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(54) Title: YARN TENSIONING METHODS, YARN TENSIONING DEVICE, A ARMATURE OF AN ELECTROMAGNET FOR THE YARN TENSIONING DEVICE, AND USE OF THE YARN TENSIONING DEVICE ARMATURE

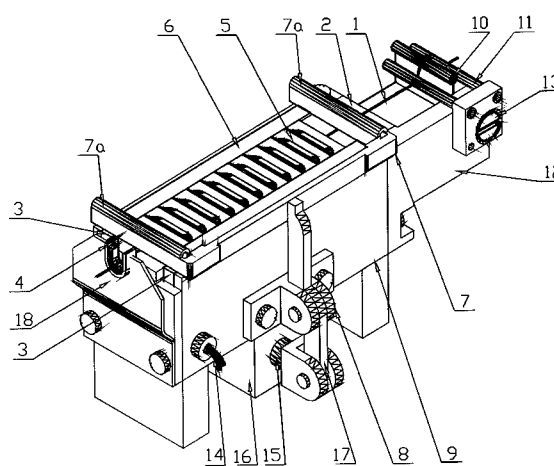


Fig.1

(57) Abstract: The subject of this invention are: yarn tensioning methods and yarn tensioning device in textile industry processes, as well as the yarn tensioning device's ferromagnetic armature, and use of the yarn tensioning device armature. In a number of textile industry processes, for instance in yarn winding, warping, twisting or joining, it is required to produce appropriate yarn tensioning, upon which the quality of yarn packing obtained is dependent, and finally the quality of textile products manufactured from such yarn. Solutions as per this invention will provide for obtaining a mean yarn tensioning value at some specific level, and will reduce its variable component.

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Yarn tensioning methods, yarn tensioning device, a armature of an electromagnet for the yarn tensioning device, and use of the yarn tensioning device armature

The subject of this invention are: yarn tensioning methods and yarn tensioning device in textile industry processes, as well as the yarn tensioning device's armature, and use of the yarn tensioning armature. In a number of textile industry processes, for instance in yarn winding, warping, twisting or joining, it is required to produce appropriate yarn tensioning, upon which the quality of yarn packing obtained is dependent, and finally the quality of textile products manufactured from such yarn. Solutions as per this invention will provide for obtaining a mean yarn tensioning value at some specific level, and will reduce its variable component.

The variation of yarn tension, especially during formation of a package, has a negative effect on the yarn technological properties and, therefore, a suitable tension stabilizing device is required. The function of tensioners is to ensure that tension of the yarn is maintained on a pre-set mean level and that its dynamic component is reduced to certain limits. In the textile industry mainly the mechanical tensioners which can be adjusted to a required tension of the yarn, are used. However modern machines can be equipped with active computer-controlled tensioners with the controlled yarn tension on the desired level independently of the motion parameters of the yarn and its initial tension.

We know the yarn tensioner described in the Polish patent No. (P 372 024), which is characterised by the fact that it contains a base plate made of para- or diamagnetic material, which is placed between two perpendicular plates made of ferromagnetic material, these plates being pole shoes of an electromagnet or a number of unipolar electromagnets, where the magnetic circuit closes a number of parallel plates that are made of ferromagnetic material. Furthermore, these plates are fixed to a flexible tape that is suspended on a frame, which rests on supports which are fixed to the body made of para-

or diamagnetic material. The yarn tensioning process takes place in yarn displacement area by yarn tensioner that causes friction resistance.

In the patent application JP2006291445 (publ. 2006-10-26) a textile machine having draft mechanism is described. This textile machine having the draft mechanism is characterized in that the tensioner member comprises at least two tensioner member portions connected to each other through a connection device, and the position of a slip plane for guiding the belts in the tensioner member can be fixed through the connection device so that the slip plane exists at an ideal position for guiding the belts during the operation.

In the patent application WO2007033771 (publ. 2007-03-29) a method for operating a workstation of a textile machine that produces crosswound bobbins is described. Said station comprises a bobbin drive, whose speed can be regulated in order to adjust the winding speed of the crosswound bobbin, a thread tensile force sensor, which is connected to a workstation computer, for monitoring the thread tensile force of a thread that is supplied from a feed bobbin and a thread tensioner for regulating the thread tensile force. According to the invention, a value for a desired thread tensile force (FZKSoll) and a value (TG) for a permitted proportional deviation from the desired thread tensile force (FZKSoll) can be entered into the workstation computer. The workstation computer can instantly suspend the winding process and trigger an alarm if the permitted proportional deviation from the desired tensile force (FZKSoll) is exceeded.

In the patent application US2005217094 (publ. 2005-10-06) a pneumatic thread tensioner and thread handling system are described. The invention relates to a pneumatic thread stretcher (T) for a rapier weaving machine or a knitting machine, in which the air current deflection surface for deflecting the thread (Y, Y1) forms a seamless extension of the inner wall of the linear guide channel, through which the thread runs. The invention also relates to a device (H) for changing the flow rate or the pressure of the air current along the deflection surface of the pneumatic thread stretcher (T) between at least two different levels, in accordance with the operating cycle of the textile machine.

In the patent description US6151924 (publ. 2000-11-28) a yarn delivery device for a textile machine is described. The invention has at least one yarn delivery roller, and a drive device for a propulsion of the delivery roller, the drive device including a drive belt, a drive roller with a peripheral section alterable in diameter and at least in part in part

looped around by the drive belt, and a tensioning unit with a guide member acting on the drive belt, the tensioning unit including a controller for producing at least one larger belt tension for normal operation of the delivery roller and a smaller belt tension for alteration of the diameter of the peripheral section of the drive roller.

In the patent description GB2325246 (publ. 1998-11-18) a yarn tensioner is described. In a yarn tensioner for textile machinery of the type having a pair of brake elements 26,27 mounted on a pin 18 and urged together by biasing means 28 to grip the yarn, the whole assembly of pin, elements and biasing means is made freely rotatable on its support so as to reduce contamination and wear of the elements. To control the rotation of the assembly a mechanical or magnetic brake 38,39 may be provided. The pin may be formed in two telescopic parts with an internal biasing tension spring.

In the patent description JP10175777 (publ. 1998-06-30) a textile machinery manufacturing twill winding package is described. A service unit is placed in a yarn rewinding part 2 and yarn 30 is accepted by what is called a yarn lifter at first. Thus, this yarn can be prepared and held for a succeeding exchange operation. Further, the control computer 38 of the service unit takes charge of the guide of a yarn rewinding part computer 39 of a yarn rewinding part 2 via a mechanical bus 40 during an exchange operation. Namely, also the control of a yarn tensioner 13 is performed via the control computer 38 of the service unit. A yarn tension value which is maintained by the yarn tensioner 14 during the exchange operation is related to a selected constitution of a package handling means or a twill package 11 every time.

In the patent description DE19716981 (publ. 1997-11-20) a textile processing roller assembly is presented. In a roller assembly for the movement of textile material, such as drawing rollers, a cut-out is activated if an additional force is detected at the rollers, which would indicate that material has wound round the rollers. Preferably the cut-out system registers changes at the unit which applies pressure to the rollers. The cut-out has a force sensor between a section where force is applied and another section where the rollers are located. The system also detect changes in the driving force applied by the drive to the rollers. It also has a sensor to register movement and/or force sensor to register the movement and/or force at a belt tensioner in the drive. A throttle is in the pressure flow line between the pressure supply and the unit to apply pressure to the rollers, and a

pressure sensor in the flow line in parallel to the throttle is linked to the cut-out system. A barrier unit is parallel to the flow throttle.

In the patent description DE19715372 (publ. 1997-10-30) a thread tension control method for textile machinery was described. The method uses an indirectly working, thread tensioner which has an arrest-brake controlled by a power supply element connected to a feeder mechanism inside a flow chamber. Fluids of different rheological characteristics, selected according to the application, are introduced into the flow chamber. Electrodes, linked to a changeable voltage supply, can generate variable electromagnetic fields in the chamber. The use of a power drive, in combination with selected fluids and variable electromagnetic fields, allows the thread tension to be maintained evenly, without any damaging friction, breaking of the threads or excessive downtime.

In spite of a great deal of works that have been aimed at arriving at a solution, which would reduce yarn damaging and breaking problems in textile industry processes, there are still no effective yarn tensioning systems at present, which would make it possible for us to control yarn tensioning as required by these technological processes. There is still a need for a solution that would make it possible to adjust yarn tensioning, especially if we bear in mind the fact that yarn unwinding and feeding conditions upstream the tensioner keep fluctuating depending on the changing size of the yarn packing, from which the yarn is unwound, and depending on the changes in shape of the bubble that is formed.

The aim of the current invention is to render the means, which would provide for the mean yarn tensioning value at some specific level and reduce its variable component. The realization of such a stated goal and the solution of problems extant in the state-of-the-art connected with controlling of the yarn tension as required by the technological process, the design of a frictional tensioner in which the nipping elements ensures that the yarn being tensioned acquires part of the overall gain in tension have been achieved within the present invention.

The subject of this invention is the yarn tensioning method that consists in passing yarn through the area, in which pressure which produces friction resistance is exerted on yarn, characterised in that the yarn displacement area is divided into a number of sections, in the area of which partial friction resistance forces are produced, whereas the amounts of

partial forces are adjusted by means of magnetic circuits, in which the intensities of magnetic field flux is controlled by means of the supply voltage. Preferably, the yarn, both at the whole displacement area, and in the areas of the particular sections, is affected by constant or variable pressures that cause friction forces.

Preferably, the amounts of partial friction forces are summed up at the end of the yarn displacement area, or they are determined individually for each of the sections that make up the yarn displacement area, and are adjusted by means of magnetic circuits, in which the intensity of magnetic field flux is controlled by means of the supply voltage.

The next subject of invention is the yarn tensioning device that contains a plate made of para- or diamagnetic material placed between electromagnet poles, characterised in that the electromagnet poles are situated in the same plane as the ceramic plate or in a parallel plane, whereas the space between the poles of the electromagnet is limited by the frame with two beams that are placed in the upper part of shorter sides of this frame, which, together with the beams, forms the yarn displacement area.

Preferably, the flexible tape is fixed to the beams and of the frame, and the cubicoid armature, which may have oblong or arc overpresses additionally made along their one longer side, are fixed to this tape at their ends, thus creating armature with arc overpress, or armature with an undercut or cubicoid cut-outs and protrusions and arc overpress, thus creating armature, as well as armature with an overpress, whereas armature create the sections that are necessary to produce partial friction resistance.

Preferably, at the yarn inlet side, outside the area of the frame, the plate is situated with the yarn guide, whereas, at the yarn outlet side, the yarn tension sensor containing the tensometric beam, placed in between the pins of the double-pin backfall, is fixed to the case of the device.

Preferably, the arm connected with its one end to the core of the electromagnetic or the pneumatic actuator, which is fixed to the case of the device, is fixed swing-wise with its other end to the frame. Preferably, electromagnets have cores whose cross-section are U- or H-shaped. The yarn tensioning device is presented on Fig. 1

The next subject of the invention is a yarn tensioning device's ferromagnetic armature, characterised in that along its one longer side, the armature has oblong or arc overpresses additionally made, thus creating the plate with arc overpress, or plate with an undercut, or cubicoid cut-outs and protrusions and arc overpress, thus creating plate, or

plate with an overpress, whereas the armature creates the sections that are necessary to produce partial friction resistance.

Preferably, the yarn tensioning device's armature is presented on Fig. 2 – 6.

The next subject of invention is a use of the armature, in which, along its one longer side, the armature has oblong or arc overpresses additionally made, thus creating the plate with arc overpress or the plate with an undercut, or cubicoid cut-outs and protrusions and arc overpress creating the plate, or the plate with an overpress, whereas the plates create the sections that are necessary to produce partial friction resistance, **in which** the yarn displacement area is divided into a number of sections, in the area of which partial friction resistance forces are produced, whereas the amounts of partial forces are adjusted by means of magnetic circuits, in which the intensity of the magnetic field flux is controlled by power supply, whereas the yarn, both in the whole displacement area and in the areas of the particular sections, is affected with constant or variable pressures that cause friction forces, and the amounts of partial friction forces are summed up at the end of the yarn displacement area, or they can be determined individually for each of the sections that make up the yarn displacement area, and they are adjusted by means of magnetic circuits, in which the intensity of the magnetic field flux is controlled by power supply, while the electromagnetic or pneumatic actuator is started up by fadeout of the signal from the tensometric sensor to the yarn tensioning device.

The subject of the present invention is presented using examples of construction depicted on drawings, where Fig. 1 shows a yarn tensioning device in axonometric view, Fig. 2 shows the cubicoid armature in axonometric view with the cross-section view, Fig. 3 shows the cubicoid armature with elongate overpress in axonometric view with the cross-section view, Fig. 4 shows the cubicoid armature with arc overpress arc in axonometric view with the cross-section view, Fig. 5 shows the cubicoid armature with cubicoid protrusion and arc overpress with cubicoid cut-out in axonometric view with the cross-section view, Fig. 5 shows the cubicoid armature with overpress with the cross-section view.

Below are several exemplary embodiments of the invention discussed.

Example

The device consists of (Fig. 1): body 2 with its flat abrasion-resistant ceramic plate 2 placed between two poles of electromagnet 3, whose core is U-shaped. In direct vicinity

of the ceramic plate 2, a frame 7 is placed, at whose shorter sides, at the top, beams 7a and 7b are situated, and flexible tapes 6 are fixed to these beams, in the area of their ends. Cubicoid armature 5, whose one longer side has oblong overpresses 8 are fixed to flexible tapes 6 with their ends. Plate 18, in whose upper part the guide 4 is situated, is fixed to the front face surface of body 9 of the device, whereas the yarn tensioning sensor 12, which contains tensometric beam 10 that is placed between pins of the double-pin backfall 13, is fixed to the rear face surface of the body 9 of the device. Furthermore, the arm 17 connected with its one end to three-sided frame 7 and to the electromagnetic actuator 16 with its other end, is fixed swing-wise to the body 9.

The armature 5 (Fig. 2 – 6) may be used in various shapes; i.e. the cubicoid armature 5a with no overpresses, the cubicoid armature 5b with arc overpress 8, or the cubicoid ferromagnetic armature 5c with an undercut, the cubicoid ferromagnetic armature 5d with cubicoid protrusion and cubicoid cut-out on longer sides, with an arc overpress being made in the cubicoid protrusion in the upper area, and some undercuts made on protrusions in the lower area, besides the cubicoid cut-out.

The cubicoid armature 5a free from undercuts are used for tensing the continuous fibre yarn, the armature 5b and the armature 5c are used for tensing the cut fibre yarn, whereas the armature 5d and ferromagnetic armature 5e are used for tensing the yarn that is highly inhomogeneous, for instance the fancy yarn.

Yarn 1 is fed by the guide 4 into the area in between the ceramic plate 2 and the ferromagnetic armature 5 which are fixed at their ends to the flexible tapes 6, whereas these tapes are fixed at their ends to the beams 7a and 7b placed in shorter sides of the three-sided frame 7, and then yarn 1 is fed through the yarn tensioning sensor 12 in such a way that it goes under the first pin of backfall 11, then on the tensometric beam 10, and finally under the second pin of double-pin backfall 13.

As soon as yarn 1 is fed on ceramic plate 2 placed in between the electromagnet poles 3 with the U-shaped core, which are located in the same plane, whereas yarn 1's transverse position is determined by the guide 4, and yarn 1 which moves along the ceramic plate 2 is pressed against it by electromagnetic field forces from armature 5 that are fixed on flexible tapes 6, which perform the role of a armature that closes the magnetic circuit. Tapes 6 enable armature 5 to go up or down perpendicularly to the plane of the ceramic plate 2, for instance when thickened or thinned section of yarn 1 finds itself under

plates 5. With a specific number of armature 5, these armature' pressure force depends on the intensity of the magnetic field that has been produced by electromagnet 3 placed inside the body 9. Upon yarn 1 passing the double-pin backfall 11 and the tensometric beam 10 of sensor 13, it presses against tensometric beam 10, which results in emerging of an electric signal that is proportional to the amount of pressure exerted by the armature 5 upon yarn 1, and this signal is transferred into the known control system placed outside the tensioning device, where there occurs a comparison of the signal value with the set signal parameter value, coupled with a proper change in the power supply of the electromagnet 3 that matches the signal from the tensometric sensor 13 with the set signal. Whenever yarn 1 is ruptured, the signal from the sensor 13 will actuate the electromagnetic actuator 16, which will raise the frame 7 up from plates 5 in order to make it possible to put yarn 1 on.

Patent claims

1. The yarn tensioning method that consists in passing yarn through the area, in which pressure which produces friction resistance is exerted on yarn, characterised in that the yarn displacement area is divided into a number of sections, in the area of which partial friction resistance forces are produced, whereas the amounts of partial forces are adjusted by means of magnetic circuits, in which the intensities of magnetic field flux is controlled using the supply power.
2. The yarn tensioning method according to claim 1, characterised in that the yarn, both at the whole displacement area, and in the areas of the particular sections, is affected by constant or variable pressures that cause friction forces.
3. The yarn tensioning method according to claim 1 or 2, characterised in that the amounts of partial friction forces are summed up at the end of the yarn displacement area, or they are determined individually for each of the sections that make up the yarn displacement area, and are adjusted by means of magnetic circuits, in which the intensity of field flux are controlled using the supply power.
4. The yarn tensioning device that contains a plate made of para- or diamagnetic material placed between electromagnet poles, characterised in that the electromagnet poles (3) are situated in the same plane as the ceramic plate (2) or in a parallel plane, whereas the space between the poles of the electromagnet (3) is limited by the frame (7) with two beams (7a) that are placed in the upper part of shorter sides of this frame, which, together with the beams (7a), forms the yarn displacement area.
5. The device according to claim 4, characterised in that the flexible tape (6) is fixed to the beams (7a) and (7b) of the frame (7), and the cubicoid armature (5), which may have oblong or arc overpresses additionally made along their one longer side, are fixed to this tape at their ends, thus creating armature (5b) with arc overpress (8), or

armature (5c) with an undercut or cubicoid cut-outs and protrusions and arc overpress (8a), thus creating armature (5d), as well as armature (5e) with an overpress, whereas armature (5) create the sections that are necessary to produce partial friction resistance.

6. The device according to claim 5, characterised in that at the yarn (1) inlet side, outside the area of the frame (7), the plate (18) is situated with the yarn guide (4), whereas, at the yarn (1) outlet side, the yarn (1) tension sensor (13) containing the tensometric beam (10), placed in between the pins of the double-pin backfall (11), is fixed to the case (9) of the device.
7. Device according to claim 5, characterised in that the arm (17) connected with its one end to the core (15) of the electromagnetic or the pneumatic actuator (16), which is fixed to the case (9) of the device, is fixed swing-wise with its other end to the frame (7).
8. The device according to claim 4, characterised in that electromagnets (3) have cores whose cross-section are U- or H-shaped.
9. The device according to claim 4, characterised in that it is presented on Fig. 1.
10. The yarn tensioning device's ferromagnetic armature, characterised in that along its one longer side, the armature has oblong or arc overpresses additionally made, thus creating the plate (5b) with arc overpress (8), or plate (5c) with an undercut, or cubicoid cut-outs and protrusions and arc overpress (8a), thus creating plate (5d), or plate (5e) with an overpress, whereas the armature (5) creates the sections that are necessary to produce partial friction resistance.
11. The device according to claim 4, characterised in that it is presented on Fig. 2- Fig. 6.
12. Use of the armature of an electromagnet, in which, along its one longer side, the armature has oblong or arc overpresses additionally made, thus creating the plate (5b) with arc overpress (8) or the plate (5c) with an undercut, or cubicoid cut-outs and protrusions and arc overpress (8a) creating the plate (5d), or the plate (5e) with an overpress, whereas the plates (5) create the sections that are necessary to produce partial friction resistance, **in which** the yarn displacement area is divided into a number of sections, in the area of which partial friction resistance forces are produced, whereas the amounts of partial forces are adjusted by means of magnetic circuits, in which the intensity of the magnetic field flux is controlled by power supply, whereas

the yarn, both in the whole displacement area and in the areas of the particular sections, is affected with constant or variable pressures that cause friction forces, and the amounts of partial friction forces are summed up at the end of the yarn displacement area, or they can be determined individually for each of the sections that make up the yarn displacement area, and they are adjusted by means of magnetic circuits, in which the intensity of the magnetic field flux is controlled by power supply, while the electromagnetic or pneumatic actuator is started up by fadeout of the signal from the tensometric sensor to the yarn tensioning device.

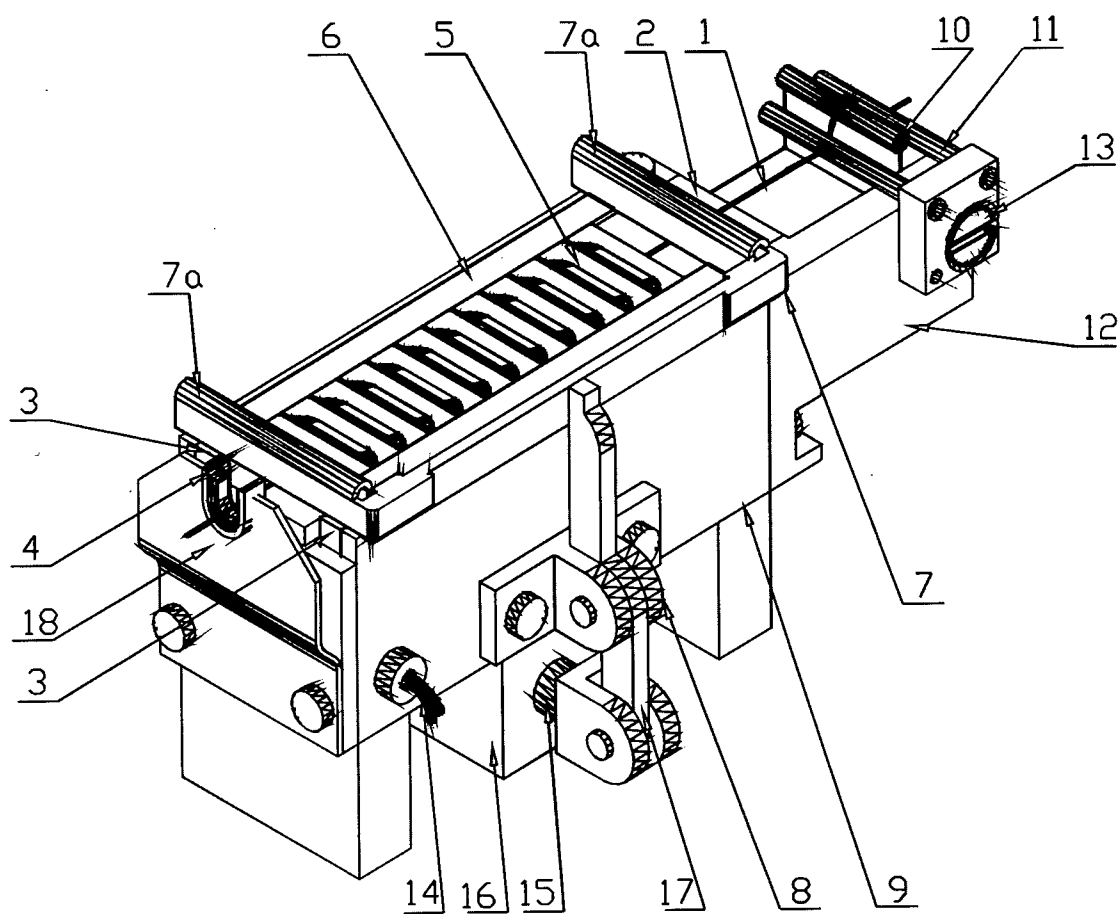


Fig.1

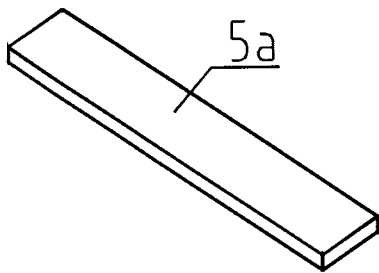


Fig. 2

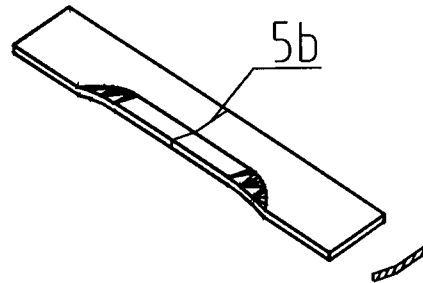


Fig. 3

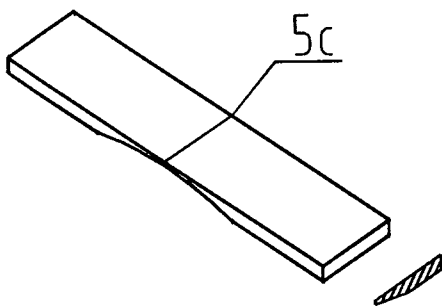


Fig. 4

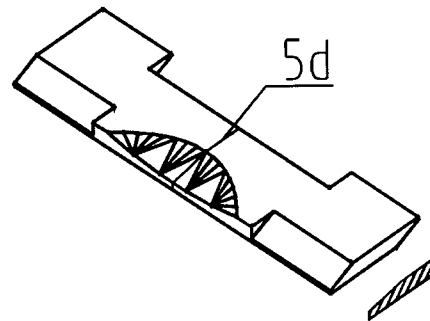


Fig. 5

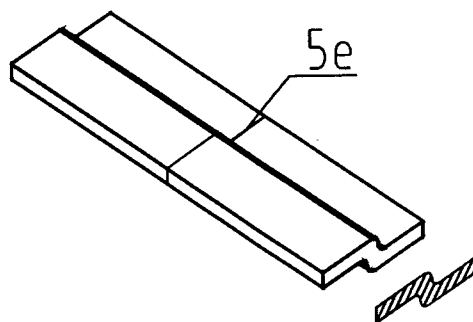


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/PL2009/000012

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H59/22

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)
B65H D03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PL 372 024 A1 (INST TECH EKSPL0ATACJI [PL]) 10 July 2006 (2006-07-10) cited in the application	1-3
A	figures & PL 199 128 B1 (INST TECH EKSPL0ATACJI [PL]) 29 August 2008 (2008-08-29)	4, 10, 12
X	EP 0 294 323 A (SULZER AG [CH]) 7 December 1988 (1988-12-07) abstract; figures	1-3
X	DE 44 33 876 A1 (NUOVO PIGNONE SPA [IT]) 30 March 1995 (1995-03-30) column 3, lines 9-35; figures	1-3
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

19 May 2009

Date of mailing of the international search report

08/07/2009

Name and mailing address of the ISA/

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Lemmen, René

INTERNATIONAL SEARCH REPORT

International application No
PCT/PL2009/000012

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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