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(11) **EP 1 598 295 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.11.2005 Bulletin 2005/47

(51) Int Cl.7: **B65H 19/14, B65H 20/34,
B65H 51/22**

(21) Application number: **05104063.2**

(22) Date of filing: **16.05.2005**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL BA HR LV MK YU

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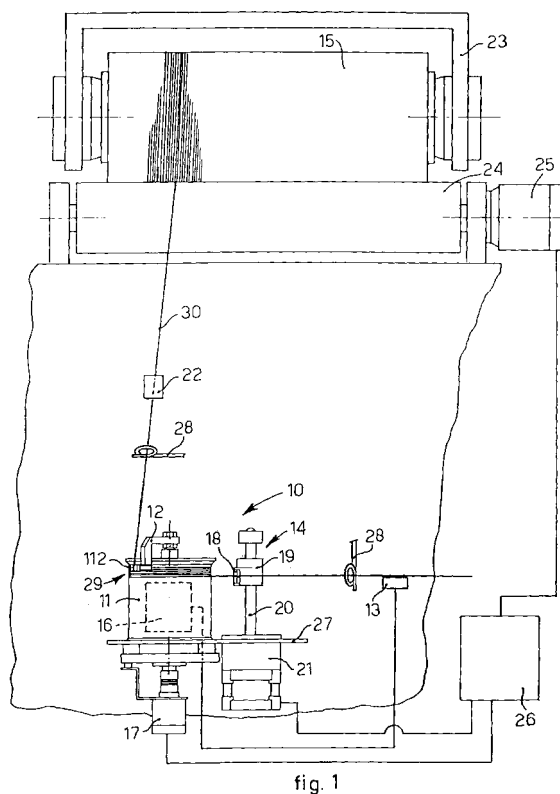
(30) Priority: **17.05.2004 IT UD20040099**

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(54) **Device and method for forming a reserve of thread in textile machines such as for example spinning machines, texturing machines, mercerizing machines or suchlike**

(57) Device and method for forming a reserve of textile thread. The device (10) is arranged between a textile machine, which feeds thread (30) continuously, and a replaceable collection element (15). The device (10) comprises accumulation means (11) on which the thread (30) is wound and on which a reserve of thread (30) is formed. The device (10) also comprises synchronization means (26) to synchronize the speed of rotation of the accumulation means (11) with the speed of rotation of the collection element (15). The synchronization allows to balance, under normal working conditions, the quantity of thread that is wound onto the accumulation means (11) with the quantity given up to the collection element (15) and, in a situation when the collection element (15) is restarted, imposes a greater speed on the collection element (15) than that of the accumulation means (11) in order to recover the reserve of thread (30).



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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a device and a method for forming a reserve of thread in textile machines such as, for example, spinning machines, texturing machines, mercerizing machines, or in any other machine which feeds a thread continuously, or substantially continuously.

[0002] The device according to the invention is arranged between a textile machine of the type indicated above and a collection device, for example a reel or a reeling head, and is used when it is necessary to replace the collection element and it is not possible, or not desired, to interrupt the feed upstream.

[0003] When the replacement operation has been performed, the device allows to restart collection without interruption, restoring normal working conditions without having to interrupt the continuous feed of the thread.

BACKGROUND OF THE INVENTION

[0004] In processes for treating textile threads there are numerous situations in which it is substantially impossible, for technical reasons regarding the apparatus or technological reasons regarding the method, to interrupt the feed of the thread, which is thus supplied substantially continuously to the collection devices. This occurs, for example, in spinning machines, mercerizing machines, texturing machines and others, where the process cannot be stopped without substantially compromising the result of the process.

[0005] One problem occurs every time that it is necessary to replace the collection element, or reel, on which the treated thread is wound. Since the feed of the thread cannot be interrupted, it is necessary to accumulate the thread that continues to arrive from the processing machine and cannot be collected during the step when the reel is lifted.

[0006] Conventional accumulation devices generally suffer from problems of synchronization, blockages, bulk, and others, which until now have prevented the development of reliable and efficient devices.

[0007] Purpose of the invention is to create a device, located between the textile machine and the collection element, able to create a reserve of thread at least during the step when the collection element is lifted, in order not to interrupt the continuous feed of the thread and to allow a correct return to normal working conditions without high risks of blockages, breakages of the thread, formation of knots and other.

[0008] The Applicant has devised and embodied the present invention to overcome the shortcomings of the state of the art and to obtain other advantages.

SUMMARY OF THE INVENTION

[0009] The present invention is set forth and characterized essentially in the respective main claims, while the dependent claims describe other innovative characteristics of the invention.

[0010] In accordance with the above purpose, a device for forming a reserve of thread according to the invention is arranged between a textile machine which continuously feeds thread, and means to collect the thread, for example, a reel associated with automatic replacement means.

[0011] According to the invention, the device comprises means to accumulate the thread, comprising a motorized cylinder on which the thread arriving from the textile machine is wound, and unwinding means, associated with said motorized cylinder and by means of which the thread, which is wound onto the motorized cylinder, is sent to the collection means.

[0012] The device also comprises synchronization means able to synchronize the speed of rotation of the motorized cylinder with the speed of rotation of the collection means, so as to balance, during normal working conditions, the quantity of thread that is wound in the accumulation means with the quantity collected in the collection means.

[0013] During the step when the collection element is replaced or lifted, the synchronization means allow, in a first step, to create a reserve of the thread in the accumulation means and, in a second step, to give up said reserve to the new collection element.

[0014] To be more exact, during the normal collection of thread on the collection element, the synchronization means maintain the speeds of rotation of the motorized cylinder and the collection element synchronized, so that the quantity of thread that is wound onto the cylinder is simultaneously removed therefrom.

[0015] It may be provided, in an initial step where the machine is set, to form a minimum and predetermined quantity of thread on the motorized cylinder which, under normal working conditions, and thanks to the synchronization mechanism mentioned above, is kept substantially constant.

[0016] In a preferential embodiment, the synchronization means act by controlling the angular position of the unwinder, which is mounted coaxial with the motorized cylinder and through which the thread is sent, in defilée mode, from the motorized cylinder to the collection element.

[0017] The optimum synchronization of the two speeds, of the motorized accumulation cylinder and of the collection element, is obtained when the unwinding element keeps a substantially stationary angular position, which corresponds to the situation where the same quantity of thread that is wound onto the motorized cylinder is given up to the collection element.

[0018] During the step when the collection element is replaced or lifted, a reserve of thread is accumulated on

the motorized cylinder, not interrupting the continuous feed of the thread.

[0019] During this step a certain quantity of thread is progressively wound onto the motorized cylinder, of a measurement correlated to the speed of feed of the thread and the time needed to complete the lifting and to restart the collection operation.

[0020] When the lifting step is finished, there is a transition step to restore normal working conditions.

[0021] The transition step provides that, for a certain time, the collection element is driven at a speed higher than that of the normal working speed, and also than the rotation speed of the motorized cylinder, the latter remaining substantially constant.

[0022] The transition step continues until the collection element has taken from the motorized cylinder all the reserve created during the replacement step, that is, until only the minimum quantity of thread, determined during the machine-setting step, remains on the motorized cylinder. At this point, the speed of the collection element is progressively reduced and returned to normal working speed, and the synchronization control is restarted with the speed of rotation of the motorized cylinder, in order to restore normal working conditions.

[0023] According to another characteristic of the present invention, means to position the thread are arranged in cooperation with the accumulation means. During the lifting step, that is, during the step when the reserve is formed on the motorized cylinder, the positioning means are able to move along the axis of the cylinder in order to arrange the spirals of thread uniformly on the surface of the cylinder, preventing any superimposition of the spirals.

[0024] This prevents any superimposition of the thread, which would impede the correct unwinding thereof when the collection step is restarted.

[0025] Advantageously, the positioning means comprise step-wise drive means.

[0026] According to another characteristic of the invention, the motor that drives the motorized cylinder is governed by the detection of the value of tension of the thread, performed upstream of the accumulation device, in order to maintain this tension at a desired and predetermined value.

[0027] Therefore, the device that detects the tension of the thread imposes the speed of rotation on the motorized cylinder, and the motorized cylinder, by means of said synchronization means, imposes the speed of rotation on the collection means.

[0028] According to a variant, at least between the motorized cylinder and the collection means, there is at least a sensor to detect the presence of the thread which, if it detects the absence of the thread, except during the lifting step, interrupts the operation of the device and sends an alarm signal.

[0029] As seen above, with the present invention we obtain the possibility of never interrupting the feed of the thread arriving from a textile machine working continu-

ously; moreover, we prevent risks of obstacles, blockages of the thread, formation of knots that can cause breakages or unacceptable reels.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0030] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic representation of the device for forming a reserve of thread associated with collection means, according to the present invention;
- fig. 2 is a perspective view of the device for forming a reserve of thread according to the present invention;
- fig. 3 is a partial view from above of the device in fig. 2, showing the different angular positions that the unwinder can assume;
- fig. 4 is a lateral view of the device in fig. 2, during the step where the reserve is accumulated;
- fig. 5 is a lateral view of the device in fig. 2, showing the step where the reserve is given up to the collection means.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0031] With reference to the attached drawings, a device 10 for forming a reserve of textile thread 30, according to the present invention, is used between a device to collect the textile thread, for example a reel 15, and a textile machine such as a spinning machine, a texturing machine, a mercerizing machine or other, not shown in the drawings, which supply the thread 30 in a substantially continuous manner within the treatment cycle.

[0032] Even though fig. 1 shows only one thread 30, only one device 10 and only one corresponding reel 15, it is understood that the invention is also applied in machines where bundles of threads 30 are continuously fed, each of which winds onto a relative reel 15 and cooperates with a relative device 10 for forming a reserve of thread.

[0033] The device 10 comprises a motorized accumulation cylinder 11, an unwinding element 12 associated with the cylinder 11 and mounted coaxial with respect thereto, a tension detector 13 and a device 14 to position the thread 30.

[0034] The motorized accumulation cylinder 11 is used to wind the thread 30, sent continuously from the textile machines, and then to send it, through the unwinding element 12, in *defilée* mode, to said reel 15.

[0035] The normal working condition provides that the thread 30, which is wound peripherally onto the motorized cylinder 11 (fig. 1), is removed from above so as to wind onto the reel 15, passing through the eyelet 112 of

the unwinding element 12.

[0036] A certain minimum quantity of thread, indicated by the number 29 in the figures, and corresponding to a determinate number of spirals of thread 30, for example from 2 to 20, advantageously from 5 to 10, is prewound onto the motorized cylinder 11 during the setting of the machine; this quantity remains wound substantially constantly on the cylinder 11, under normal working conditions, since the same quantity of thread 30 that enters the cylinder 11 is simultaneously sent to the reel 15.

[0037] The latter is arranged on a frame 23 (fig. 1), and is associated with a conventional automatic replacement mechanism, not shown in the figure. The reel 15 is made to rotate, in a conventional manner, by means of a roller 24 associated with an electric motor 25 which, for the functions that will be described hereafter, is commanded by a command unit 26.

[0038] The accumulation cylinder 11 is driven by an electric motor 16 which, in this case, is arranged coaxial inside the cylinder 11 itself and is mounted on a support 27.

[0039] The tension detector 13 (fig. 1) is of the proportional type and its function is to detect the value of tension of the thread 30 arriving from the textile machine so that this value is maintained substantially at a predetermined value.

[0040] For this reason, the motor 16 of the motorized cylinder 11 is governed by the measurement made by the detector 13, and its speed of rotation is controlled so as to keep this value substantially constant.

[0041] The unwinding element 12 is mounted idle with respect to the accumulation cylinder 11 and is connected, by means of a shaft, coaxial with the hollow shaft of the electric motor 16, to an encoder 17.

[0042] The encoder 17 continuously detects the angular position of the unwinding element 12 (fig. 3), and in particular detects the variations therein, positive or negative, for the purposes which will be described hereafter, with respect to a reference angular position corresponding to a correct working situation.

[0043] The device 14 (figs. 1 and 2) that positions the thread 30 is located in this case between the tension detector 13 and the accumulation cylinder 11, and comprises an eyelet 18, mounted on a support 19, inside which the thread 30 passes. The support 19 is able to move, in a substantially vertical direction, on two cylindrical guides 20, and is driven, during the step where the reel 15 is lifted and the reserve is formed, by means of a worm screw 31 made to rotate by a step-by-step motor 21, commanded by the command unit 26.

[0044] A sensor 22 is positioned between the accumulation cylinder 11 and the reel 15 and is able to verify the presence or absence of the thread 30. If there is no thread 30, the sensor 22 signals the absence thereof and the continuous feed process of the thread 30 is stopped, if possible, and an alarm signal is sent.

[0045] Two guide eyelets 28 are arranged one be-

tween said sensor 22 and the unwinding element 12, and the other between the tension detector 13 and the positioning device 14; their function is to guide the thread 30.

[0046] The functioning of the device 10 provides a normal working step, a step to accumulate the reserve and a transition step.

[0047] In the normal working step, as said, the thread 30 is wound onto the accumulation cylinder 11 and the same quantity of thread is simultaneously sent, from above, to the reel 15, through the unwinding element 12. Therefore, only the reserve 29 on the accumulation cylinder 11 remains, which was preset at the beginning, in this case in correspondence with the upper part of the cylinder 11.

[0048] In this step, in order to maintain the normal working condition, the speed of rotation of the reel 15 is kept constantly synchronous, or proportional, to the speed of rotation of the accumulation cylinder 11 by means of the control carried out by the command unit 26.

[0049] To be more exact, this control is performed by means of the encoder 17 associated with the unwinding element 12.

[0050] The encoder 17 detects the angular displacements of the unwinder 12 with respect to a reference position (indicated by a continuous line in fig. 3), the position of which corresponds to a synchronous rotation drive of the reel 15 and cylinder 11. If an anti-clockwise displacement is detected (position 12a in fig. 3), this means that the cylinder 11 is rotating more quickly than the reel 15, since the thread 30 entering the cylinder 11 is not discharged through the eyelet 112 of the unwinder 12, at the same speed on the reel 15. In this case, the command unit 26 commands the reel 15 to accelerate.

[0051] Vice versa, if a clockwise displacement is detected (position 12b in fig. 3), this means that the cylinder 11 is rotating more slowly than the reel 15. In this case, the command unit 26 commands the reel 15 to slow down, until the position of the unwinder 12 around the reference position is restored.

[0052] Therefore, the command unit 26 constantly tracks the synchronization of the reel 15 and the cylinder 11, with continuous corrections of the speed, until it substantially stabilizes the angular position of the unwinder 17 and obtains that the correct working conditions are maintained.

[0053] The speed is also controlled according to the measurements made by the tension detector 13, which imposes a determinate speed on the motorized cylinder 11, and consequently on the reel 15.

[0054] During the operation to replace or lift the reel 15, which conventionally has a duration of about 15-20 seconds, there is an accumulation step (fig. 4) in which the thread 30, which continues to be fed by the machine upstream of the device 10, is only wound onto the accumulation cylinder 11, thus creating a reserve of thread 30. In fact, in this step the thread 30 cannot be removed

towards the reel 15, which is in the replacement step.

[0055] The accumulation step entails a rotation of the unwinder 12, together with the accumulation cylinder 11, since the unwinder 12 is no longer held, or rather drawn in the opposite direction to the rotation of the cylinder 11 by the thread 30 which exits in order to wind onto the reel 15.

[0056] The number of revolutions that the cylinder 11, together with the unwinder 12, performs during the formation of the reserve can therefore be detected by the encoder 17 and memorized in the command unit 26, substantially quantifying the quantity of thread accumulated during the lifting operation.

[0057] In order to prevent, during this step, any superimposition of the spirals of thread on the surface of the cylinder 11, which in the subsequent step would impede a correct unwinding and create risks of blockages and breakages of the thread, substantially simultaneously with the start of the formation of the reserve, the step-by-step motor 25 of the positioning device 14 is driven by means of the command unit 26.

[0058] This drive determines the progressive step-wise descent of the support 19, so as to displace the thread along the axis of the cylinder 11, thus allowing the thread to wind onto the surface of the accumulation cylinder 11 without any superimposition of the spirals.

[0059] The step of accumulating the thread 30 on the cylinder 11 is stopped as soon as a new cop has been located in the frame 23 and the collection operation can be restarted.

[0060] Then there is a transition step (fig. 5), to return the device 10 to the normal working condition. In this step, the command unit 26 imposes on the motor 25, which makes the reel 15 rotate, a much higher speed of rotation, for example about two times higher, than that of the accumulation cylinder 11.

[0061] In this way, the reserve previously accumulated on the cylinder 11 is rapidly given up to the reel 15.

[0062] Since the speed of rotation of the accumulation cylinder 11 is lower than that of the reel 15, the unwinder 12 rotates in the opposite direction to the direction of rotation of the cylinder 11.

[0063] This allows to unwind the thread 30, which forms the reserve, for a number of revolutions of the accumulation cylinder 11 which has been memorized in advance and corresponds to the revolutions which were necessary to create the reserve.

[0064] The higher rotation speed of the reel 15 is maintained until the reserve has been completely eliminated, so that a quantity of thread equal to that found in the working condition remains on the cylinder 11, but this time in the lower part thereof.

[0065] At this point the command unit 26 restores control of the angular position of the unwinder 12, so as to progressively return the speed of rotation of the reel 15 in synchrony with that of the accumulation cylinder 11. Moreover, the support 19 of the positioning device 14 is commanded to rise, displacing the reserve of thread 30

progressively towards the top of the cylinder 11, that is, to the normal working position.

[0066] From this point on, the normal working conditions are restored, which are maintained until the next lifting operation. It is clear, however, that modifications and/or additions of parts may be made to the device 10 as described heretofore, without departing from the field and scope of the present invention.

[0067] For example, the cylinder 11 can be of the replaceable type, for example by others of a different height or diameter, according to the times required for the lifting operations and hence in relation to the quantity of thread that has to be temporarily accumulated. The step-by-step motor of the positioning device 14 can be replaced by a linear motor with controlled drive, or by any type of motor, possibly with feedback control. Moreover, other sensors or detectors may be provided, to control the tension and/or the presence of the thread at other points in the path of said thread.

[0068] It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the art shall be able to achieve many other equivalent forms of device, all of which shall come within the field and scope of the present invention.

Claims

1. Device for forming a reserve of textile thread, arranged between a textile machine which feeds thread (30) continuously, and collection means comprising a replaceable collection element (15), **characterized in that** it comprises:

- accumulation means (11) on which the thread (30) arriving from the textile machine is wound and on which, when said collection element (15) is stopped, a reserve of thread (30) is formed, and
- synchronization means (26) able to synchronize the speed of rotation of said accumulation means (11) with the speed of rotation of said collection element (15) in order to balance, under normal working conditions, the quantity of thread (30) that is wound onto said accumulation means (11) with the quantity given up to said collection element (15) and, in a situation when said collection element (15) is restarted, to impose a greater speed on said collection element (15) than that of said accumulation means (11) in order to recover the reserve formed in said accumulation means (11) during the replacement step.

2. Device as in claim 1, **characterized in that** it comprises unwinding means (12), associated in idle manner with said accumulation means (11) and

able to send said thread (30) to said collection element (15).

3. Device as in claim 2, **characterized in that** said unwinding means (12) have a first substantially immobile condition in the situation of balance between the thread (30) winding onto said accumulation means (11) and the thread (30) given up to said collection element (15), a second condition wherein they rotate together with said accumulation means (11) during the formation of said reserve, and a third condition of inverse rotation to that of said accumulation means (11) since they are drawn by the thread (30) when said reserve is given up to said collection element (15). 5 10 15
4. Device as in claim 2 or 3, **characterized in that** said unwinding means (12) are associated with position detection means (17) able to send to said synchronization means (26) a signal to indicate a condition of imbalance between the speed of rotation of said accumulation means (11) and the speed of rotation of said collection element (15). 20
5. Device as in claim 4, **characterized in that** said position detection means comprise an encoder (17) and said synchronization means comprise an electronic command unit (26). 25
6. Device as in any claim hereinbefore, **characterized in that** said accumulation means comprise a motorized cylinder (11). 30
7. Device as in any claim hereinbefore, **characterized in that** it comprises a positioning device (14) to position said thread (30) on said accumulation means (11), said positioning device (14) being able to be activated in the formation of said reserve on said accumulation means (11) in order to distribute the spirals of thread (30) winding thereon without superimpositions. 35 40
8. Device as in claim 7, **characterized in that** said positioning device (14) comprises at least a thread-guide element (19) and a step-wise motor (21) able to move said thread-guide element (19) along the axis of said accumulation means (11). 45
9. Device as in any claim hereinbefore, **characterized in that** it comprises means to detect the tension (13), arranged upstream of said accumulation means (11) and able to condition the speed of rotation thereof, in order to maintain the winding tension of said thread (30) at a predetermined value. 50
10. Device as in claim 1, **characterized in that** it comprises detection means (22) to detect the presence of said thread (30), arranged at least between said 55

accumulation means (11) and said collection element (15).

11. Method for forming a reserve of textile thread, wherein a textile machine continuously feeds thread (30) which is collected on collection means comprising a replaceable collection element (15), **characterized in that** it comprises:
 - a first step, or normal working step, wherein the thread (30) arriving from the textile machine is wound onto accumulation means (11) and, simultaneously, is sent to said collection element (15), the speed of said collection element (15) and of said accumulation means (11) being synchronized so as to have a balance between said thread (30) wound onto the accumulation means (11) and said thread (30) sent to the collection element (15);
 - a second step, or reserve forming step, wherein said collection element (15) is stopped and a reserve of thread is formed on said accumulation means (11);
 - a third step, or transition step, wherein said collection element (15) is made to restart at a higher speed than that of said accumulation means (11) until the whole of said reserve formed in the second step is used, and then begins to rotate again at a speed correlated to that of said accumulation means (11).
12. Method as in claim 11, **characterized in that** in said second step, the stoppage of said collection element (15) comprises the replacement of a full collection element (15) with an empty collection element. 5
13. Method as in claim 11 or 12, wherein an unwinding element (12) is arranged coaxial with said accumulation means (11) and is suitable to send said thread (30) to said collection means (15) and to be made to rotate by said thread (30) in the opposite direction to the direction of rotation of said accumulation means (11), **characterized in that** the synchronization of the speeds of rotation of said accumulation means (11) and of the collection element (15) is obtained by searching for a substantially stationary condition of said unwinding element (12). 10
14. Method as in claim 13, wherein said unwinding element (12) is associated with an element to detect the angular position (17), **characterized in that** said element to detect the angular position (17) is an encoder able to send to a command unit (26) signals relating to a displacement in one direction or the other of said unwinding element (12) with respect to a reference position, said command unit (26) sending signals to the drive means (24, 25) of 15

said collection element (15) in order to restore a condition of substantial synchrony between the speed of rotation of said accumulation means (11) and the speed of rotation of said collection element (15).

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15. Method as in any claim from 11 to 14 inclusive, **characterized in that** said step to form said reserve provides to activate positioning means (14) so as to move said thread (30) along the axis of said accu-

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mulation means (11) in order to facilitate the deposition of the spirals of said thread (30) without superimpositions.

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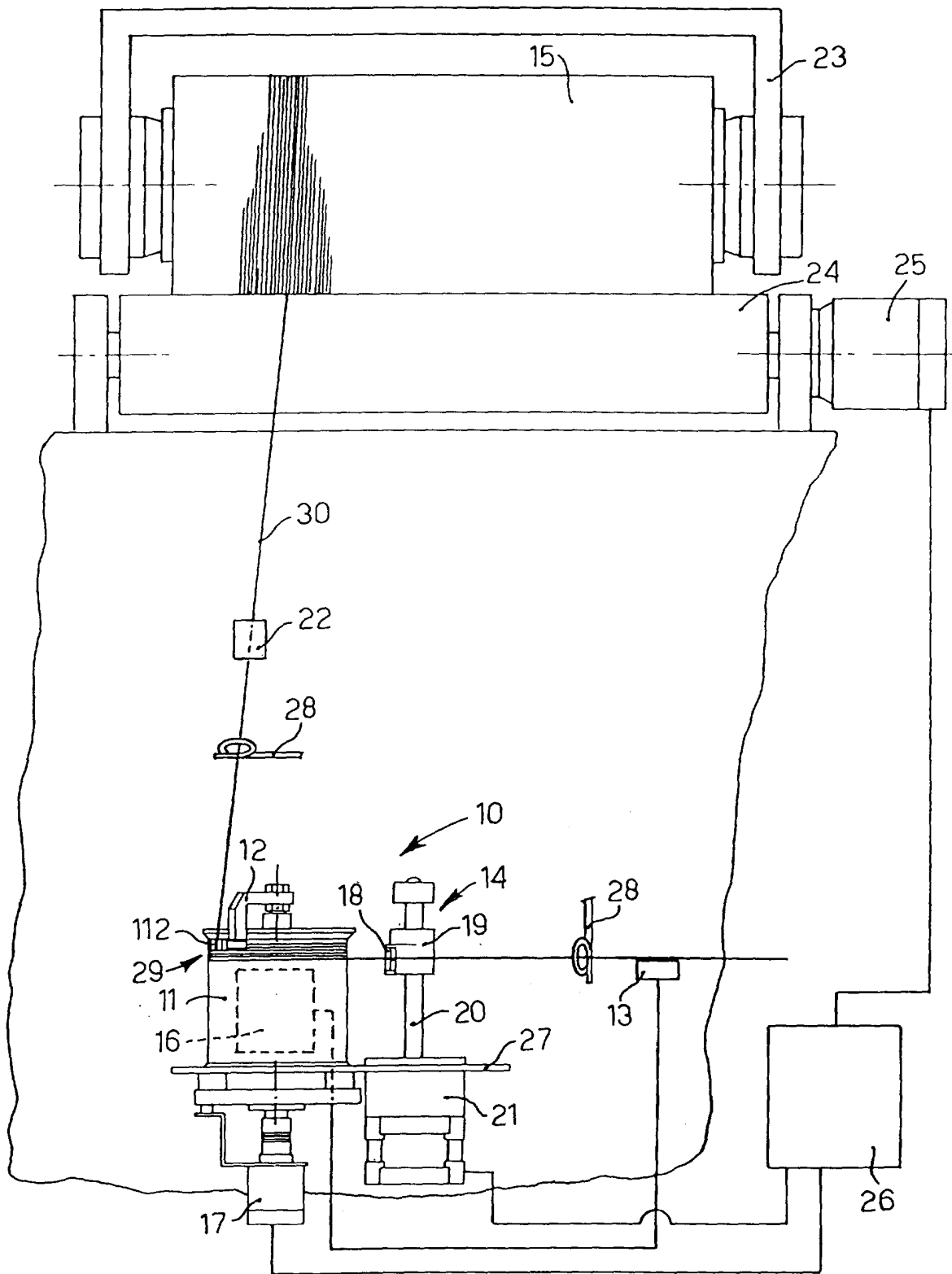


fig. 1

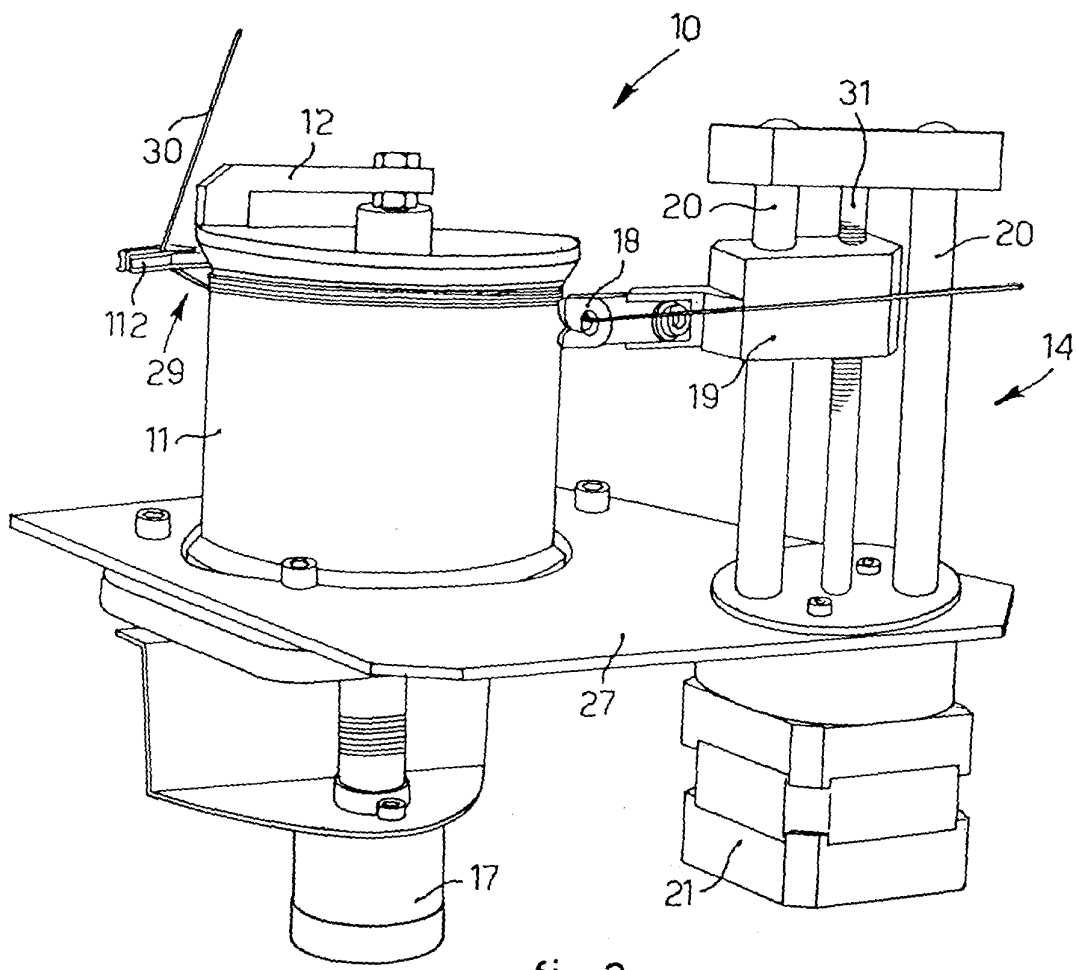


fig. 2

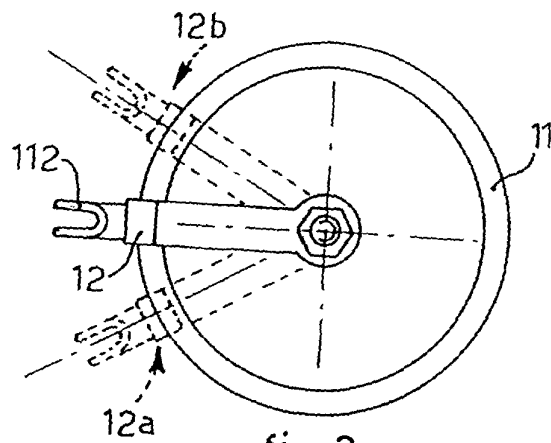
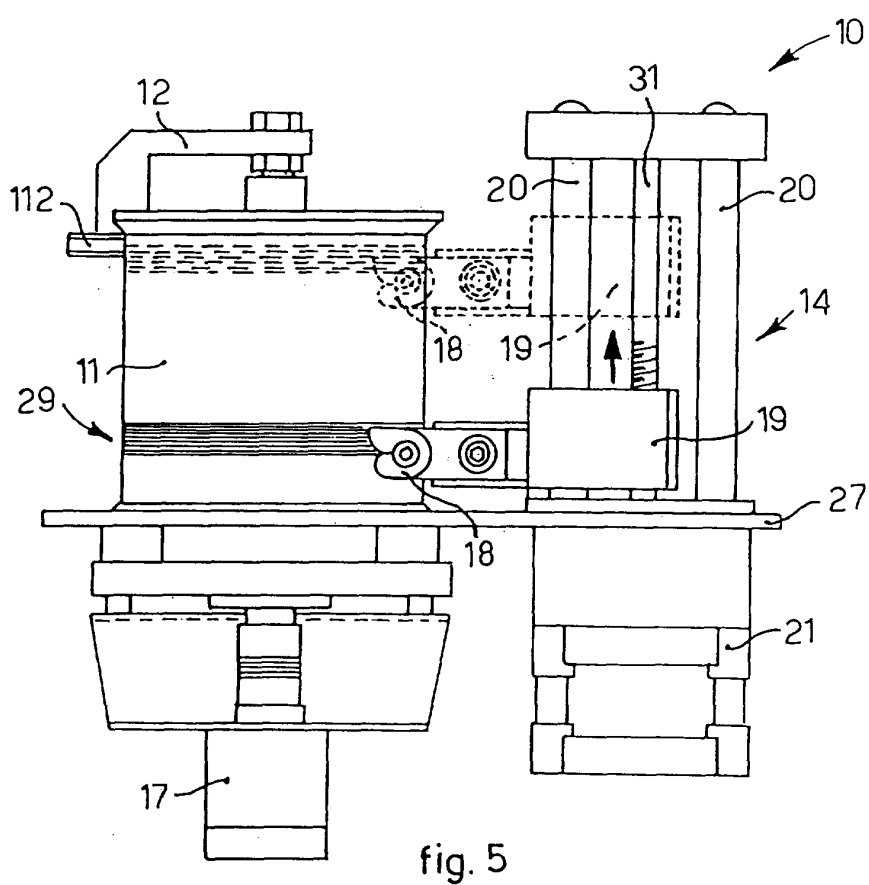
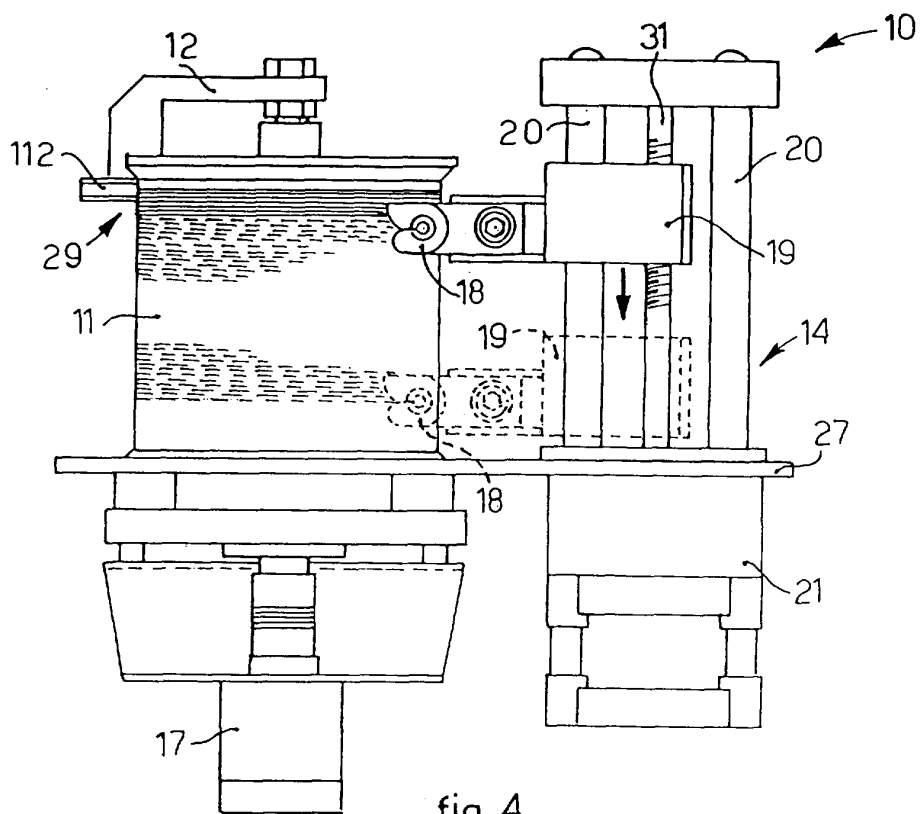


fig. 3





European Patent
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EUROPEAN SEARCH REPORT

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Place of search Munich		Date of completion of the search 19 August 2005	Examiner Kising, A
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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