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YARN FEEDER DEVICE WITH SPRING STOP FOR YARN FEELERS

The invention relates to a yarn feeder device having the characteristics of the preamble to claim 1.

Yarn feeder devices are known that have a yarn feed wheel with yarn wrapped around it, which serves on the one hand to draw a yarn off from a yarn bobbin continuously and on the other to furnish this yarn to a yarn-consuming station, such as a knitting machine. Such yarn feeder devices have a retainer or base body on which a yarn feed wheel is rotatably supported with a preferably vertical pivot shaft. The yarn feed wheel is supported by the shaft and is driven via pulleys disposed on the other side of the shaft. Both along the way to the yarn feed wheel and on the way from the yarn feed wheel, the yarn is passed through yarn guide elements, such as eyes.

For instance for checking whether a yarn is present or not, a so-called yarn feeler is often present. This is a lever that is pivotably supported on the base body or retainer and that bears down with its free end on the yarn. If the yarn sags or tears, the lever is no longer kept in its operating position by the yarn and thus pivots downward into a position in which it turns a warning light on, for instance. This is the response position.

As a rule, the yarn feeler lever is located on the yarn in the vicinity of a yarn guide element that keeps the yarn at a defined height. When the yarn is being threaded in, it must be guided through the yarn guide element. If this is done by hand, the yarn feeler lever is often an obstacle, if it is located next to the yarn guide means. On the other hand, during operation of the yarn feeder device, the yarn feeler means must be



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prevented from skipping or fluttering on the yarn travelling through it. Otherwise, the function of the yarn feeder devices could be impaired.

Based on the above, it is the object of the invention to create a yarn feeder device that functions reliably and is easier to manipulate.

The yarn feeder device of the invention attains this object. To that end, the yarn feeder device is assigned a stop means that limits the travel of the yarn feeler means in or immediately next to the operating position, and the stop means is embodied as yielding. The yieldingness is dimensioned such that the forces acting on the yarn feeler means in ongoing operation are unable to overcome the limit set by the stop means, which thus acts as a fixed stop. However, if a yarn is to be inserted into the yarn feeder device, then the yarn feeler means can be pressed upward beyond the operating position, thus giving the yarn guide means enough clearance that the yarn can easily be guided by hand through the yarn guide means. The stop means is accordingly designed such that the limitation it presents to the range of motion can easily be overcome with the forces brought to bear by hand in threading the yarn, while for the comparably much lesser forces that the yarn is capable of exerting, the stop means is virtually rigid.

The stop means is preferably a resilient stop means.

The resilient yieldingness can be attained in fundamentally different ways. In a first embodiment, the yarn feeler means, such as an eye or part of a wire bail that rests on the yarn, is held by a rigid, pivotably supported lever, and the pivoting range is limited by a stop that is embodied resiliently. In another exemplary embodiment the stop is rigid, and the lever itself is embodied resiliently. At least in that case, the lever

forms part of the yieldingly embodied stop means for the yarn feeler means.

If the lever arm for embodying the stop means is embodied as resiliently yielding, a very simple, robust embodiment is obtained. The other embodiment with the rigid lever and spring stop for it, however, may have somewhat improved manipulability.

The resilient stop means can be formed by a leaf spring, tension spring, or compression spring. A leaf spring is preferred, which cooperates for instance with a cam that is connected in a manner fixed against relative rotation to the lever that supports the yarn feeler means.

The spring means and the cam can be shaped and disposed such that between the operating position and the response position of the yarn feeler means, no moment that affects the pivoting of the lever occurs. This can also be achieved if the spring means, such as a leaf spring, rests permanently on a cylindrical surface of the cam, for instance in order to prestress the bearing of the lever in one direction. It can thus be attained that the bearing is free of play.

As the spring means, a prestressed spring means is preferably used. Prestressing can be attained for instance by providing that a spring, such as a leaf spring, which is assigned to the cam rests with prestressing on an abutment, so that normally it does not touch the cam. The spacing between the spring and the cam is selected such that the cam touches the spring when the yarn feeler lever is raised beyond its operating position.

Thus a corresponding rotation of the cam does not become possible until a torque that overcomes the spring prestressing is exerted. Thus there is an abrupt change in the characteristic curve of the restoring torque. As a result, the spring stop, for yarn forces occurring during

operation, functions like a fixed stop. Manually, however, the stop can easily be overcome - especially once the prestressing force is overcome, no further substantial increase in force or substantial increase in the contrary torque occurs any longer. On the contrary; this moment can drop again.

The "hard" limitation of the pivoting range of the yarn feeler lever, that is, the limitation that is unyielding even to relatively strong forces, is preferably effected by a special stop that is separate from the resilient stop means. This special stop can be attained for instance by a yarn guide means or its retainer. The separation of the resilient stop means and the nonresilient stop means has the advantage that an overload on the resilient stop means can be avoided easily.

The resilient stop comes into play in a position that is only slightly above the operating position. This is a position in which the yarn rests on the yarn guide means at an angle of virtually 180° . In other words, this is the position in which a yarn extends between two yarn guide means essentially taut (straight), that is, with the desired yarn tension, when the yarn feeler means is bearing down on it.

Bails that, in a preferred embodiment, are open at least after downstream of yarn feed wheel serve as the yarn guide means. Initially, they guide the yarn only in the manner of a supporting surface; above that, the yarn could be lifted from the corresponding supporting surfaces. However, this is prevented by the yarn feeler lever, which at least in regular operation holds the yarn down and thus guides it on the support surface of the yarn guide element. Thus the yarn feeler lever takes on a guidance function. In this way, despite the open design of the yarn guide element in the form of an open bail,

erratic yarn travel (skipping, fluttering) is avoided. In terms of yarn guidance, the open yarn guide elements in conjunction with the yarn feeler lever are thus at least equivalent to closed yarn guide eyes. However, precisely because of the open design and the possibility of lifting the yarn feeler lever by force beyond its operating position, yarns can be threaded in much more easily.

Further details of advantageous embodiments of the invention can be learned from the ensuing description or the drawing or are the subject of dependent claims.

In the drawing, exemplary embodiments of the invention are illustrated. Shown are:

Fig. 1, a yarn feeder device in operation, in a side view;

Fig. 2, a yarn feeder device with a yarn feeler lever in the response position, in a side view;

Fig. 3, the yarn feeder device of Figs. 1 and 2 after a yarn has been threaded in;

Fig. 4, the yarn feeder device of Figs. 1-3, opened and partly dismantled, showing the bearing of the yarn feeler lever;

Fig. 5, a resilient stop means for the yarn feeler lever, in a schematic side view;

Fig. 5a, a modified embodiment of the resilient stop means, in a schematic side view;

Fig. 6, the stop means of Fig. 5, in a different operating position and in a schematic side view;

Fig. 6a, the stop means of Fig. 5a, in a different operating position and in a schematic side view;

Fig. 7, a yarn feeler lever with an resilient stop and weight relief, in a schematic fragmentary view;

Fig. 8, a graph showing the torques exerted on the yarn feeler lever as a function of its position; and

Fig. 9, a modified embodiment of the yarn feeder device with a yarn feeler lever in the threading position.

In Fig. 1, a yarn feeder device 1 is shown whose housing 2 is embodied as a central bearer. On one end 4, it is provided with a fastening clamp 5 for fastening to a knitting machine or similar yarn-using machine, while on the opposite end 6, a yarn brake 7 is disposed. This yarn brake serves by nonpositive engagement to brake a yarn 8 travelling through.

Between the two ends 4, 6, there is a vertical shaft, which is supported rotatably in the housing 2 about a rotary axis D, and on its lower end it has a yarn feed wheel 9, which has a ring 10 on the top. This ring is preferably embodied as a deep-drawn sheet-metal part. Its outer circumferential face 11 is closed and profiled, while the upper and lower edges 14, 15 are each embodied conically. One or more pulleys 16, which above the housing 2 are connected to the shaft, are used to drive the yarn feed wheel 9.

The yarn feed wheel 9 forms an advancement device that serves to advance the yarn 8 in accordance with a specified value. The specified value comprises the rpm of the yarn feed wheel at which it is driven. The yarn 8, to that end, wraps around the yarn feed wheel 9 in a plurality of windings and forms a lap 17 on the yarn feed

wheel 9. To deliver the yarn 8 to the yarn feed wheel 9 in a defined way and thus to the lap 17, and to guide the yarn 8 downward from the yarn feed wheel 9 in a controlled way, one or more yarn guide means are provided. These include at least one yarn guide bail 18, which the yarn 8 passes through immediately after being paid out from the yarn feed wheel 9. The yarn guide bail 18 is embodied for instance as a substantially U-shaped wire bail, with two legs joined together via a crossbar 19. The crossbar 19 guides the yarn 8. It is embodied as approximately straight and is disposed at a right angle to the rotary axis D of the yarn feed wheel 9. Alternatively, a yarn outlet eye or a similar element may be provided as the yarn guide means. However, embodying it as an open yarn guide bail has the advantage that the yarn 8, depending on the direction of rotation of the yarn feed wheel, is guided on one end or the other of the crossbar 19, so that in both directions, well-defined conditions of paying out the yarn from the yarn feed wheel 9 result. The yarn guide bail 18 can be disposed relatively close to the yarn feed wheel 9. To guard against wear, the yarn guide bail 18 can have a ceramic overlay. The crossbar 19 can also be embodied entirely of ceramic, if necessary. In the embodiment of the yarn guide means as an open yarn guide bail 18, only a very slight tendency for fluff or other dust to deposit on it results. Hence there is no need to fear clogging.

In the embodiment of the yarn guide means as an eye, conversely, there is the advantage that it can be embodied in a simple way as a ceramic element. In that case, the tendency to clog up may be somewhat higher.

To make it possible to establish various operating states, the yarn guide means (the yarn guide bail 18) is preferably supported adjustably. To that end, both legs of the yarn guide bail 18 are enclosed in a sliding block

guide, for instance, which [verb missing] an adjustment of the yarn guide element approximately in a range represented by an arrow 21 in Fig. 1 and is adjustable in the appropriate direction.

For further guidance of the yarn 8, further yarn guide means can be provided. These include for instance a yarn guide bail 22, which is disposed following the yarn guide bail 18 and is likewise embodied as a wire bail. The yarn guide bail 22 is retained by one leg on the yarn feeder device 1 and is comparatively narrower than the yarn guide bail 18. Its crossbar 23 is rounded in a semicircular shape.

On the inlet side (in terms of the travel of the yarn 8, before the yarn feed wheel 9), further yarn guide means in the form of yarn inlet eyes 24, 25 may be provided on both sides of the yarn brake 7. These eyes are embodied as ceramic eyes, for instance, which are retained on suitable retainers and are connected to the housing 2.

A yarn feeler lever 26 is pivotably supported on the housing 2. The yarn feeler lever 26 can be embodied as a two-legged wire bail, whose legs 27 fit laterally over the yarn guide bail 18. On the lower end, that is, the end remote from the pivotable bearing, the legs 27 are joined together by a crossbar 28, which weighs down on the yarn 8. The crossbar 19 and the crossbar 28 form a yarn guide eye that guides the yarn at the top and bottom. The crossbar 28 together with the crossbar 23 in turn forms a yarn guide eye that guides the yarn at the top and at the bottom. The eyes thus formed are formed of overlapping open elements. By exerting extra pressure on the yarn feeler lever 26 beyond its operating position I, these eyes can be opened to a certain extent for threading the yarn.

The pivotable bearing of the yarn feeler lever 26 is embodied on and in the housing 2 and is shown separately in Fig. 4. The housing 2 comprises an upper housing part 2a (Fig. 4) and a lower housing part 2b (Fig. 1). The upper housing part 2a has extensions 31, which on their underside each have a notch 32 for receiving inward-bent ends of the legs 27 of the yarn feeler lever 28. The ends of the legs 27 thus form a kind of shaft. For bearing this shaft, a recess 33 is embodied in the lower housing part; it is adapted in shape to the extension 31 and together with the notch 32 forms a bearing opening.

The inward-bent ends of the legs 27 are joined to one another by a molded plastic body 34. It holds the inward-bent ends of the legs 27 together.

Because of the pivotable bearing of the yarn feeler lever 26, its crossbar 28, which forms a yarn feeler means, can be pivoted by its own weight out of the position shown in Fig. 1 into the position shown in Fig. 2, if the yarn 8 allows this. In that position, a switch device, for instance, not otherwise shown, responds to the shifting in position of the yarn feeler lever 26 and for instance switches on a light 35. The position II shown in Fig. 2 for the yarn feeler lever 26 is therefore the response position, while the position I shown in Fig. 1 exists during normal position and is thus called the operating position. The pivoting range of the yarn feeler lever 26 includes at least both positions I and II. Within this range, the yarn feeler lever 26 is easily movable.

In position I, the crossbar 28 is approximately in a line with the crossbars 19, 23. The yarn 8 travelling through the two yarn guide bails 18, 22 and under the crossbar 28 is thus nearly taut, or even completely taut.

At the crossbar 28, it traverses an angle of approximately 160 to 180°. To prevent the yarn feeler lever 26 from skipping or fluttering on the yarn travelling through, there is a predetermined stop above its operating position I. This stop is formed by the cam 36, shown in Figs. 5 and 6 and provided for instance on the molded plastic body 34; this cam is connected in a manner fixed against relative rotation to the yarn feeler lever 26 and cooperates with a spring 37. The spring is embodied as a leaf spring, for instance, and is joined by one end solidly to the housing 2 (in particular to the upper housing part 2a). The leaf spring 37, in the vicinity of its free end, rests on the cam 36 and tenses the inward-bent ends of the legs 27 toward the recess 33 of the lower housing part 2b (Fig. 1). Play-free support of the yarn feeler lever 26 is thus achieved.

Between its two curved regions, the cam 36 has at least one straight or flattened region, which in the position III (Fig. 8) rests flatly on the leaf spring 37.

The cam 36 is calibrated such that it does not begin to deflect the spring 37 until the yarn feeler lever 26 has pivoted upward beyond its operating position I. The cam 36 deflects the spring 37 in the process, as Fig. 6 shows.

In Fig. 5a, a modified embodiment of the spring means is shown that has been conceived in particular with a view to especially low-friction support of the yarn feeler lever 26 and an especially steep or stepped rise S (Fig. 8) of the characteristic curve of the spring. In the embodiment of Fig. 5a, as in the embodiments described, the leaf spring 37 is retained by one end. It extends past the cam 36 and rests resiliently under prestressing on a fixed abutment 40. The abutment 40 can be embodied as a protrusion in the housing both between the cam 36 and the fixed bearing of the spring 37 or alternatively on the opposite side or on both sides, as shown in Figs. 5a and

6a. The abutment 40 is disposed such that between the leaf spring 37 and the part of the cam 36 near the axis, a slight gap 41 remains, so that the leaf spring 37 does not contact the cam 36. Hence the leaf spring 37 does not press against the cam 36. In terms of its size, the gap 41 is dimensioned such that no matter what the given production tolerances, it is greater than 0, and contact between the leaf spring 37 and the cam 36 is avoided.

If the yarn feeler lever 26 is lifted beyond its operating position, the nose or protrusion of the cam 36 touches the leaf spring 37. This protrusion initially acts as a stop for the cam 36. Not until the torque acting on the cam 36 is so great that the prestressing force of the leaf spring 37 can be overcome is the spring lifted from the stop 40, whereupon the cam 36 can rotate onward. The result is the stepped course of the characteristic curve shown in Fig. 8. Once the leaf spring 37 has lifted from its stop 40, the torque exerted on the cam 36 by the leaf spring 37 no longer increases substantially, however. On the contrary; upon further rotation of the cam, by varying the angular relationship between the cam 36 and the leaf spring 37, a certain reduction in the contrary torque can occur upon cam rotation.

To prevent the spring means 37 from touching the cam 36 as long as the yarn feeler lever 26 has not lifted beyond its operating position I, the cam 36 has a circular-arc-shaped circumferential region 42, which extends beyond the total pivot angle within which no contrary force is to be generated. Within this circular-arc region 42, the outer circumferential face of the cam 36 has a constant radius. In the region of the nose of the cam, however, the radius is increased markedly.

In addition, a weight relief spring 38 can be

provided, which is shown in Fig. 7. The weight relief spring 38, bent approximately in a horseshoe or a U with legs bent outward, is seated pivotably by one leg in an abutment 39 that is fixed to the housing. By its other end, it engages a notch provided in the plastic body 34. This notch is calibrated such that in the operating position of the yarn feeler lever 26, the relief spring 38 generates a torque that is oriented counter to the force of the weight of the yarn feeler lever 26. The resultant torque is a slight moment that moves the crossbar 28 downward, so that the crossbar 28 weighs down on the yarn 8 with only a very slight force.

The yarn feeder device 1 described thus far functions as follows:

In operation, the yarn 8 assumes the position shown in Fig. 1. As a result of the rotation of the yarn feed wheel 9, yarn 8 is constantly furnished to the knitting machine. In the process, the yarn 8 passes through the yarn guide bails 18, 22, remaining so taut between them that the yarn feeler lever 26 is retained in its operating position I. This operating position I is shown on the left, on the abscissa, in the graph of Fig. 8. In this graph, the deflection angle of the yarn feeler lever 26 is shown with a positive direction counterclockwise. If the yarn tension decreases, the yarn feeler lever 26 can pivot downward somewhat. In the graph of Fig. 8, this corresponds to a motion to the left on the abscissa. The weight relief spring 38 in the process passes through its dead center point, so that then it additionally acts to drive the yarn feeler lever 26 clockwise. The torque M_A that acts on the crossbar 28 increases in the process.

In the operating position I, the torque exerted by the weight relief spring 38 is counter to the force of weight, so that the resultant torque M_B is very slight.

If the yarn feeler lever 26 is lifted counterclockwise beyond its operating position I, then the nose of the cam 36 comes into contact with the leaf spring 37, so that suddenly a comparatively high torque M_G in the clockwise direction occurs. Thus the course of the overall characteristic curve of the spring, in a position III located somewhat above the operating position I, has a step S, which for normal operation of the yarn feeler lever 26 functions like a fixed stop. The contrary moment M_G , however, is not so great that it cannot be overcome by hand. It allows further counterclockwise pivoting of the yarn feeler lever 26, when the yarn feeler lever 26 is lifted by hand beyond the position III. The further course of the characteristic angle/torque curve (or characteristic force-travel curve) K is relatively arbitrary. It suffices if the characteristic curve remains in a region bounded by dashed lines L1, L2 in Fig. 8. The force or the torque can, if desired, remain positive; however, it can also become negative, in order to define an upper detent position (marked R in Fig. 8). The step S can, as shown, mean an abrupt change in the course of the contrary torque. However, even a steeply rising portion of the characteristic curve often suffices.

As a result of the resilient stop means, formed by the cam 36 and the spring 37, for the crossbar 28 serving as a yarn feeler element, a stop for the yarn feeler lever 26 that prevents skipping or fluttering of the yarn feeler lever 26 is defined for normal operation of the yarn feeler lever 26 and the yarn feeder device 1. On the other hand, the yarn feeler lever 26 can be moved by hand until it strikes the leg of the yarn guide bail 22. This is shown in Fig. 3. The position is marked IV and is marked accordingly in Fig. 8. In this position, the yarn 8 can be guided especially well by the yarn guide bails 18, 22 and thus threaded in. In the process, the yarn

feeler lever 26 is kept in its position III by a force F that is to be exerted by hand. The space between the two yarn guide elements 18, 22 is free and thus accessible by hand.

A similar provision can be made for an inlet yarn feeler 41, which may be provided between the yarn brake 7 and the yarn inlet eye 25. This yarn inlet feeler 41 is likewise supported pivotably on the housing 2.

In addition, a manually actuated feeler block 42 (Fig. 1) may be provided. It can comprise a slide upon whose actuation the yarn feeler lever 26 remains held in its operating position I without dropping into its response position II. The feeler block 42 can be displaced back and forth in the direction of the arrow 43 in order to activate or deactivate the yarn feeler lever 26. It is also possible to embody the feeler block 42 in such a way that it transfers the yarn feeler lever 26 upon actuation into its position IV. In such an embodiment, it is then no longer necessary to restrain the yarn feeler lever 26 in its position IV as the yarn 8 is threaded in.

In the final analysis, the force F is exerted via the feeler block 42.

A further-modified embodiment of the yarn feeder device is shown in Fig. 9. While in the embodiments described above the resiliently yielding stop means for the crossbar 28 has been formed via the rigid legs 27 of the yarn feeler lever 26, which is rigid overall, and the spring arrangement shown in Figs. 5 and 6, the resilient stop means in the embodiment of Fig. 9 is formed by what here are resiliently flexible legs 27 of the yarn feeler lever 26. The crossbar 28 is retained via the resilient legs 27, and a rigid stop is assigned to the yarn feeler lever 26 in the bearing device. The yarn feeler lever 26 can be transferred by hand by a force F into its position

IV, in which the crossbar 28 is in contact with the leg of the yarn guide eye 22.

The yarn feeder device 1 of the invention has one or more yarn feeler levers 26, which are movably supported on the housing 2. The yarn feeler lever 26 is movable between an operating position I and a response position II. In the operating position I, its crossbar 28 which forms the yarn feeler means is approximately in line with yarn guide elements, such as the struts 19, 23 of yarn guide bails 18, 22. Somewhat above its operating position I, the yarn feeler lever 26 meets a stop past which the yarn 8 does not move it. To improve accessibility to the yarn guide elements 19, 23 particularly when yarn is being inserted and threaded in, the stop of the yarn feeler lever 26 is embodied as yielding. The yarn feeler lever 26 can therefore be moved upward manually past the stop on its lower end 28, in order to open up the space enclosed between the yarn guide elements 19, 23.

Claims:

1. A yarn feeder device (1), in particular for knitting machines,

having a yarn conveyor (9), which serves to advance yarn (8) in accordance with a specified value,

having at least one yarn guide means (19), which serves to guide the yarn (8) advanced by the yarn conveyor (9),

having at least one yarn feeler means (28), which is disposed beside the yarn guide means (19) and is movably supported between an operating position (I) and a response position (II) and is retained in the operating position (I) by the yarn (8), a motion of the yarn feeler means (28) in or beside the operating position (I) being limited by a stop means (27, 36, 37),

characterized in that

the stop means (27, 36, 37) is embodied as yielding.

2. The yarn feeder device of claim 1, characterized in that the stop means (27, 36, 37) is embodied as resiliently yielding.

3. The yarn feeder device of claim 1, characterized in that the yarn feeler means (28) is supported by a lever arm (27), which is pivotably supported in a bearing device (32, 33).

4. The yarn feeder device of claim 1, characterized in that the lever arm (27) is embodied as resiliently yielding.

5. The yarn feeder device of claim 1, characterized in that a cam means (36), which is connected to a lever arm (27), and a spring means (37) that is assigned to the cam means (36) belong to the stop means (27, 36, 37).

6. The yarn feeder device of claim 5, characterized in that the spring means (37) is assigned an abutment, on which the spring means (37) rest with prestressing and which is disposed in such a way that the spring means (37) can be lifted from the abutment (40) by the cam means (36).

7. The yarn feeder device of claim 6, characterized in that when the yarn feeler lever (26) is located below its operating position (I), the spring means (37) and the cam means (36) define a gap (41) with one another.

8. The yarn feeder device of claim 5, characterized in that the spring means (37) and the cam means (36) define a characteristic force-travel curve (K), which in the operating position (I) of the yarn feeler means has a step (S).

9. The yarn feeder device of claim 1, characterized in that the yarn feeler means (28) is disposed between two yarn guide means (19, 23).

10. The yarn feeder device of claim 9, characterized in that a bearer (22) of one of the yarn feeler levers (19, 23) serves as a limitation for the motion of the yarn feeler means (28).

11. The yarn feeder device of claims 8 and 9, characterized in that the step (S) of the characteristic force-travel curve is disposed at a point (III) at which the yarn (8) is essentially straight between the yarn

guide means (19, 23).