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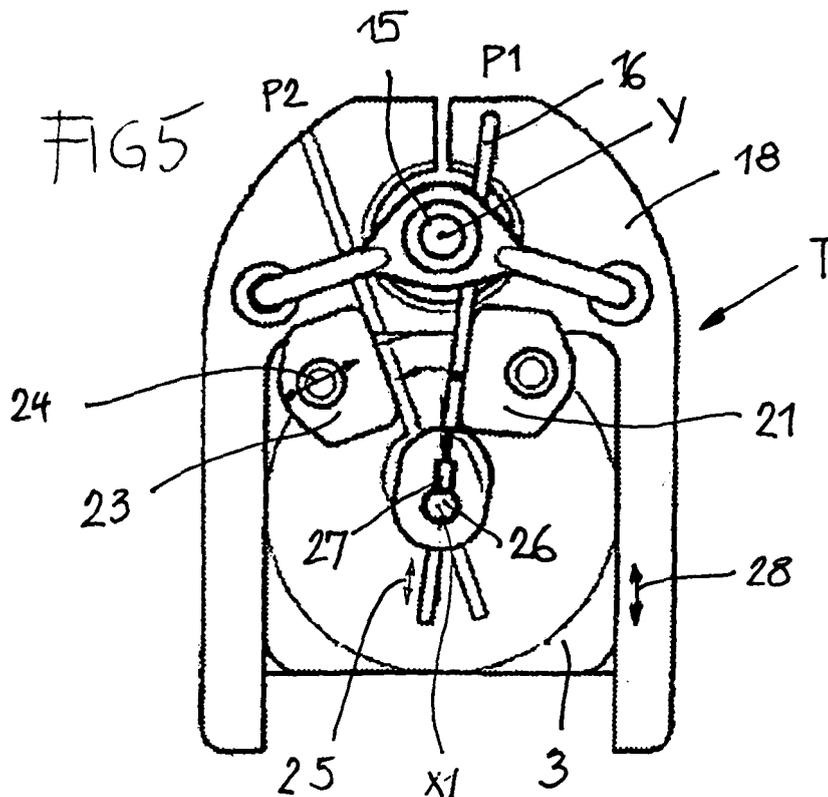
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(54) **Take-up device**

(57) A take-up device T for a yarn consuming textile machine M, comprises a take-up arm 16 supported for a pivot movement or a linear movement between a first position P1 at one side of a yarn path 13 defined by yarn guides 14, 15 crosswise through the yarn path into a second position P2 at the opposite side of the yarn path. The

take-up arm 16 can be urged at least in movement direction towards the second position P2 by a force generator. The force generator is a controllable motor (3) the force of which is applied via the take-up arm (16) on the yarn Y in the yarn path 13. The force can be varied by an external signal. The motor is a rotary motor or a linear motor.



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Description

[0001] The invention relates to a take-up device according to the preamble part of claim 1.

[0002] A take-up device for a yarn consuming textile machine has to take-up an excess yarn length in some operation cycle phases of the textile machine and to keep the stored excess yarn length taut with a certain force, e.g. while the yarn has and is relaxed. The take-up device has to yield in other operation cycle phases when the yarn is stretched or pulled off by other components. In case of a rapier weaving machine as the yarn consuming textile machine the take-up device has the function of keeping the yarn stretched with a certain force so that the yarn maintains a desirable geometrical configuration e.g. in the region of a yarn selector and does not disturb another processed yarn of another yarn channel, and such that the first rapier is enabled to correctly grip the yarn in the yarn selector prior to an insertion into the weaving shed of the rapier weaving machine. When the first rapier starts to accelerate into the weaving shed, the take-up device has to yield as quickly as possible and to pay out the stored yarn length in order to add as little additional tension to the tension in the yarn caused by the pulling action of the first rapier. Shortly before the first rapier reaches the middle of the weaving shed and starts to decelerate drastically to a stop, the take-up device again takes up the excess yarn length and stores this yarn length in stretched condition, such that the yarn transfer from the first rapier to the second rapier occurs as intended. During the subsequent acceleration of the second rapier the take-up device again has to yield as quickly as possible, before the take-up device again has to take-up and store yarn close to the end of the insertion and after the deceleration of the second rapier to a stop. The take-up device then has to keep the stored excess yarn length taut with a predetermined force until the next insertion starts in the same yarn channel. This means that the take-up device has to respond quickly to take up yarn when the yarn becomes relaxed, has to stretch the stored excess yarn length with a certain force, but also has to yield as quickly as possible when the yarn is pulled or stretched due to consumption by the rapier weaving machine. These are two completely contrary requirements for the take-up device, in particular when the take-up device is equipped with a permanently acting turning force generator generating a turning force or torque tending to keep the take-up arm in the second position.

[0003] In a conventional take-up device for a rapier weaving machine the take-up arm is permanently loaded towards the second position by a pre-loaded spring constituting the turning force generator. The spring biases the take-up arm such that the take-up arm deflects the relaxing yarn within the yarn path between the yarn guides and will store the excess yarn length with a force determined by the pre-load of the spring. As soon as the yarn is pulled off, the yarn tension rises and the turning force generated by the spring overcomes such that the

take-up device yields, until finally the take-up arm might reach the first position again. When the yarn is pulled off and the tension in the yarn increases accordingly, the yarn does not only have to overcome the turning force of the spring but also the moment of inertia of the take-up arm. This causes a permanently acting mechanical load on the yarn and additional tension added to the tension in the yarn already caused by the pulling off action even while the take-up arm is held in the first position. The higher the acceleration of the running yarn or the stronger the gradient of the yarn tension increase caused by the pulling off action are, the more additional tension is added by the take-up device to the then already present tension in the yarn. This frequently may cause yarn breakages.

[0004] US 7,275,291-A discloses a controlled yarn stretcher operating with pressurised air as a medium for achieving the take-up function. The yarn path extends through a guiding tube. Pressurised air is blown through the tube counter to the running direction of the yarn, when the take-up function is needed. The pressure level of the pressurised air can be varied. In an expedient embodiment the pressure level of the pressurised air or the flow rate is varied in correlation with an operation cycle of the textile machine, e.g. a rapier weaving machine, such that the yarn stretcher does not influence the yarn run when the pulling off action already causes tension in the yarn. The pneumatic yarn stretcher however, operates with several drawbacks. Firstly, the pressurised air might cause serious changes in the yarn structure which changes cannot be tolerated for certain yarn qualities. Secondly, the pressurised air as the take-up medium acts with a delayed response both when starting and when terminating a take-up function. On the other hand, pressurised air as the take-up medium has the big advantage that the pneumatic yarn stretcher is more forgiving than a purely mechanically acting take-up device, meaning that controlling the pneumatic yarn structure in correlation to an operation cycle of the rapier weaving machine does not need extremely high precision.

[0005] It is an object of the invention to provide a take-up device as mentioned at the beginning which does not unduly load the yarn or deteriorate the structure of the yarn and does not add undesirable additional tension to the tension in the yarn during operation cycle phases already causing tension in the yarn.

[0006] This object is achieved with the features of claim 1.

[0007] Only when the take-up function is needed, will the motor be controlled to load the take-up arm with a force such that the intended take-up function will be achieved. As soon as the yarn is pulled off or is loaded with yarn tension by other means downstream of the take-up device, the force will be reduced at the same time or even before such that the yarn does not have to overcome the force and such that the take-up device yields either more easily or even without residual resistance. The take-up device does not add any additional or un-

desirably high tension when there is tension in the yarn caused by consumption. There are two possibilities for varying the force. In the first case, the motor generates the force first in the direction necessary for the take-up function when a take-up function is needed, but generates a much lower force or no force at all when a take-up function is not needed any longer. This means that then the yarn has to overcome a much lower mechanical load of the take-up arm or only the load of the inertia of the take-up arm alone to e.g. return the take-up arm to the first position. In the second case the turning force may be generated and varied bi-directionally, meaning that the yarn does not have to overcome any significant resistance of the take-up arm when starting to run off or when the yarn tension increases by means acting downstream of the take-up device. The take-up device is taking up excess yarn length when the yarn relaxes, and keeps the yarn taut. As soon as the take-up function is no longer needed, the mechanical load caused by the take-up arm becomes lower or practically zero such that then wear on the yarn is minimised and no additional undesirable yarn tension will be added to the yarn tension caused by the pulling off action or a stretching action by components of the yarn consuming textile machine downstream of the take-up device. In both cases the force will be varied such that an optimum yarn control will be executed according to the operation cycle of the e.g. intermittently and/or irregularly operating textile machine.

[0008] In an expedient embodiment the motor of the take-up device is an electric motor, a magnet motor, or a pneumatic motor, and either a rotary motor or a linear motor. Such motor types allow to precisely control and vary the turning force or the linear force applied by the take-up arm on the yarn. Furthermore, these motor types even when generating a maximum turning force are able to yield at least partially like a spring.

[0009] In an expedient embodiment the force of the motor will be varied between a maximum value and a value which at least substantially corresponds with a zero value force. The maximum value suffices to either hold the take-up arm in the second position counter to the reaction force of the yarn or even at a stop defining the second position. When the force is reduced to zero, the yarn only has to overcome the inertia of the take-up arm when the take-up arm is to return to the first position and when a take-up function is no longer needed. However, the force instead may be reduced only partially or according to a variably controlled force profile, e.g. if appropriate to achieve an optimised yarn control.

[0010] Another expedient embodiment uses a reversibly controlled motor. In this case the motor may return the take-up arm back in the direction to or even to the first position, when the yarn pulling off action starts, such that the yarn does not have to overcome any or very little mechanical load when the take-up arm is to be returned. In case of a reversible motor two different operational principles are possible. According to the first principle the motor will keep the take-up arm in the first position until

a take-up function is needed, and then moves the take-up arm in the direction to the second position, and will bring back the take-up arm to the first position after termination of the take-up function. According to the second principle the motor will hold the take-up arm with a certain force in the second position, as long as the external signal does not command the return of the take-up arm to the first position. The force direction then is inverted, e.g. such that the arm return is executed according to a certain adjustable force or motion profile or without a significant mechanical co-action between the take-up arm and the yarn.

[0011] In a further particularly important embodiment the force generated by the motor is varied and/or inverted in correlation with an operation cycle of the textile machine. The take-up device then is controlled in adaptation to the operation of the textile machine and will carry out a take-up function exclusively when needed according to the respective and current operation cycle of the textile machine, and also will initiate or terminate each take-up function cycle in correlation with the course of the development of the operation cycle of the textile machine. This results in a precise adaptation of the operation of the take-up device to the operation cycle of the textile machine, such that no additional undesirable tension will be added to the yarn tension already built up in the yarn, and such that the tension in the yarn caused by a take-up function will precisely be matched with the requirements of functions occurring in the textile machine.

[0012] In a preferred embodiment the motor is connected to a programmed electronic control device generating the external signal controlling the motor, the force value and the direction of the force. In the case of an electric motor or a magnet motor as the motor of the take-up device the control device comprises a current value control circuit or is connected with a current value control circuit. In this case the magnitude of the force may be controlled directly proportional to the value of the current supplied to the motor.

[0013] In the case that the force direction can be inverted, it is expedient to provide a position sensor generating signals indicating the respective position of a driving motor component or of the take-up arm. The position sensor is connected with the control device such that a closed regulation loop is constituted with a feedback control of the motor.

[0014] In the case of e.g. a rapier weaving machine as the yarn consuming textile machine, the electronic control device may be connected to a bus transmitting information e.g. of the rotary angle position of e.g. a main shaft of the rapier weaving machine. The programming of the control device includes at least turning force values, e.g. as current values, and/or target take-up arm positions, respectively associated to selected rotary angle positions or rotary angle ranges of the main shaft. During operation of the rapier weaving machine the take-up device will execute each take-up function fully automatically and according to the programming.

[0015] As, conventionally, such yarn consuming textile machines, like a rapier weaving machine, comprise several yarn channels each equipped with a take-up device, according to an expedient embodiment the take-up devices in the several yarn channels are either connected

to individual electronic control devices or to a common control device, both allowing to individually program each respective take-up device. This may be important in the case of different yarn qualities processed in the different yarn channels, because each yarn quality might need individual programming of the take-up device functions.

[0016] The take-up device may be arranged between a yarn feeding device equipped with a yarn brake and a yarn detector and/or a yarn selector arranged downstream of the yarn feeding device.

[0017] The take-up device may be mounted at an outlet of the yarn feeding device, preferably even at the outlet of a balloon breaker cone of the yarn feeding device. The take-up device even may replace a yarn guiding outlet of the yarn feeding device or of the balloon breaker cone.

[0018] The take-up device may have a housing which, preferably, can be mounted to the outlet of a yarn feeding device or to the outlet of a balloon breaker cone. The housing comprises a single or a pair of yarn guides. The motor driving the take-up arm is placed in the housing and supports the take-up arm at an output shaft. Stops defining the first and second positions of the take-up arm may be mounted at the housing, preferably adjustable and preferably made from resilient material. As such the take-up device is a complete structural unit which can be mounted to retrofit already existing yarn feeding devices or yarn feeding device balloon breaker cones.

[0019] In another embodiment the longitudinal extension of the pivotable take-up arm with respect to the pivot axis may be adjusted upon demand, and/or the distance between the pivot axis and the yarn path defined by the yarn guides, may be adjustable upon demand, in order to adapt the take-up device to various requirements, e.g. yarn qualities or requirements dictated by the yarn consuming textile machine or the respective yarn channel.

[0020] Expediently, the motor is a step motor or a permanent magnet motor. Such motor types show minimum hysteresis, can be controlled extremely precisely, have a long service lifetime, and even allow a position detection of the take-up arm internally such that a separate position sensor may be dispensed with.

[0021] Expediently, the motor is either a rotary motor or a linear motor depending on the moveability of the take-up arm!

[0022] The core of the invention is to variably control the mechanical action of the take-up device on the yarn such that the yarn will be controlled optimally and in adaptation to the operation cycle of the yarn consuming machine, and with a view to a disturbance-free machine operation and high uniform quality of the final product. This is achieved by a motor variably driving and adjusting the force imparted by the take-up arm on the yarn such that a take-up function is executed only when needed for

an operation cycle of the textile machine, that the turning force is controlled and varied as necessary, and that the take-up arm does not at all or only as desired generate mechanical load on the yarn when the take-up function has to be terminated or when the take-up function is not needed any longer for the operation cycle of the textile machine.

[0023] Expediently, the motor is either a rotary motor or a linear motor.

[0024] Embodiments of the invention will be explained with reference to the drawings. In the drawings is:

Fig. 1 a schematic plan view of a yarn processing system including a controlled take-up device,

Fig. 2 a schematic illustration of the function of a take-up device,

Fig. 3 a perspective view of a first embodiment of a take-up device,

Fig. 4 a perspective view of a second embodiment of a take-up device, and

Fig. 5 a front view of another embodiment of a take-up device.

Fig. 6 a side view of another embodiment.

[0025] Fig. 1 schematically shows a yarn processing system S including a yarn consuming textile machine M, like a rapier weaving machine R as in the shown embodiment. The rapier weaving machine R is a non-limiting example for a yarn consuming textile machine in functional association with which the invention may be embodied. Further, non-limiting examples for such yarn consuming textile machines are circular knitting machines e.g. for producing striped knitwear, flat knitting machines, projectile weaving machines, etc.

[0026] The yarn processing system S in Fig. 1 shows one yarn channel 9 of several yarn channels for processing the same or different yarn qualities. The yarn Y intermittently processed in the shown yarn channel 9 is pulled off from a bobbin 1 by a yarn feeding device F having e.g. a balloon breaker cone 2 at the outlet and an internal yarn tensioner or break 29, e.g. a brush-ring contacting a storage body. Downstream of the balloon breaker cone 2 a take-up device T is arranged. The take-up device T instead could be mounted or arranged at the outlet of the yarn feeding device F directly, irrespective whether or not a balloon breaker cone 2 is provided. Downstream of the take-up device T a yarn detector 7 is monitoring the correct run of the in this case intermittently consumed yarn Y and/or the presence of the yarn Y, e.g. in the entrance region of a yarn selector 8 to which the several yarn channels 9 are connected. The yarn selector 8 is arranged upstream of a weaving shed 10 of the rapier weaving machine R. The rapier weaving machine R has

at least one first gripper 11 which is moved from a stop position as shown in the region of the yarn selector into the weaving shed 10 and in the weaving shed 10 towards the middle of the weaving shed 10. As soon as the first gripper 11 has reached the middle of the weaving shed 10 and has transported the tip of the yarn Y to this location, a yarn transfer takes place into a second gripper 12 which is moved to the middle of the weaving shed 10 from the right side in Fig. 1. The second gripper 12 subsequently pulls the transferred yarn Y to the right edge region of the weaving shed, while the first gripper 11 is returned.

[0027] The take-up device T is equipped with a motor 3 controlled uni-directionally or bi-directionally by an external signal from an electronic control device C having an input or programming section 4 and being connected e.g. with a main control unit CU of the rapier weaving machine R, e.g. via a line including at least a so-called angle bus 5 for transmitting information about the angular movement of e.g. a main shaft 6 of the rapier weaving machine R. The control device C may include or may be connected to a current value control circuit 30. The motor 3 is either a rotary motor or a linear motor for driving a take-up arm 16 either linearly or through a pivot stroke, in each case crosswise through a yarn path.

[0028] The take-up device T may comprise a position sensor 22 connected to the control unit C or the main control unit CU. The position sensor 22 is useful in the case of a reversible motor 3, to detect the operative position of a driven or driving component of the take-up device T or the motor 3, and to input a corresponding position signal into the control device C..

[0029] The take-up device T is controlled e.g. by the control device C according to the operation cycles of the rapier weaving machine R, such that the take-up device T is only executing a take-up function for storing excess yarn length when needed for a proper operation of other components in the yarn processing system S, like the yarn selector 8, in conjunction with the first and second rapiers 11 and 12, and, in some cases, for a cutting function of an inserted weft yarn. The take-up device T, furthermore, has to establish a certain yarn geometry during at least the time periods of a take-up function and such that the yarn in the respective yarn channel 9 is kept stretched with a certain force and a certain geometry in the region of the yarn selector 8, and/or in the middle of the weaving shed 10, and/or at the right side of the fabric edge when the second gripper 12 has pulled the yarn Y fully through the weaving shed 10. The synchronisation of the take-up functions of the take-up device T with the operation cycle or operation cycle phases of the rapier weaving machine R is executed e.g. by programming the control device C and by processing angle information transmitted via the angle bus 5.

[0030] The take-up function of the take-up device T is shown in more detail in Fig. 2. As long as no take-up function is needed, the yarn Y defines a straight yarn path 13 through two distant yarn guides 14, 15, e.g. yarn

eyelets. In the intermediate space between the yarn guides 14, 15 a take-up arm 16 is arranged for a pivot movement between a first position P1 at one side of the yarn path 13 crosswise through the yarn path 13 to a second position P2 at the other side of the yarn path 13, in order to deflect the yarn Y from the straight yarn path 13 into a substantially triangular shape as shown in full lines in Fig. 2. This take-up function means that the take-up device T will store excess yarn length of the then in most cases stopped and relaxed yarn Y and will keep the yarn stretched even further downstream. The yarn running direction is shown by an arrow 19. The take-up arm 16 moves in both directions as shown by a double arrow 17. The motor 3 drives the take-up arm 16 such that the speed, the acceleration and/or the stroke of the take-up arm 16 can be controlled upon demand. Furthermore, the turning force generated by the motor 3 and imparted by the take-up arm 16 on the yarn Y may be controlled and varied, e.g. such that the take-up arm 16 is able to yield under a certain reaction force of the yarn Y, i.e., to yield within the limited stroke range.

[0031] The first and second positions P1, P2 of the take-up arm 16 may be defined by stops (not shown in Fig. 2).

[0032] The motor 3 of the take-up device T, preferably, is an electric motor like a step motor or a magnet motor like a permanent magnet motor, or even a pneumatic motor, and in the core of Fig. " a rotary motor.

[0033] The invention contemplates two different modes of operation of the take-up device T of e.g. Fig 2:

[0034] In a first case the motor 3 is acting uni-directionally like a controlled spring to urge the take-up arm 16 from the first position P1 towards the second position P2 with a predetermined and controlled turning force.

The turning force is set such that, e.g., during the take-up function the yarn Y which is deflected by the take-up arm 16 is kept taut with a certain stretching force, i.e. the reaction force of the stretched yarn Y and the turning force of the take-up arm 16 in the contact point with the yarn Y are balanced. When then the tension in the yarn varies due to influences of components in the yarn path e.g. downstream of the take-up device T, the take-up arm 16 either is moving further towards the second position P2 or is yielding, depending on whether the tension in the yarn is increasing or is decreasing. In this operation phase the motor 3 is acting like a spring with a uni-directional turning force as the spring force. The motor 3 may vary the turning force if needed. As soon as the yarn Y is pulled in the direction 19 out of the yarn feeding device F, the tension in the yarn will rise automatically because the mass of the yarn has to be accelerated, and because the yarn feeding device generates a certain resistance. At the same time or even prior to this point in time the turning force of the motor 3 is varied, i.e. is reduced, preferably to a zero turning force such that the take-up arm 16 no longer loads the deflected yarn between the yarn guides 14, 15, but to the contrary, the yarn Y may easily return the take-up arm 16 to the first position or

close to the first position P1. During this return action the reaction force of the yarn Y only has to overcome the small inertia of the take-up arm 16, because the turning force generated by the motor already has vanished. For a proper operation of the components downstream of the take-up device, as an alternative, it may be expedient, not to totally reduce the turning force of the motor 3 acting on the take-up arm 16 in the direction towards the second position P2, but to gradually or in a controlled manner reduce it to a lower turning force value than the turning force value generated during the take-up function, such that the take-up arm 16 is returned counter to a certain but lower resistance.

[0035] In a second case, the motor 3 is controlled bi-directionally to change the sense of the force direction commanded by the external signal from the control device C. This means that, as soon as the take-up function is no longer needed or needs to be varied, the turning force generated by the motor on the take-up arm 16 in the direction towards the second position P2 may not only be reduced or even reduced to zero, but the direction of the turning force even may be reversed such that the motor 3 fully or partially returns the take-up arm 16 towards the first position P1. In this case the yarn Y, when being pulled in the direction 19 and containing increasing yarn tension already does not need to return the take-up arm 16 at all.

[0036] In the first and second cases, the take-up arm 16 may be held by the motor 3 e.g. in the first position P1 as long as no take-up function is needed, and may be brought into the second position P2 or to a certain position ahead of the second position P2 only when a take-up function is needed. In the second case of a motor 3 allowing to reverse the direction of the turning force for the take-up arm 16, preferably, a position sensor, like the position sensor 22, is monitoring the position of the take-up arm 16 and/or a rotary component of the motor 3 moving in unison with the take-up arm 16.

[0037] In the first case (uni-directionally driven motor 3) the turning force for the take-up arm 16 may be controlled between maximum and minimum values, preferably zero, by varying the value of the current supplied to the motor 3 (an electric motor or a rotary magnet motor). In the second case, not only the turning force can be varied as needed, but also the direction of the pivot movement of the take-up arm 16. In this case the value of the current supplied can be varied, the direction of the current can be reversed, and the position of the take-up arm 16 between the first and second positions P1, P2 can be varied and monitored in a closed feedback regulation loop.

[0038] Generally, the control device C may include a current value control circuitry 30 or the like. The programming executed by the control device C (which control device C even could be integrated into the main control unit CU) e.g. includes certain current values associated to certain rotation angles or rotation angle ranges of the main shaft 6 of the rapier weaving machine R. The pro-

gramming can be individual for each yarn quality, i.e. can be different for the take-up device T in another yarn channel 9.

[0039] The take-up devices shown in Figs 3 and 4 are designed to be mounted e.g. to the outlet of the balloon breaker cone 2 shown in Fig. 1 or at the outlet of the feeding device F, respectively. A housing 18 accommodates the motor 3. The housing 18 in Fig. 3 has two spaced apart cheeks 20 each containing a yarn guide 14, 15, e.g. ceramic yarn eyelets. The take-up arm 16 is arranged in-between the cheeks 20 and is supported by a output shaft (not shown) of the motor 3. A stop 21 may define at least one of the first and second positions P1, P2 of the take-up arm 16.

[0040] In the embodiment shown in Fig. 4 only one cheek 20 is provided. The single cheek 20 contains the yarn guide 15. The second yarn guide 14 needed to define the yarn path 13 in this case may be a part of the balloon breaker cone 2 or the yarn feeder F instead.

[0041] The shorter cheek 20' in Fig. 4 may be formed with a socket for placing the position sensor 22 monitoring the position or movement of the take-up arm 16 in relation to the yarn path and/or between the first and second positions P1, P2.

[0042] Instead of a structurally integrated position sensor 22, in case of a step motor or a magnet motor, the position information of the rotary component of the motor may even be derived electronically by other methods directly from the motor such that a structurally integrated position sensor 22 can be dispensed with.

[0043] Fig. 5 is a front view of a further embodiment of a take-up device T. The housing 18 is U-shaped such that the motor 3 is received between the housing legs. The position of the motor 3 can be varied as indicated by a double arrow 28, and such that the distance between an output shaft 26 of the motor 3 and the yarn Y in the yarn guide 15 may be varied. Furthermore, the active longitudinal extension of the take-up arm 16 may be varied by an adjustment device 27 schematically indicated close to the output shaft 26 of the motor 3.

[0044] The first and second positions P1, P2 may be defined by, preferably elastic or resilient, stops 21, 23 fixed to the motor 3 or the housing 18, respectively. Each stop 21 may be adjusted in the direction of a double arrow 24 in order to change the positions P1, P2 or to vary the distance or stroke between both positions P1, P2.

[0045] The motor 3 is either a uni-directionally or bi-directionally operating motor, preferably a rotary or linear electric motor, magnet motor or even a pneumatic motor. In the first case the force imparted by the output shaft 26 on the take-up arm 16 may be varied by the external signal from the control device C, preferably between a maximum value and zero or a lower value close to zero. In the second case the direction of operation of the motor 3 can be inverted to carry out the entire or at least a partial return function of the take-up arm 16 into the first position without forcing the yarn to return the take-up arm when the yarn is pulled off by components located downstream

of the take-up device. In the second case, i.e. in connection with the bi-directionally operating motor 3, the position sensor 22 is implemented to give additional information to the control device C about the respective actual position of the take-up arm for the control device C. Instead, the take-up arm 16 could be moved linearly crosswise through the yarn path. In this case, the take-up arm may be a yarn eyelet or a fork element connected e.g. directly to a lineally moving driving component of the linear motor.

[0046] When the motor 3 has brought the take-up arm 16 to the second position P2 at the stop 23 in Fig. 5, the contact pressure between the take-up arm 16 and the stop 23 may be set upon demand. However, the take-up arm 16 is loaded by the turning force of the motor 3 such that it may yield if the reaction force imparted by the deflected yarn on the take-up arm 16 exceeds a certain value.

[0047] In the case of the rapier weaving machine R shown in Fig. 1 the take-up device T has to execute a take-up function e.g. when the yarn Y is stopped and becomes relaxed, in order to take-up excess yarn length and to keep the yarn Y stretched with a certain force e.g. in the region of the yarn selector 8, also in the region where the first gripper 11 will take the yarn before inserting the yarn into the shed further in the region of the transfer from the first gripper 11 to the second gripper 12 in the middle of the weaving shed 10, and finally in the region where the second gripper 12 is decelerated and stopped. Keeping the yarn taut in the yarn selector 8 is important, because the yarn selector 8 at the same time may contain several yarns of all yarn channels 9. Any relaxed or slacky yarn then could easily become intermingled with the other yarns. In the region where the first gripper is taking the yarn, the stopped yarn has to be kept stretched with a force such that the first gripper 11 can properly grip the yarn. In the transfer phase, the yarn has to be kept taut with a certain force such that the first gripper 11 can transfer the yarn properly to the second gripper 12. In the stop area of the second gripper 12, finally the yarn has to be kept taut and stretched when stopped such that the yarn can be released from the second gripper 12 properly. In operation cycle phases in-between these above-mentioned operation cycle phases of the rapier weaving machine R, any take-up function is undesirable as well as any undesirable interference of the take-up device T on the yarn (i.e. friction and/or braking deflection), because then the take-up arm would add additional tension to already high tension in the yarn Y, e.g. while the first gripper 11 is accelerating sharply, or while the second rapier 12 is accelerating sharply, or whenever the yarn is running with relatively high speed while being pulled off from the yarn feeding device F. In the yarn feeding device F the tensioning device 29 is producing a certain basic yarn tension only when pulling off the yarn Y from the storage body of the yarn feeding device F. However, this basic yarn tension does not suffice to keep the yarn stretched in rest periods, but to the contrary,

then the take-up function of the take-up device T is needed. By varying the turning force imparted by the motor 3 on the take-up arm 16, the take-up device T will mechanically load the yarn Y only when needed for a correct operation of the yarn processing system S, while the take-up device will release or set free the yarn from any mechanical load or only will generate a very low mechanical load, respectively, whenever a take-up function or an interference of the take-up device on the yarn run are not useful. In case of a bi-directionally operating motor the take-up arm 16 even can be moved away from the yarn into the first position P1 or in any random position between the given positions P1, P2 before the yarn becomes stretched by components acting from the downstream side.

[0048] Fig. 6 illustrates a take-up device T using a linear motor (an electric, magnetic, pneumatic type) as the motor 3 for lineally driving and/or positioning the take-up arm 16 crosswise to the yarn path 13. The movement direction of the take-up arm 16 is indicated by axis X2 and may correspond to the motor axis. The take-up arm 16 is connected with the output shaft 26, and may be a straight rod, a fork-like element 30 or even an open or closed yarn eyelet 31.

Claims

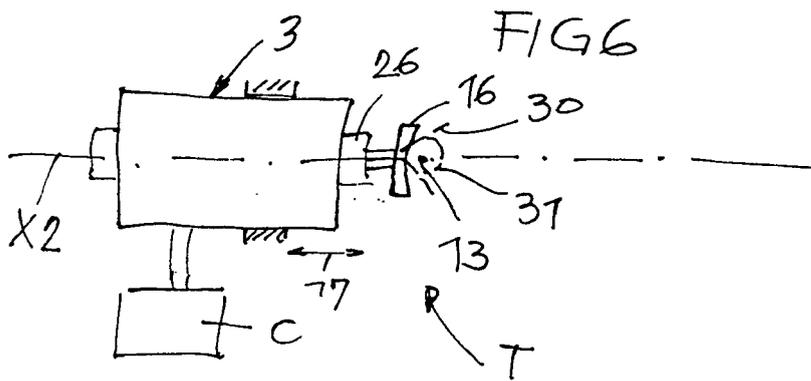
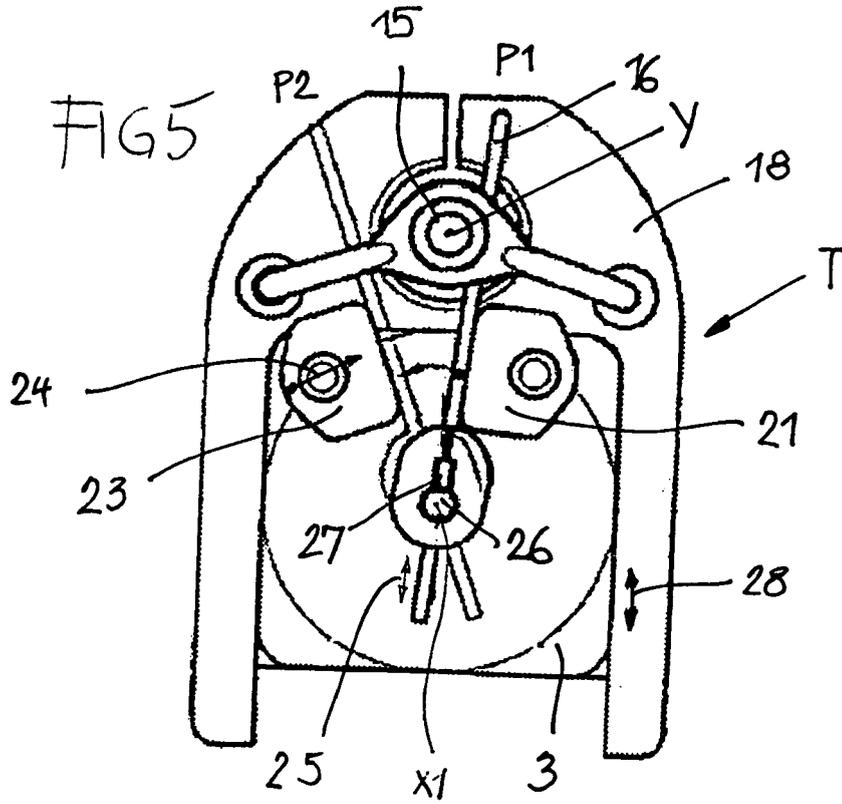
1. Take-up device (T) of a yarn consuming textile machine (M), in particular a rapier weaving machine (R), the take-up device (T) comprising a take-up arm (16) supported for a relative movement between a first position (P1) at one side of a yarn path (13) defined by yarn guides (14, 15) crosswise through the yarn path (13) and a second position (P2) at the opposite side of the yarn path (13), and a force generator for urging the take-up arm (16) with a force in at least a direction towards the second position (P2), the force of the force generator being applied on the yarn (Y) in the yarn path (13) via the take-up arm (16) **characterised in that** the force generator is a motor (3) controlled by an external signal, and that the force generated by the motor (3) can be varied by the external signal supplied to the motor (3).
2. Take-up device as in claim 1, **characterised in that** the motor (3) is an electric motor, a magnet motor or a pneumatic motor, and that the motor (3) either is a rotary motor or a linear motor.
3. Take-up device as in claim 1, **characterised in that** the force of the motor can be varied between a maximum value and substantially zero either gradually or in steps.
4. Take-up device as in claim 1, **characterised in that** the motor (3) is a reversible motor, and that the force of motor (3) can be varied in at least one direction

of the movement of the take-up arm (16) between the first and second positions (P1, P2).

5. Take-up device as in at least one of the preceding claims, **characterised in that** the force of the motor (3) is generated and/or varied and/or inverted in correlation with an operation cycle of the textile machine (M). 5
6. Take-up device as in claim 1, **characterised in that** the motor (3) is connected with a programmable electronic control device (C) generating the external signal, and that in case of an electric motor or a magnet motor as the motor (3) the control device (C) either includes a current value control circuit (30) or is connected with a current value control circuit (30). 10
7. Take-up device as in claims 4 and 6, **characterised in that** at least one position sensor (22) is functionally associated either to a movable driving component (26) of the motor (3) or to the take-up arm (16). 15
8. Take-up device as in at least one of the preceding claims, **characterised in that** in the case of e.g. a rapier weaving machine (R) as the textile machine (M) the control device (C) is connected with a bus (5) for transmitting information about a rotary angle e.g. of a main shaft (6) of the rapier weaving machine (R), and that the program of the control device (C) includes at least selected rotary angles or rotary angle ranges combined with associated motor force values, e.g. in the form of current values, and/or target positions of the take-up arm (16). 20 25 30
9. Take-up device as in at least one of the preceding claims, **characterised in that** take-up devices (T) in several yarn channels (9) of the textile machine (M) either are connected with individual control devices or with a common control device (C), both allowing to program the take-up devices (T) individually. 35 40
10. Take-up device as in at least one of the preceding claims, **characterised in that** the take-up device (T) is arranged between a yarn feeding device (F), preferably equipped with a yarn brake (29), and a yarn detector (7) and/or a yarn selector (8) arranged downstream of the yarn feeding device (F). 45
11. Take-up device as in claim 10, **characterised in that** the take-up device (T) is mounted to an outlet of the yarn feeding device (F). 50
12. Take-up device as in claim 1, **characterised in that** the take-up device (T) comprises a housing (18), preferably to be mounted to the outlet of a yarn feeding device (F) or of a balloon breaker cone (2) of the yarn feeding device (F), the housing (18) having ei-

ther a single or a pair of yarn guides (14, 15), that the motor (3) is accommodated by the housing (18) and carries the take-up arm (16) at an output shaft (26), and that stops (21, 23), preferably made from resilient material and being adjustable, for defining the first and second positions (P1, P2) of the take-up arm (16), are provided at the housing (18).

13. Take-up device as in claim 12, **characterised in that** the longitudinal extension of the pivotably supported take-up arm (16), and/or the distance between the output shaft (26) and the yarn path (13) are or is adjustable. 10
14. Take-up device as in claim 2, **characterised in that** the electric motor (3) is a step-motor or a permanent magnet motor. 15
15. Take-up device as in claim 2, **characterized in that** the take-up arm (16) is a pivot arm supported for a pivot movement about a pivot axis (X1), preferably is carried by an output shaft (26) of a rotary motor. 20
16. Take-up device as in claim 2, **characterized in that** the take-up arm (16) is supported for a linear movement along an axis (X2) extending crosswise through the yarn path (13), preferably is connected with a driving component (26) of a linear motor. 25 30



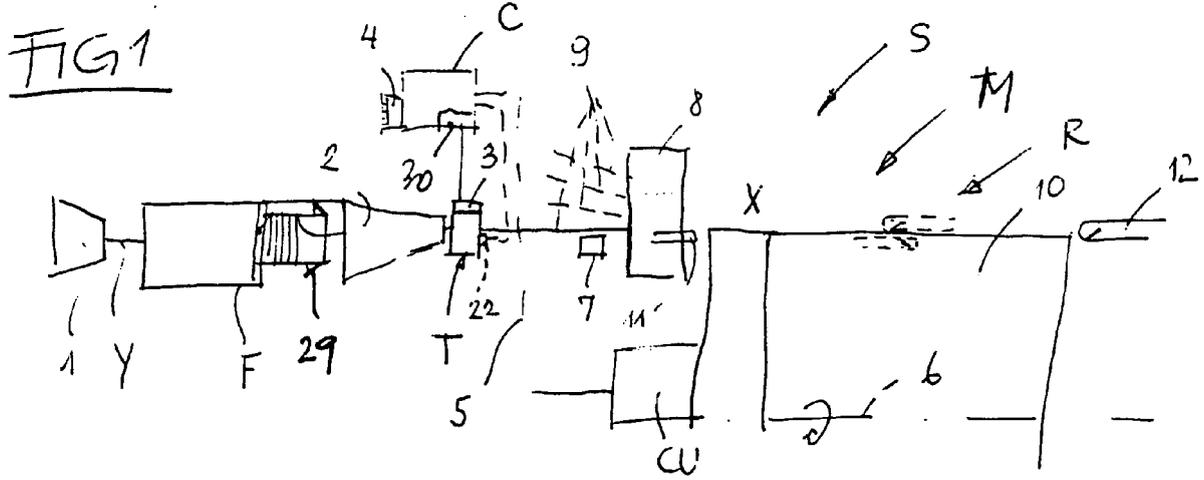


FIG 2

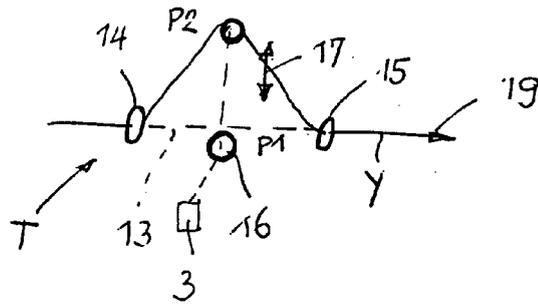


FIG 3

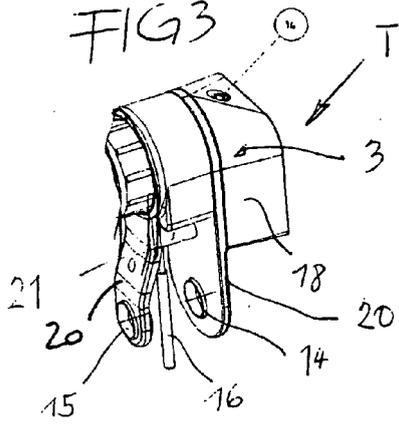
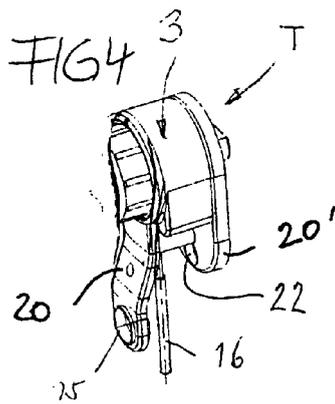


FIG 4





EUROPEAN SEARCH REPORT

Application Number
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