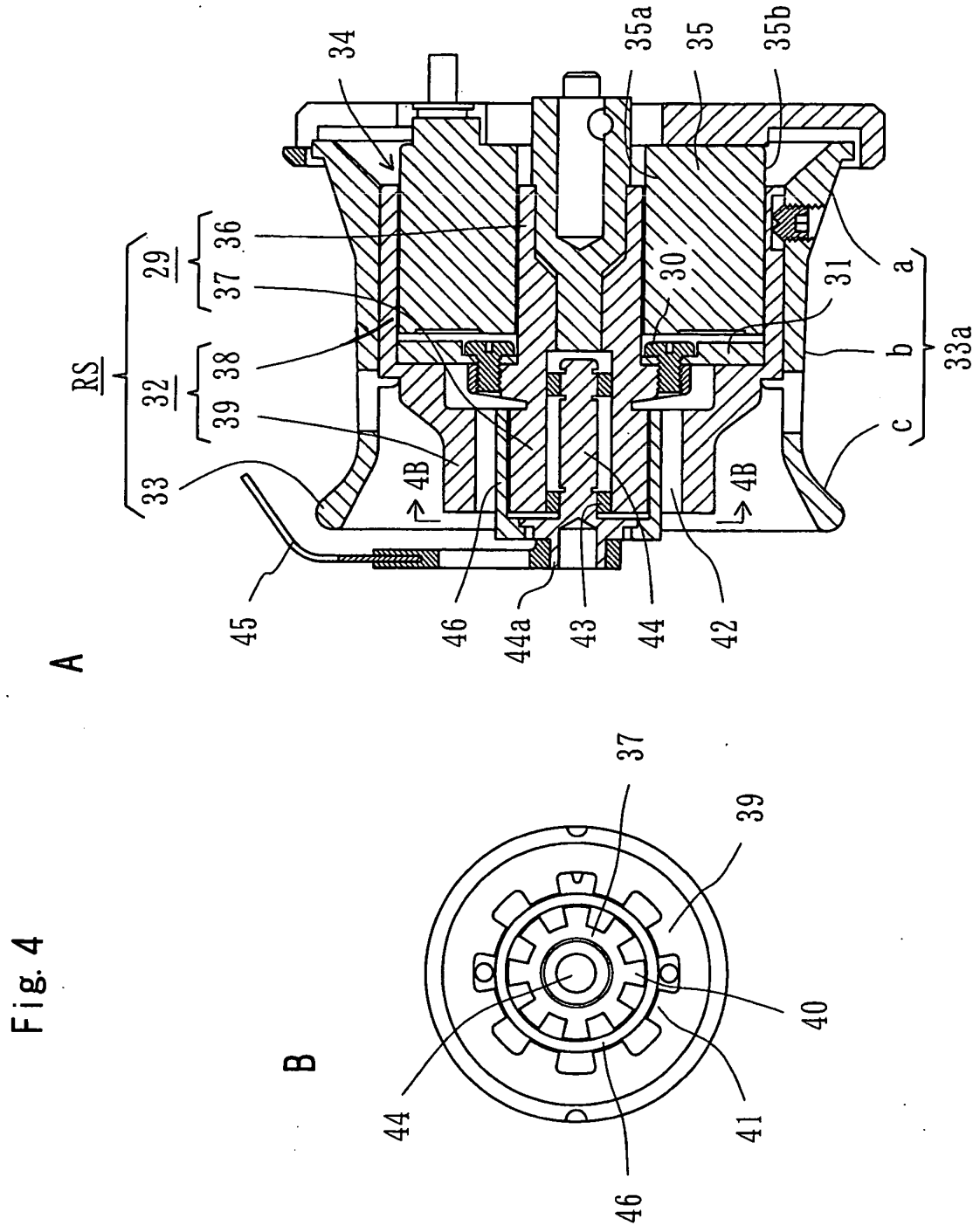

7
32
39
38
35b
35
25
45
33a
22
31
30
35
44
28
44a
43
21
37
36
34
27
46
33
29

Fig. 4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B
RS
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32
33
34
35a
35
35b
36
37
38
39
30
31
a
b
c
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4B
4B
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46
44a
43
44
42
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40
44
41
46

Fig. 5

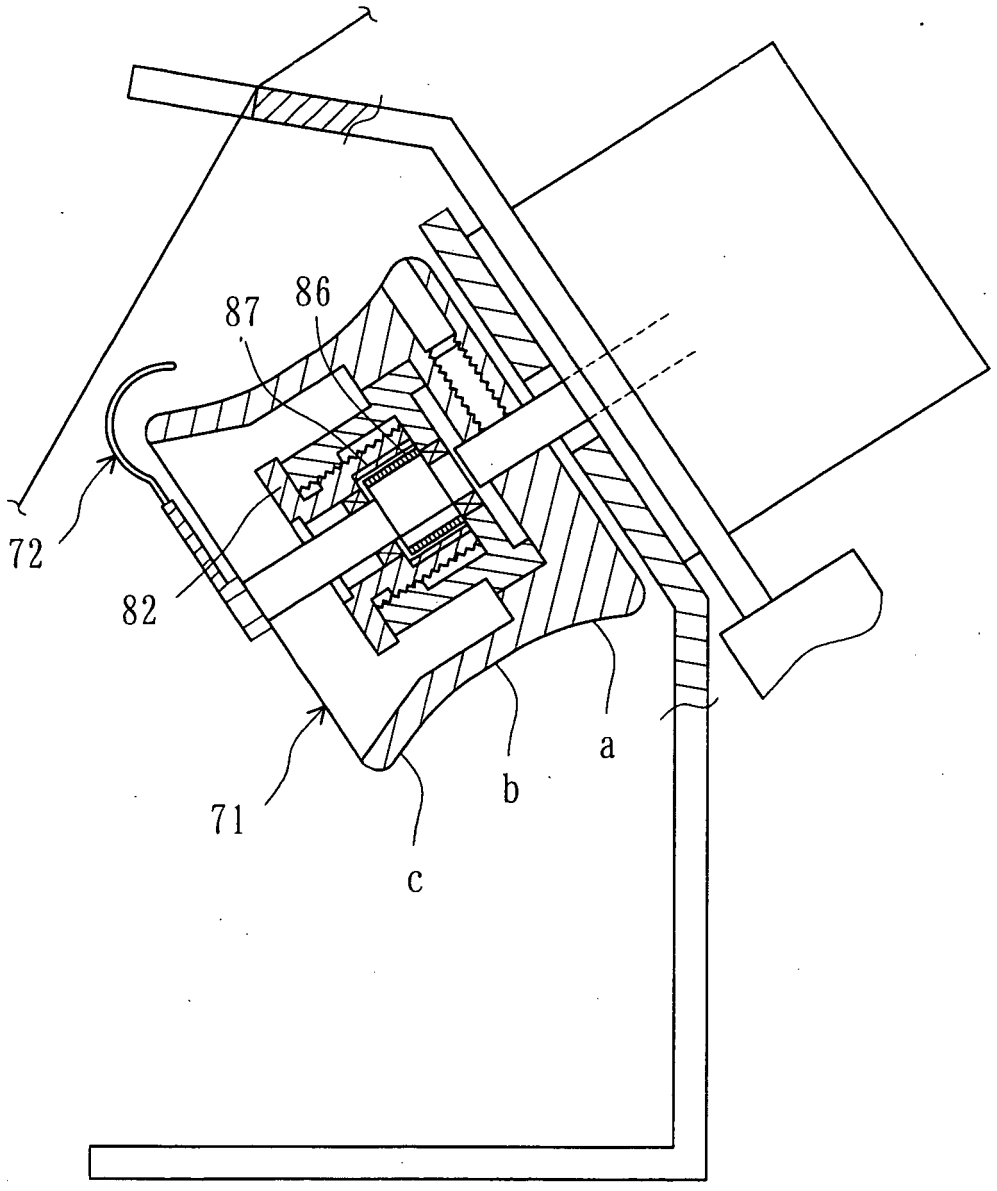
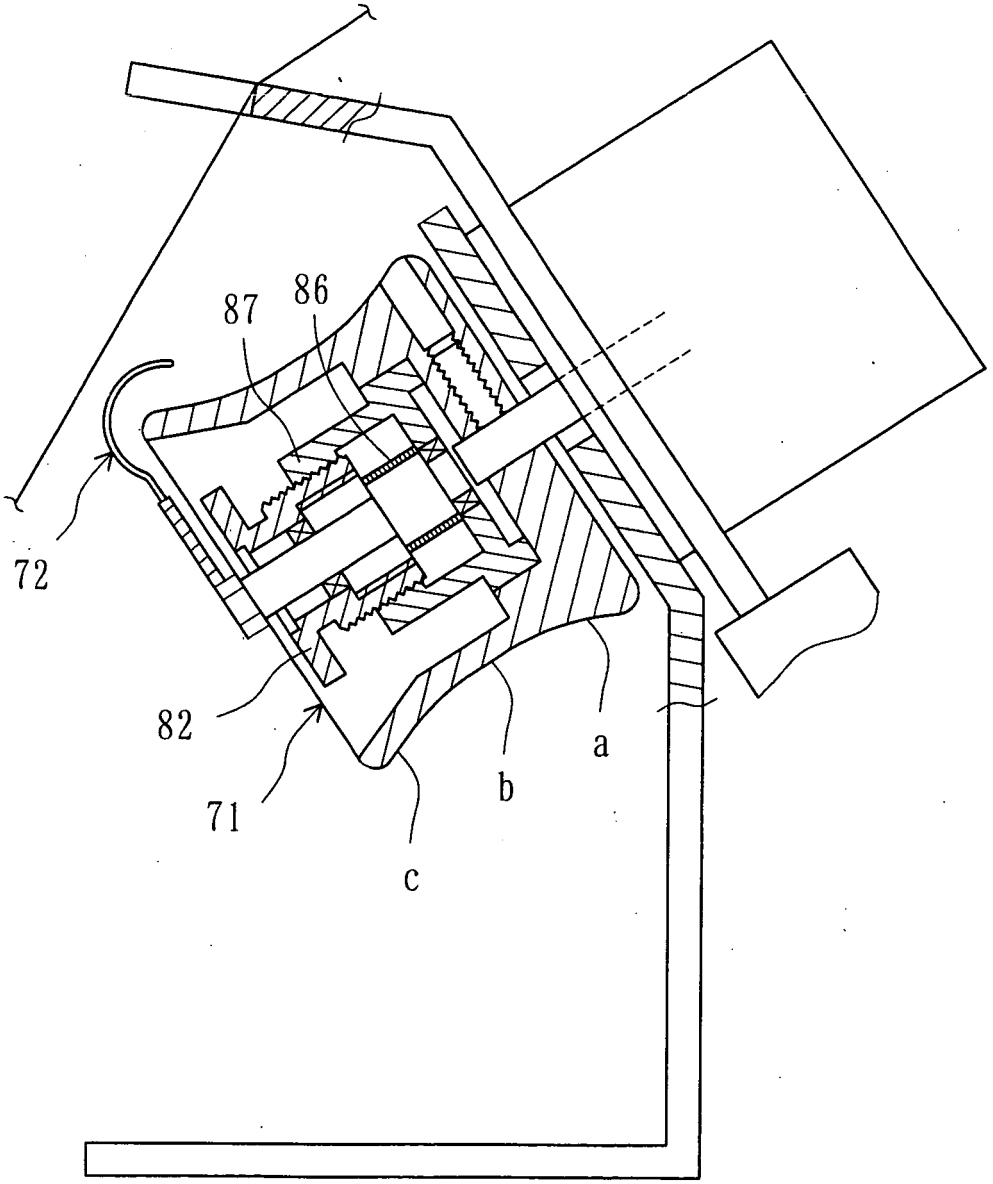


Fig. 6



## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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- EP 1457448 A2 **[0008]**
- US 6244395 B1 **[0009]**