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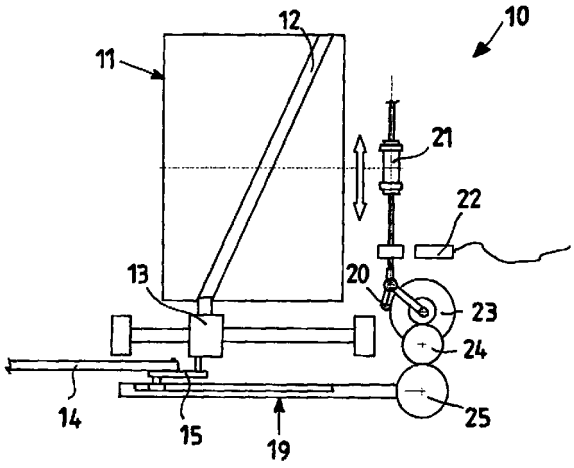
(54) Device for the tapering of yarn-gathering bobbins on a twisting frame

(57) A device for the tapering of yarn-gathering bobbins on a twisting frame comprises a traversing roller (11) which is actuated by the main motor of the twisting frame by means of appropriate mechanisms and is provided with a Z-shaped profile (12) generating a reciprocating motion in a connecting road (14) and where the law governing tapering of the bobbins is controlled by an inclinable tapering guide (19), which is kinematically connected to the aforesaid connecting road (14) and is able to vary the stroke of the reciprocating motion of the connecting road (14). If the said device, the inclination of the tapering guide (19) is adjusted by means of the operation of a pneumatic actuator (21), where each stroke of the pneumatic actuator (21) enables practically instantaneous variations in tapering having a pre-set value to be obtained.

Fig.1



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Description

[0001] The subject of the present invention is a device for tapering yarn-gathering bobbins on a twisting frame.

[0002] Two types of yarn-gathering bobbins are known: tapered ones and straight-sided ones.

[0003] Tapered bobbins consist of a cylindrical portion with two truncated cones at either end. The characteristic datum for their formation is the reduction of stroke, which corresponds to the difference in length between the initial stroke and the final stroke described by the thread-guide during formation of the bobbin.

[0004] It is known that tapering may be obtained using two different categories of device, and in the first place by means of centralized tapering devices, which are made using various techniques that enable the strokes applied to the bobbins to be controlled simultaneously during gathering of the yarn.

[0005] Alternatively, it is possible to use devices for individual tapering, which are made up of a mechanism fixed to the vain-gathering frame, so that each bobbin can be formed with a different tapering.

[0006] It should further be noted that the shape of the sides of the tapered bobbin may be rectilinear, concave or convex, and is generally conditioned by various production requirements; for example, concave shapes are preferred whenever there is the danger of turns of yarn being dropped, whereas convex bobbins are preferred for use in dyeing.

[0007] The various shapes of the sides are obtained according to the tapering system used. It is to be pointed out that, with traditional mechanical systems, the only shape obtainable is the convex one.

[0008] The need to eliminate the hard edges of the bobbins, which are formed at the intersection of the cylindrical stretch and the truncated-cone stretch on account of the action of reversal of motion, has led to bobbins being created with differentiated strokes.

[0009] The differentiation of the strokes is represented by a modulation of the stroke during winding in such a way as to distribute the yarn and thus prevent it from accumulating on the edges. Basically, the said modulation enables the yarn to be deposited una tantum not on the edge of the bobbin but further inside, so preventing crossing of the yarn on the edge.

[0010] In traditional mechanical tapering devices, the reciprocating movement of the connecting road and hence of the thread-guide is generated by a winding cam, which is driven by the main motor by means of appropriate mechanisms and gear transmissions, and the Z-shaped profile of which engages an element which moves with reciprocating motion and with a constant stroke on fixed guides. The reciprocating motion of the said element is transferred to the connecting road by means of a quadrant. The fulcrum of this quadrant is on an element which slides on fixed guides, one end of the quadrant being pivoted to the connecting road, and the other end being pivoted to a sliding block in an inclinable slide which acts as a tapering guide.

[0011] The inclination of the tapering guide is the parameter which enables variation of the stroke of the reciprocating motion transmitted by the quadrant to the connecting road, so producing the tapering.

[0012] The geometrical configuration of the tapering guide and of the quadrant is such that, in order to obtain a non-zero tapering, from the start of winding to the end of winding the inclination of the guide must increase.

[0013] The increase in inclination of the guide in traditional mechanical devices comes about in a constant way in time, in so far as the motion is always derived from the main motor by means of a kinematic chain, the main elements of which are described in what follows.

[0014] From the axes of the yarn-gathering cylinders, the motion, which is appropriately reduced, is transferred to a first gear wheel, which engages a connecting rod; the latter, by means of a ratchet mechanism, transmits the movement to a gear wheel from which, by means of further reductions, the movement then passes to a gear wheel which sets a shaft in rotation.

[0015] The shaft set in rotation in this way is provided, at its bottom end, with a worm screw which, as final element in the kinematic chain, varies the inclination of the tapering guide.

[0016] However, upon what has been described so far a number of remarks and clarifications should be made, which illustrate the limitations implicit therein. In this system, which is rigidly fixed to the main motor, the tapering follows a law of linear motion in time, i.e., the speed of tapering is constant so that the shape of the sides of the bobbin can only be of the convex type.

[0017] In addition, on the first gear wheel nine positions are present, which can each form the fulcrum of the connecting rod, and the different positioning causes a different rotation of the gear wheel to correspond to each turn of the first gear wheel. More precisely, with the fulcrum in position 1 the ratchet mechanism moves on by one tooth of the racket mechanism,at each turn of the first gear wheel; with the fulcrum in position 9, the ratchet mechanism moves on by nine teeth at every turn of the first gear wheel. This adjustment makes it possible to have the sides of the bobbin more or less inclined, but always with a convex shape (by "inclination" is meant the line joining the edge of the first layer with the edge of the last layer).

[0018] The traditional mechanical system of differentiation is based on the principle of decoupling of the inclination of the tapering guide from the rest of the tapering mechanism.

[0019] All this is achieved by means of a cam which is driven by the yarn-gathering cylinders and which, by alternately raising and lowering a lever, consequently increases the inclination of the tapering guide.

[0020] These temporary and instantaneous varia-

tions are simply superimposed on the effect of tapering and are completely independent of the latter, with the advantage of enabling management of the effect of differentiation simply by changing the various cams, without changing the tapering law.

[0021] Also known is a motor-driven system which disengages from the main motor the mechanism that carries out inclination of the tapering guide.

[0022] A completely dedicated stepper motor (or rather, one stepper motor for each side of the machine) directly moves the shaft on which the worm screw for inclining the guide is fixed, so eliminating the entire kinematic chain upstream.

[0023] Taking as input datum the number of turns performed by the yarn-gathering cylinders, the machine PLC manages operation of the motors so as to obtain as effects both tapering and differentiation.

[0024] The main advantage of such devices with dedicated stepper motor, in addition to rendering the mechanics lighter, is the possibility of creating tapering laws with variable speeds, thanks to the independence from the main motor.

[0025] However, the need emerges for obtaining the said different tapering laws in a more simple and economic way.

[0026] A purpose of the present invention is therefore to make a device for tapering yarn-gathering bobbins on a twisting frame which will enable the use of a dedicated stepper motor to be avoided in order to obtain different tapering laws of the bobbin of yarn.

[0027] Another purpose of the invention is to provide a device for the tapering of yarn-gathering bobbins with a variable tapering law which may be applied easily to existing machines.

[0028] Not the least important purpose of the present invention is to provide a device for the tapering of yarn-gathering bobbins with a variable tapering law which will offer the possibility of introducing subsequently new shapes for the sides of the bobbins by modifying the software alone.

[0029] These and other purposes are achieved by a device for tapering yarn-gathering bobbins on a twisting frame, according to Claim 1, to which the reader is referred for reasons of brevity.

[0030] Further purposes and advantages of the present invention will emerge clearly from the ensuing description and from the attached drawings, which are provided purely to give an explanatory and non-limiting example, and in which:

- Figure 1 is a schematic view of a device for tapering yarn-gathering bobbins on a twisting frame, according to the present invention;
- Figure 2 is a schematic elevation of what is represented in plan form in Figure 1;
- Figure 3 is a detailed view of the device according to the invention; and
- Figure 4 is a partially sectional elevation of the worm screw belonging to the device according to the invention.

[0031] With particular reference to the above figures, the device for tapering yarn-gathering bobbins on a twisting frame, according to the present invention, is designated as a whole by the reference number 10.

[0032] Before proceeding to a detailed description of the present invention, it is to be pointed out that the principle on which the present device is based to obtain rectilinear or concave inclined sides of the bobbin is given by the independence of the tapering control from the control of the other axes (movement of the spindles or yarn-gathering cylinders) so as to be able to establish a tapering law which depends in a non-linear way on time (variable tapering speed).

[0033] The device 10 for tapering yarn-gathering bobbins on a twisting frame, according to the present invention, comprises a traversing roller 11, which is driven by the main motor (not illustrated) by means of appropriate mechanisms and gear transmissions, and the Z-shaped profile of which 12 engages in reciprocating motion an element 13.

[0034] The reciprocating motion of the element 13 is transferred to a connecting road 14 by means of a quadrant 15, where the fulcrum 16 of the said quadrant 15 is on the element 13, one end 17 of the quadrant 15 being pivoted to the connecting road 14, and the other end 18 being pivoted to a sliding block in an inclinable guide 19.

[0035] The inclination of the inclinable guide 19 is adjusted by means of a ratchet mechanism 20 driven by a pneumatic actuator 21 governed by a solenoid valve. A possible and preferred embodiment of the invention involves the use, as pneumatic actuator, of a double-acting dual-stem or through-stem cylinder 21. In this way, it is possible to drive two mechanisms located on two opposite sides of the twisting frame.

[0036] The geometrical configuration of the tapering guide 19 and of the quadrant 15 is in fact such that, to obtain a non-zero tapering, from start of winding to end of winding, the inclination of the guide must increase.

[0037] The movement transmitted by the cylinder 21 by means of the ratchet mechanism 20 is in turn transmitted to a gear wheel 23, from which, by means of further reductions 24, it is transmitted to the gear wheel 25. The shaft 26, which is set in rotation by the gear wheel 25, has at its lower end a worm screw 27 which, as last element of the kinematic chain, varies the inclination of the tapering guide 19. The rotation of the gear wheel 23 may be by one or more teeth for each stroke of the cylinder 21, according to the chosen stroke of the cylinder 21.

[0038] Each to-and-fro stroke of the cylinder 21 enables practically instantaneous tapering increments of a constant value to be obtained.

[0039] In addition, the tapering law is directly linked

to the time intervals between each stroke of the cylinder 21.

[0040] For example, by maintaining an unvarying interval between start and end of winding, a linear tapering in time is still obtained, whereas, by increasing the intervals either in a discrete way or continuously, a tapering is obtained which is non-linearly dependent on time.

[0041] The law whereby the length of the time intervals between each stroke increases is managed by a PLC. The said PLC processes an input signal that is directly correlated to time, such as, for example, the amount of yarn wound or the number of turns made by the yarn-gathering cylinder (the said data are already available because current machines already process them for other purposes), and according to the law contained in the software the PLC varies the interval between the cylinder strokes.

[0042] The variety of shapes and inclinations that the sides of the bobbin can assume is directly linked to the laws entered in the software or to the variability of a single law by means of the modification of appropriate coefficients.

[0043] A preferred but non-limiting solution is that of a limitation to two coefficients for reasons of simplicity of data entry by the user.

[0044] As regards the new device described, a number of observations may be made.

[0045] The minimum values of the intervals between the strokes are of the order of a few seconds, and hence altogether compatible with the mechanics of the system introduced, consisting of a cylinder 21 and a solenoid valve.

[0046] To control the effectiveness of the pneumatic cylinder 21, a sensor 22 may be installed, which records the stroke of the cylinder 21 that has taken place, and can thus set off an alarm in the case of failure to record a stroke within a certain time.

[0047] With such a sensing system available, it is then possible to enter a maintenance alarm linked to a number of critical strokes for the elements of the system (cylinder 21 and solenoid valve).

[0048] The characteristics, as well as the advantages, of the device for tapering yarn-gathering bobbins on a twisting frame, which forms the subject of the present invention, emerge clearly from the foregoing description.

[0049] In particular, the advantages are represented by:

- economy of the modification, in so far as the additional element presents a low cost as compared to known solutions controlled by electric motors;
- unaltered mechanics of the traversing roller box, and hence its reliability;
- elimination of a major part of the traditional mechanics;
- possibility of adapting existing machines with minimum intervention; and
- possibility of subsequent introduction of new shapes for the sides of the bobbins simply by modifying the software.

[0050] Finally, it is clear that numerous variations may be made to the device for tapering yarn-gathering bobbins on a twisting frame, which forms the subject of the present invention, without thereby departing from the principles of novelty inherent in the inventive idea. In the practical implementation of the invention, the materials, shapes and sizes of the items illustrated may clearly be any whatsoever according to the requirements, and the said items may be replaced with others that are technically equivalent.

Claims

1. A device for the tapering of bobbins for gathering yarn on a twisting frame, comprising a traversing roller (11) which is actuated by the main motor of the aforesaid twisting frame by means of appropriate mechanisms and the Z-shaped profile (12) of which generates a reciprocating motion in a connecting road(14) and where the law governing tapering of said bobbins is controlled by an inclinable tapering guide (19), which is kinematically connected to the aforesaid connecting road (14) and is able to vary the stroke of the reciprocating motion of said connecting road (14), characterized in that the inclination of said tapering guide (19) is adjusted by means of the operation of a pneumatic actuator (21), where each stroke of said pneumatic actuator (21) enables practically instantaneous variations of tapering having a pre-set value to be obtained.

2. A device according to Claim 1, characterized in that the aforesaid pneumatic actuator (21) is a dual-stem double-acting cylinder (21) operated by a solenoid valve.

3. A device according to Claim 2, characterized in that the movement transmitted by the cylinder (21) is in turn transmitted, by means of a ratchet mechanism (20) to a first gear wheel (23), from which, through other reductions (24), it is transmitted to a second gear wheel (25), where a shaft (26), set in rotation by said second gear wheel (25), has at its bottom end a worm screw (27) which engages the end of said tapering guide (19) so as to vary the inclination of the latter.

4. A device according to Claim 1, characterized in that the reciprocating motion is transmitted to said connecting road (14) by means of an element (13) on which a quadrant (15) pivots, and where one first end (17) of said quadrant (15) pivots on said connecting road (14), and one second end (18) pivots

on a sliding block which slides in said inclinable tapering guide (19).

5. A device according to Claim 1, characterized in that the above-mentioned tapering law is correlated to the variation in the time intervals between each pulse of said pneumatic actuator (21) and is managed by a PLC which processes an input signal directly correlated to time and which, according to the above-mentioned tapering law, varies the interval between the pulses.

6. A device according to Claim 1, characterized in that, in order to control the effectiveness of said pneumatic actuator (21), a sensor (22) is present which records the stroke performed by said pneumatic actuator (21) and may set off an alarm in the event of failure to record within a pre-set time interval.

7. A device according to Claim 6, characterized in that it envisages a maintenance alarm related to a number of critical strokes for the aforesaid pneumatic actuator (21) and solenoid valve.

Fig.1

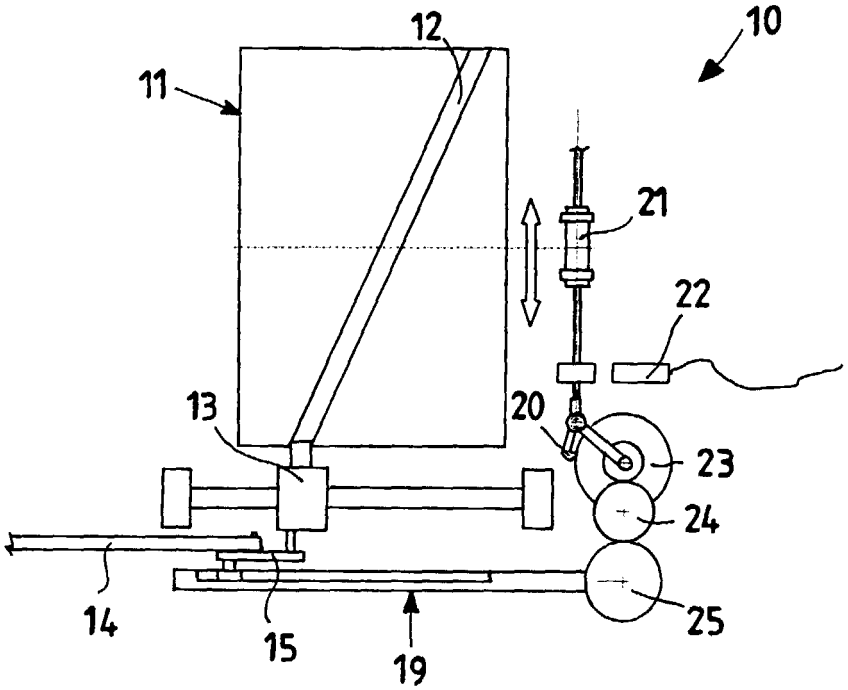

Fig.2

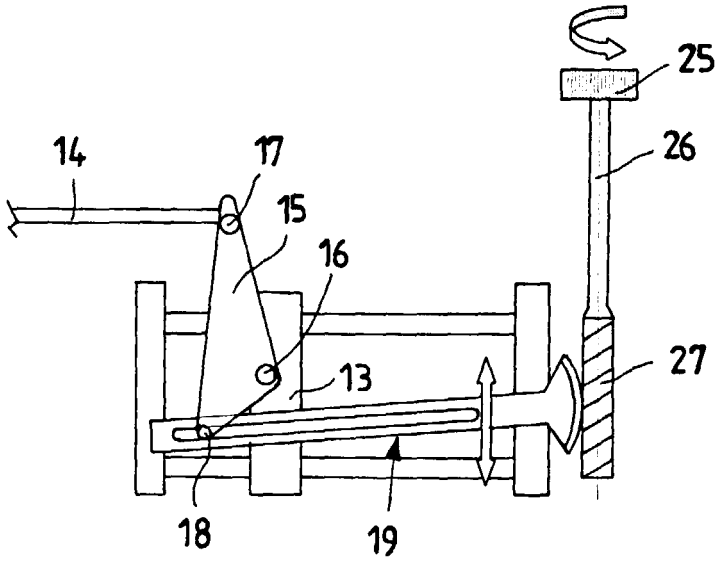

Fig.3

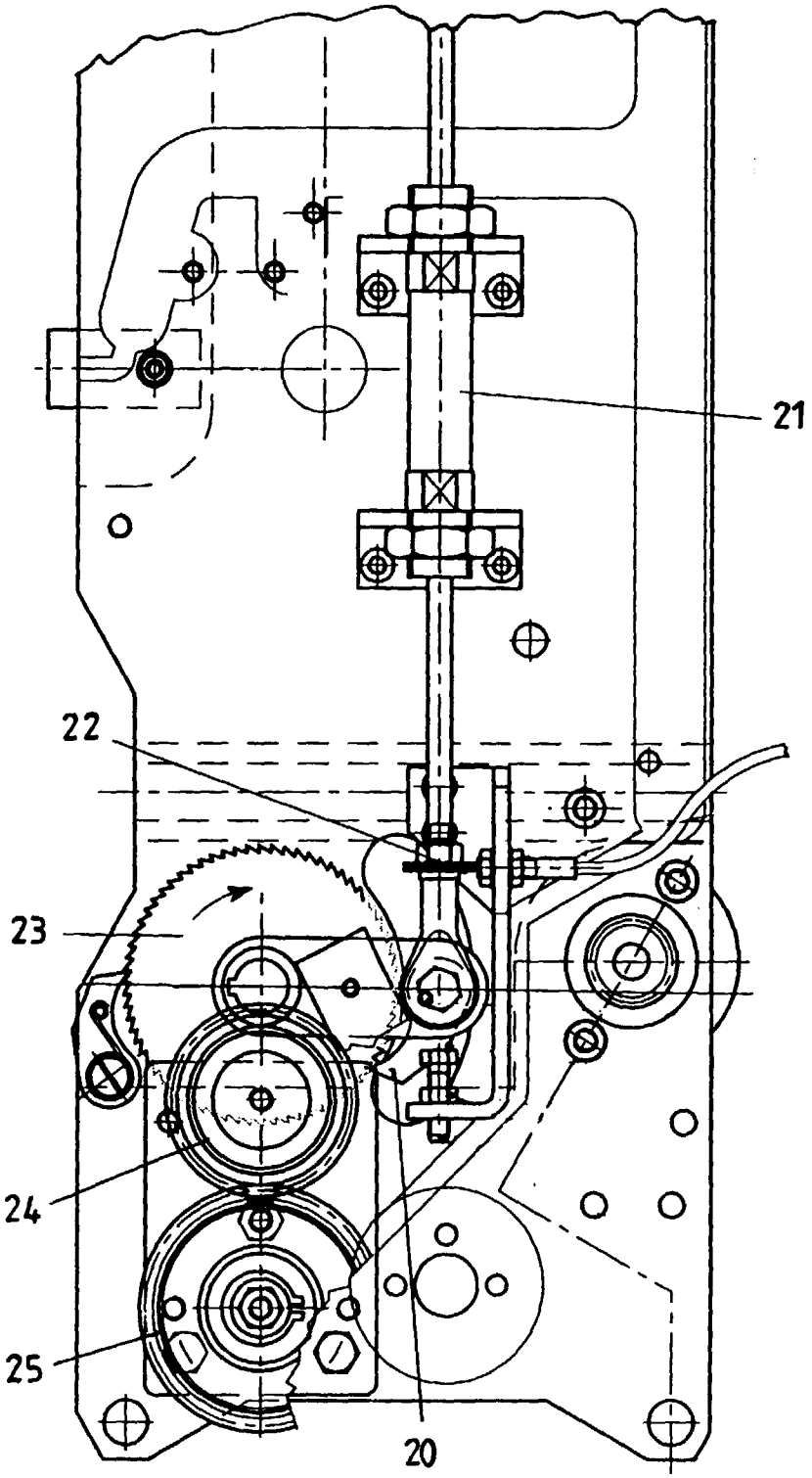

Fig.4