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(11) Publication number:

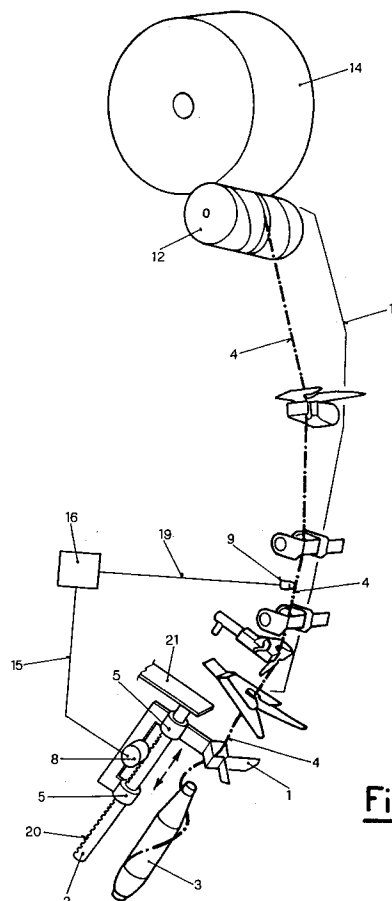
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EUROPEAN PATENT APPLICATION(21) Application number: **91202060.9**(51) Int. Cl.⁵: **B65H 59/06, B65H 57/22**(22) Date of filing: **13.08.91**(30) Priority: **29.08.90 IT 2132890**(43) Date of publication of application:
01.04.92 Bulletin 92/14(84) Designated Contracting States:
CH DE FR GB LI(71) Applicant: **SAVIO S.p.A.**
Via Udine 105
I-33170 Pordenone(IT)(72) Inventor: **Badiali, Roberto**
Via Carducci 1/A
I-33170 Pordenone(IT)
Inventor: **Ouaia, Amedeo**
Via Ceolini 70
I-33080 Porcia, Pordenone(IT)(74) Representative: **Roggero, Sergio et al**
Ing. Barzanò & Zanardo Milano S.p.A. Via
Borgonuovo 10
I-20121 Milano(IT)(54) **Device for adjusting the tension of the thread as it unwinds in a spooler.**

(57) The present invention relates to a device for adjusting the tension of the thread as it unwinds in a spooler, which is designed to wind thread at high speed, the said device comprising a movable element (1), which acts as an unwinding accelerator and which at the tip surrounds the axis of the cop (3) and along the said axis descends and moves in an essentially concentric position during unwinding of the wound thread.

The said movement is activated by a kinematic mechanism moved by a drive source (8) operated by the electrical signals from a tension sensor (9) which measures, moment by moment, the tension of the thread, which travels to be transferred from the cop (3) below to the reel (14) above being wound.

**Fig.1****EP 0 478 023 A1**

The present invention relates to a device for adjusting the unwinding tension of the thread in a spooler, which is designed to wind thread at high speed unwinding it from a cop below and collecting it on a reel above being formed. Some textile working stages involve firstly transferring the thread, at the maximum speed possible, from one package to another. For example, a thread produced in a spinning machine, particularly in a continuous ring frame, is normally wound onto a spool or reel. The thread is then transported and supplied as a spinning cop for a rewinding stage. Spooling involves transferring (rewinding) from the starting cop to the collecting reel, with unravel unwinding, i.e. with axial extraction of the thread from the stationary cop. The starting package is often a cop from a ring spinner. Due to the mechanical limitations of a continuous ring frame, the spinning cops have a relatively small quantity of thread, up to a few hundred grams at most. Consequently, they are rewound and wound onto reels on which the quantity of thread and shape are suitable for use in a subsequent operation and the thread from several cops is collected in succession on a single reel. The purpose is always to obtain packages which are more suitable for the subsequent working stages such as dyeing, warping, inserting the weft, etc.

During these transfer operations, the thread may be improved by removing sections with defects of various types. With the continuous increase in the speed of such operations (expressed by the length of thread transferred in one unit of time) to reduce production costs, ever greater tension values in the thread are created and, therefore, more frequent breakages, which cause a considerable fall in the operating performance of the spooler and its productivity. Incidentally, breakage of the thread occurs under a tension which is greater than the thread's tensile stress.

The thread on each spinning cop, which has been supplied at a set position of a spooler, is drawn upwards with a tension value which gradually increases between the beginning and end of the spinning cop being unwound, as is well known to the textile dressers. Indeed, when the layer of thread on each spinning cop decreases as the winding operation of the spooler progresses, the layer of thread thus diminished twists only round the bottom end of the cop and the thread, drawn out of it, travels upwards twisting back round the surface of the cop. In this case, the angle of separation of the layer of thread decreases and therefore tension is applied to the travelling thread due to the friction between the lengths of thread, or the contact of the thread with the cop and this may lead to breakage of the thread. This phenomenon occurs more readily in spoolers with a high winding

speed. In the more modern spoolers thread transfer speeds of 20-30 m/s are reached.

Furthermore, since the tension at the start of unwinding thread from a single spinning cop is low, the thread is wound onto the reel at a low tension and thus the layer of thread wound at low tension may be expanded outwards at one end of the reel due to the pressure of the layer of thread on top of it. Since usually to obtain one reel several spinning cops are used, the expanded part appears within each set period thus causing the formation of a reel with faulty winding which may give rise to unacceptable production for subsequent working stages.

In such an operating process a device is required which adjusts the winding tension of the thread between the start and finish of the cop thus reducing the unwinding tension at the end of the supply cop.

Elements are known in the state of the art which by acting on the path of the thread in a fixed position guide it in precise unwinding forms which make it possible to limit the maximum tension values at which breakages of the thread being wound frequently occur.

These known elements, which act as unwinding accelerators (balloon-breakers) have various geometrical forms, as is well known by those working within the field. However, in the best of cases they only lessen the phenomenon, but do not lead to an optimum result of uniformity in the unwinding tension between the start and finish of unwinding the thread from the supply cop.

Means of controlling the spooling speed, i.e. the winding speed, have also been proposed as a countermeasure to keep the thread tension at practically constant levels from the beginning to the end of the cop from which the thread is being unwound, as described in US Patent 4805846.

To obtain a thread tension which is approximately constant, in the said Patent the effect of the spooling speed on the thread tension is used. Indeed, by considerably reducing the spooling speed, in the interval of time in which the thread is unwound from the bottom part of the spinning cop, the tension is kept at a more or less uniform level for the entire duration of the spooling process. Such a solution will considerably reduce the operating performance of the spoolers in that for a certain interval of time the unwinding speed is considerably reduced and therefore a smaller quantity of thread will be transferred (wound on) in one unit of time. To all practical purposes this is unusable since it results in a considerable drop in the operating performance of the spooler and consequently in a reduction in its productivity. The aim of the present invention is to resolve the above-mentioned problems of the known state of the art by providing a device which ensures that the ten-

sion of the thread being supplied in the spooler is kept at an essentially constant value during unwinding of the entire spinning cop and which offers the following advantages:

- it can be applied for any type of thread be it fine, medium or thick;
- it can be installed on existing spoolers;
- it enables the thread at high transfer speed to assume a geometrical configuration of contained energy dissipation which is highly important in the above-mentioned known state-of-the-art applications

These and yet other advantages are achieved by the device described in the present invention capable of making uniform and regular the value of the unwinding tension in a spooler, which is designed to wind thread at high speed unwinding it from a cop below that supplies thread to the reel above being formed, the said device including:

- a movable element which acts as an unwinding accelerator and at the tip surrounds the axis of the cop and along the said axis slides and moves in an essentially concentric position between the beginning and end of the cop during unwinding of the wound thread;
- a kinematic mechanism which activates the said movement of the movable element along the axis of the cop being unwound;
- a tension sensor which measures, moment by moment, the tension of the travelling thread as it transfers from the supply cop below to the reel above being wound.

The device that adjusts the unwinding tension in a spooler described in the present invention, takes concrete form, in its practical application, by the fact that the element that acts as an unwinding accelerator by containing and limiting centrifugation of the thread is essentially quadrangular in shape and has a side slit for introduction of the thread which occurs each time the supply cop is replaced.

The device that adjusts the tension of the thread as it unwinds in a spooler described in the present invention, also takes concrete form, in its practical application, by the fact that the kinematic mechanism for moving the said movable element along the axis of the cop is a rack which engages with a toothed pinion which is rotated by an electric step motor, the latter being activated so as to ensure that the tension of the thread as it is transferred from the cop to the reel falls within a range of values permitted by the unwinding operation in progress.

The device that adjusts the tension of the thread as it unwinds in a spooler described in the present invention, takes concrete form, moreover, in its practical application, by the fact that the tension sensor that measures the tension value of the thread as it travels from the cop to the reel is a

piezoelectric element, or any other known element, which transmits electric signals to a control device which compares the said signals with reference values that fall within a permitted range of values.

The said control device in turn outputs electrical signals which activate and operate the electrical step motor whenever the electrical signals emitted by the tension sensor differ from the reference values in the range of permitted values. The device for adjusting the thread as it unwinds in a spooler described in the present invention takes concrete form, moreover, in its practical application by the fact that the supporting frame common both to the movable element, which acts as an unwinding accelerator, and also to the electric step motor, can slide along a rack shaft and the said shaft is essentially parallel to the axis of the cop being unwound.

The invention shall be described in detail below on the basis of the example of embodiment schematically represented in the drawings in the attached Figures, and additional details and characteristics shall be explained, in which connection it must be well understood that any variations in reciprocal positions of the elements and the consequent simplifications which could arise therefrom must be regarded as included in the protection requested as constructional variations covered by the general concept.

In the attached drawings:

- Fig. 1 is an axonometric schematic view of the device covered by the present invention, showing also the path of the thread from the cop below being unwound up to the reel above being formed and the said view shows the moment rewinding of the thread wound onto the cop supplying the spooler begins;
- Fig. 2 is an axonometric schematic view of the device covered by the present invention at the moment when the cop is full of wound thread and is therefore the moment when unwinding of the thread to transfer it to the reel above begins;
- Fig. 3 is an axonometric schematic view of the device covered by the present invention at the moment when the cop has on its end part a limited accumulation of wound thread and is therefore the moment just before unwinding of the thread from the cop to transfer it to the reel above ends.

In the Figures the same elements bear the same reference numbers.

Furthermore, for the purpose of clarity of the invention as a whole, in the Figures the parts not necessary to understanding the invention, such as the operating and functional units along the path of the thread, the motorisation centre of the thread guide roller, the reel-carrier arm, the various sup-

porting structures and the means of supply, support and cop removal, are omitted.

In the said attached Figures:

1 is the movable element quadrangular in shape which acts as an unwinding accelerator and in addition has a side slit for introducing the thread at each replacement of supply cop 3. Its position is essentially concentric and perpendicular to the axis of bobbin 23 and, therefore, to cop 3 of wound thread. The said element 1 is placed with its bottom edge, at the start of rewinding thread 4 from cop 3 full of wound thread, at a distance from the tip of bobbin 23 essentially fluctuating at around 20mm (in accordance with the experimental results of the proposer); 2 is a shaft fixed to support plate 21, the latter being fixed as a single body to the spooler frame (not illustrated). The said shaft 2 is formed in such a way that, along a section of its straight side, it has teeth to form a rack element 20; 3 is the cop of wound thread made in a ring spinner; 4 is the path, shown by a dotted and dashed line, of the thread which is unwound from cop 3 below and runs upwards to wind itself in crisscross coils around the reel being formed 14; 5 is a supporting frame which slides axially along shaft 2. The said frame 5 supports in a fixed way and as a single body quadrangular element 1, motor 8 and also sensor 9 so that during its downward movement, shown by arrow 7, the said elements 1, 8 and 9 also move perfectly synchronized and to an identical extent; 8 is an electric step motor which activates and operates precise angular rotations of toothed pinion 18 which, by engaging with toothed rack 20, moves frame 5 and thus elements 1 and 9 up or down; 9 is a tension sensor which measures the tension value of the thread as it travels from the cop to the reel and the said sensor is a piezoelectric element, or any other known tension sensor, which transmits electric signals to a control device 16 through electrical wire 19. As the said electrical signals are input into control device 16 they are amplified and compared with reference values that fall within a permitted range of values. Whenever the electrical signals coming from the tension sensor and being input into control device 16 differ from the reference values in the range of permitted values, control device 16 outputs electrical signals which activate and operate, through electrical wire 15, the electric step motor 8. Incidentally, as the truncated cone section of wound thread 24, by proceeding of the unwinding of the thread 4 from the cop 3, gradually and continuously descends, sensor 9 will at the same time detect a gradual and continuous increase in the winding tension, as is well known to those working within the field. Whenever the said increase in tension assumes a value that differs by an increase fixed beforehand from the reference

value, motor 18 is activated and causes a precise axial movement in the direction of arrow 7 of supporting frame 5 through the sliding pair of toothed pinion 18 and rack 20. The said movement in the direction of arrow 7 also causes downward movement of quadrangular element 1; 12 is the supply cylinder which rotates reel 14 and, imparting an alternating back-and-forth movement, guides the thread onto the said reel 14; 10 is the schematic outline of the structure of a spooler; 14 is the reel which is a package of thread with a truncated cone shape, or a cylindrical shape, and the said package is produced by a spooler and intended for subsequent working stages (dyeing, warping, weaving, etc.); 23 is the thread winding bobbin, i.e. the support for the thread wound in the copping operation by a ring spinner to form a cop of yarn 3.

The operation of the device for making the value of the unwinding tension in a spooler uniform, illustrated by the attached drawings, can be easily understood by those working within the field.

A cop 3 full of wound thread is placed on the cop-holder post (not shown) in the supply position. Its thread 4, using known means and devices, is brought to wind itself onto the reel being formed 14 and rewinding of the thread begins, i.e. the transfer of thread 4 from cop 3 below to reel 14 above. The device covered by the present invention is stationary in the upper limit position (see Fig. 2). Sensor 9 measures the tension of the thread travelling from the cop to the reel and at the start of unwinding quadrangular element 1 is positioned at a precise distance from the tip of bobbin 23. Thread 4, drawn upwards by supplier cylinder 12, on unwinding from cop 3, causes a gradual and continuous increase in thread tension particularly in the end part of unwinding (see Fig. 3). This increase in tension is detected by photocell sensor 9 which, through electronic board 16, activates electric step motor 8.

The latter causes angular rotations of toothed pinion 18 forces, through rack 20, supporting frame 5 gradually to descend as shown by arrow 7 until it occupies the lower limit position as can be clearly seen in Figure 3. During this descent, motor 8 and quadrangular element 1 descend to an identical extent since they are integral and form one body with supporting frame 5. Movable quadrangular element 1 will always be at an essentially constant distance from the rewinding point of thread 4 from cop 3. The said essentially constant distance between quadrangular element 1 and the rewinding point below during the entire unwinding of thread 4 from cop 3 results in a uniform constant value of the tension of thread 4 from the beginning to the end of cop 3, from which the thread is unwound to be transferred onto reel 14 being formed above. In this way the tension of thread 4 is maintained at an essentially uniform level for the entire duration of

the spooling process due to the operating presence of the device in question, which will consequently prevent most of the breakages of thread 4 during its transfer from cop 3 to reel 14.

All this enables extremely striking comparisons to be made particularly in the case of high-speed spoolers in which the speed of transfer of thread 4 from cop 3 to reel 14 is in the order of 200 m/min and above.

Since the tension of the thread remains more or less uniform it is possible, as frequent accidental breakages do not occur, to obtain great improvements in the operating performance of spoolers and consequently in their productivity.

It is purely by way of example that a toothed pinion and rack transmission pair has been used since similar sliding pair mechanisms may be used capable of axially moving quadrangular-shaped element 1, which acts as an unwinding accelerator; furthermore, various modifications in detail may also be made to the form of supporting frame 5 and its method of fixing to the drive element without going beyond the scope of the invention.

Claims

1. A device for regulating the tension of thread as it unwinds in a spooler, which is designed to wind thread at high speed unwinding it from a cop below which supplies thread to a reel above being formed and the said device is characterised in that it has:

- a movable element which acts as an unwinding accelerator and at the tip surrounds the axis of the cop and along the said axis descends and moves in an essentially concentric position between the beginning and end of the cop during unwinding of the wound thread;
- a kinematic mechanism which activates the said movement of the movable element along the axis of the cop being unwound;
- a tension sensor which measures, moment by moment, the tension of the travelling thread as it transfers from the supply cop below to the reel above being wound.

2. A device for regulating the tension of thread as it unwinds in a spooler, according to Claim 1, characterised in that the element that acts as an unwinding accelerator, since it contains and limits centrifugation of the thread, is essentially quadrangular in shape and has a side slit for the introduction of thread which occurs each time the supply cop is replaced.

3. A device for regulating the tension of thread as it unwinds in a spooler, according to Claim 1, characterised in that the kinematic mechanism which moves the said movable element along the axis of the cop is a rack which engages with a toothed pinion which is rotated by an electric step motor, the latter being activated so as to ensure that the tension of the thread as it is transferred from the cop to the reel falls within a range of values permitted by the winding operation in progress.

4. A device for regulating the tension of thread as it unwinds in a spooler, according to Claim 1, characterised in that the tension sensor that measures the tension value of the thread as it travels from the cop to the reel is a piezoelectric element, or any other known element, which transmits electric signals to a control device which compares the said signals with reference values that fall within a range of values permitted by the type of thread being wound.

5. A device for regulating the tension of thread as it unwinds in a spooler, according to Claim 4, characterised in that the control device generates electrical signals which activate and operate the electrical step motor whenever the electrical signals emitted by the tension sensor differ from the reference values in the range of permitted values.

6. A device for regulating the tension of thread as it unwinds in a spooler, according to Claim 1, characterised in that the supporting frame common both to the movable element, which acts as an unwinding accelerator, and also to the electric step motor, can slide along a rack shaft and the said shaft is essentially parallel to the axis of the cop being unwound.

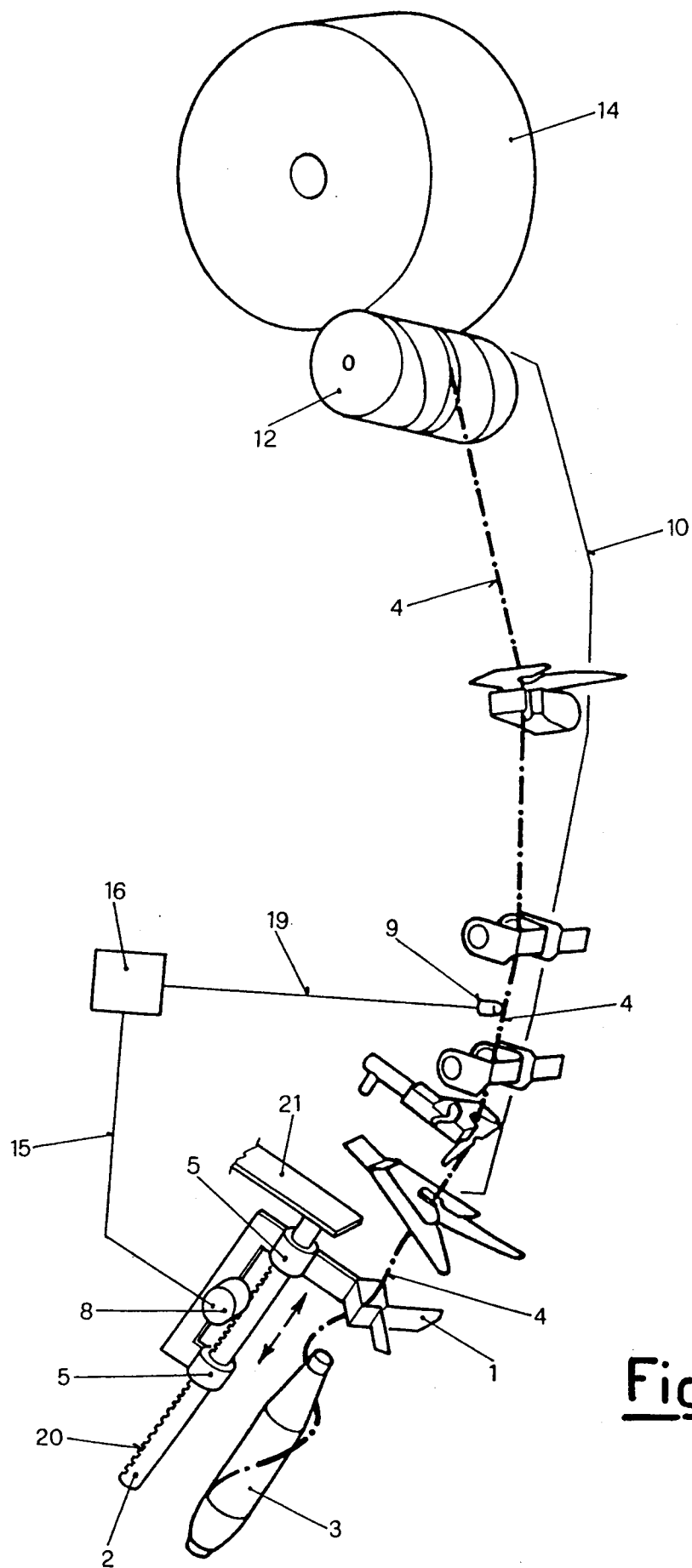
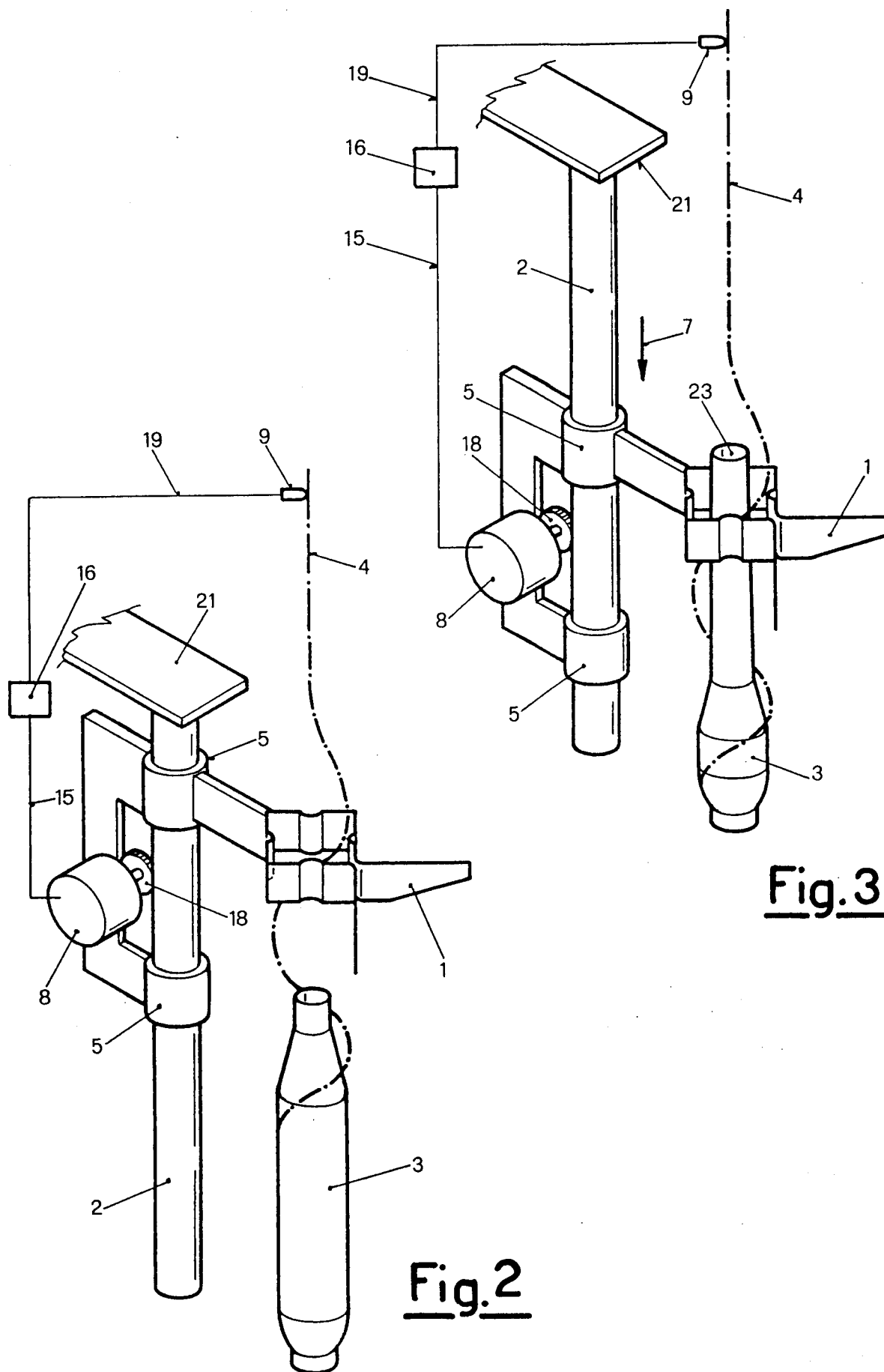


Fig.1





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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 2060

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	CH-A-351 202 (Dr. Ing. W. REINERS) * Page 3, lines 20-34 * - - -	1,3,5,6	B 65 H 59/06 B 65 H 57/22
X	EP-A-0 225 670 (PICANOL N.V.) * Page 3, lines 18-45; page 5, line 37 - page 6, line 23 * - - -	1-5	
A	US-D-506 167 (M. BROWN) * Claim 1 * - - -	1	
A	US-A-2 994 491 (E. WEBER) * Figures 13-16 * - - -	2	
A	PATENT ABSTRACTS OF JAPAN, vol. 10, no. 388 (M-549)[2445], 25th December 1986; & JP-A-61 178 373 (MURATA MACH. LTD) 11-08-1986 * The whole document * - - -		
A	CH-A-397 490 (MMW-ZWIRNMASCHINEN AG) - - - - -		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 65 H D 01 H
Place of search		Date of completion of search	Examiner
The Hague		19 December 91	D HULSTER E.W.F.
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