

[54] **APPARATUS FOR PREVENTING THE CURLING AND LOOPING OF THE YARN IN A TRAVELER-RING TWISTING MACHINE**

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[57] **ABSTRACT**

A thread-twisting apparatus comprises a supply device for feeding a thread to a thread-twisting assembly including a spindle and a traveler ring orbiting the spindle. A thread sensor engages the thread between the traveler ring and the supply device and is effective to tighten the thread only upon loosening and reduction of tension in the thread on standstill of the spindle. The device comprises a weighted bent wire lever whose arms form an obtuse angle. One arm is provided with an eye aligned in normal operating position with a guide eye above the spindle.

[30] **Foreign Application Priority Data**

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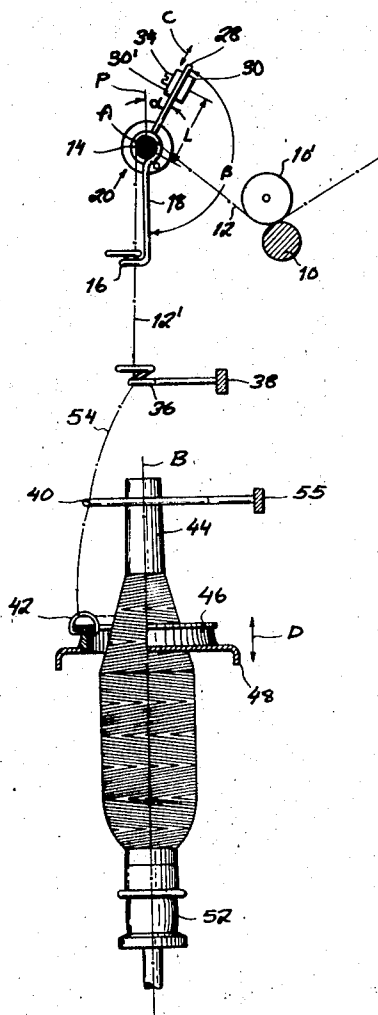
[58] Field of Search.....57/19, 34 R, 58.49,
57/58.83, 66, 75, 78, 80, 106, 107, 109, 111,
114; 242/45; 66/146

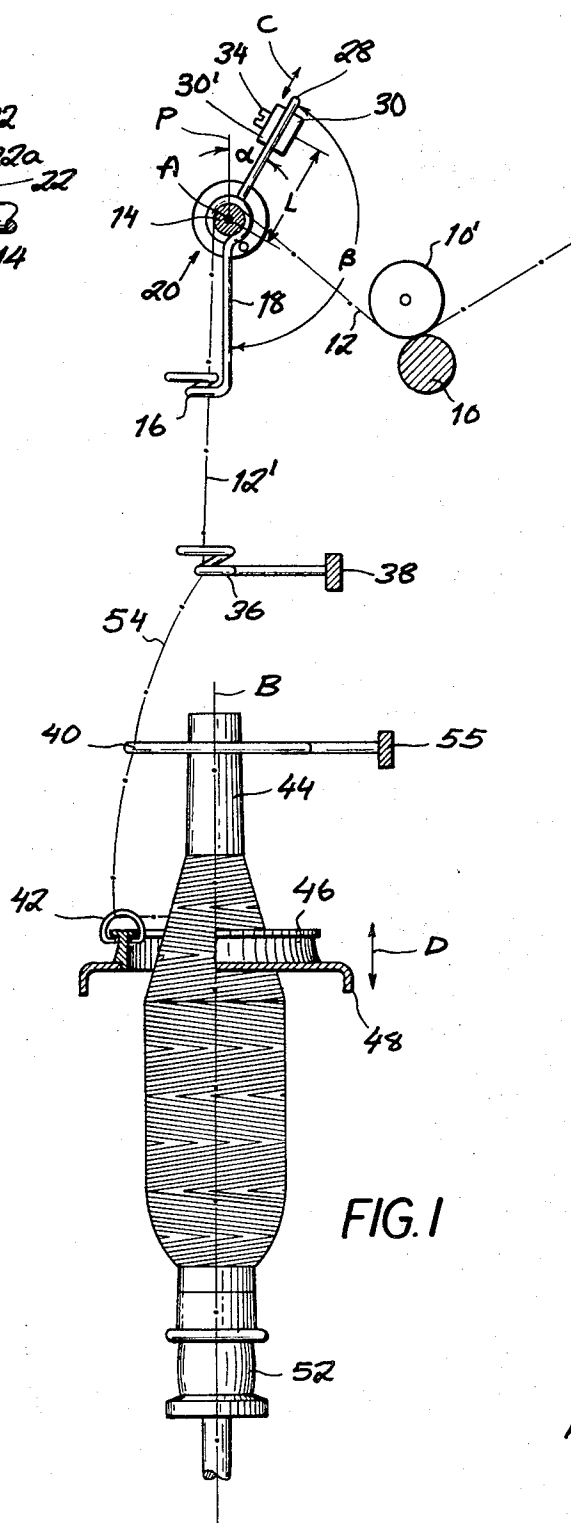
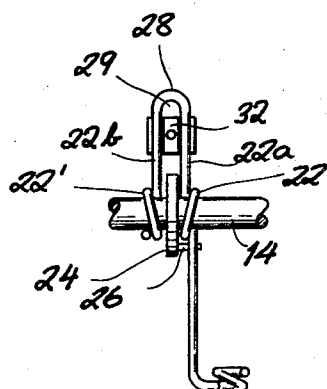
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10 Claims, 7 Drawing Figures

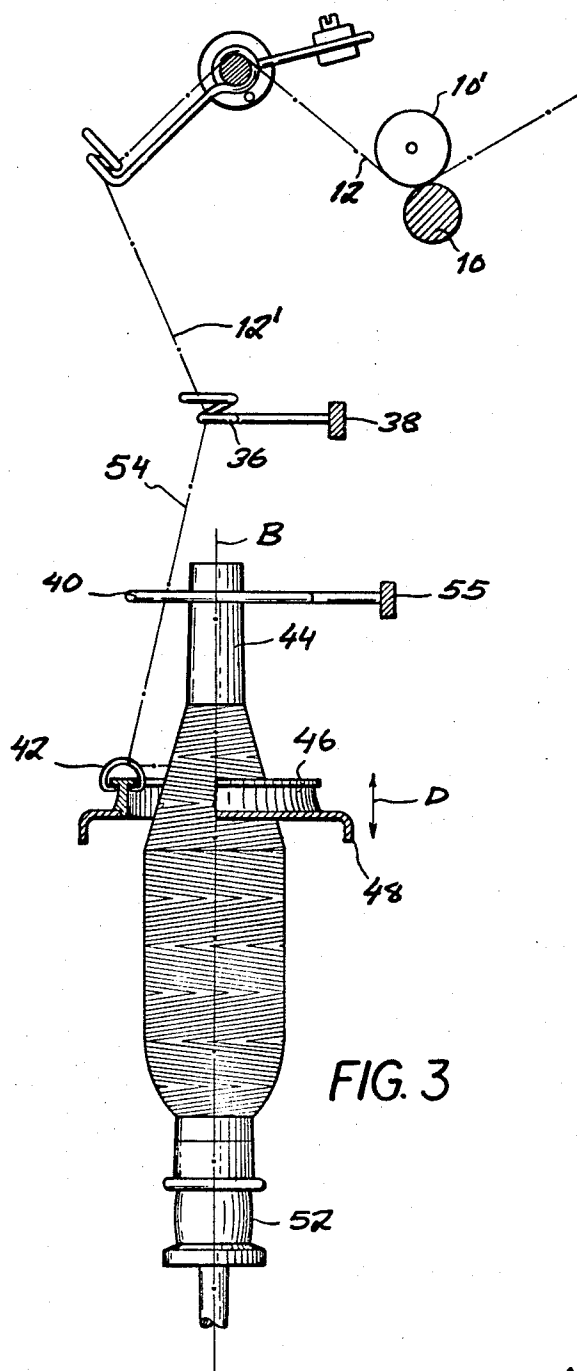




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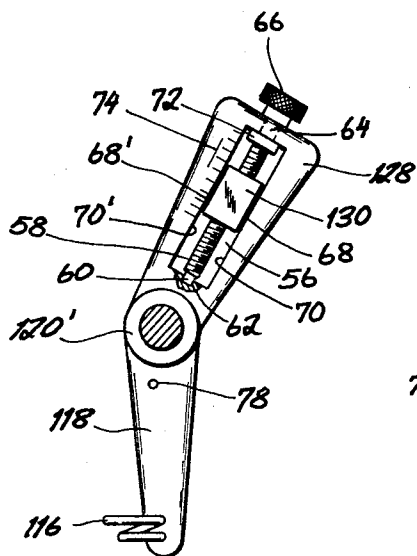


FIG. 4

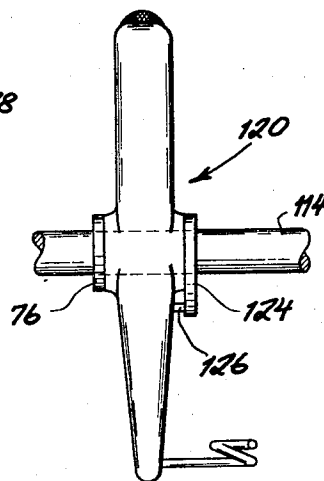


FIG. 5

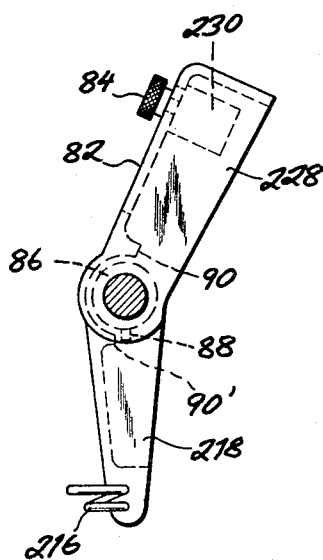


FIG. 6

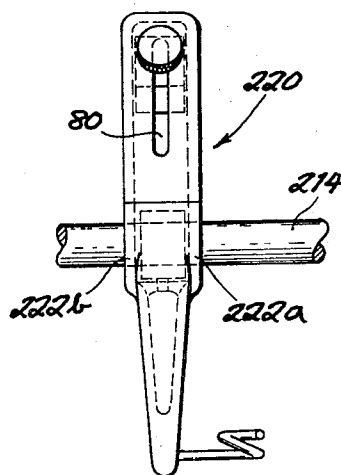


FIG. 7

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APPARATUS FOR PREVENTING THE CURLING AND LOOPING OF THE YARN IN A TRAVELER-RING TWISTING MACHINE

FIELD OF THE INVENTION

My present invention relates to a twisting or twining machine in which the yarn is paid off or deposited upon a spool of a spindle with the aid of a traveler ring and, more particularly, to a system in a twisting or twining apparatus for limiting the formation of curls or loops.

BACKGROUND OF THE INVENTION

For the twining or twisting of yarn, rovings, thread or filaments it is conventional practice to provide a spool or the like upon a rotatable spindle and a traveler ring which orbits the spindle and is carried around the latter by the yarn passing through this ring. As a result of centrifugal force, a yarn balloon is formed which, on the one hand, generates a tension in the thread and, on the other hand, entrains the traveler ring along its orbit. Since excessive tensions may be provided in the thread as a result of these centrifugal forces, especially where large balloons are formed and the balloons might interfere with adjacent spindles, it is common practice to provide balloon limiters around the spindle, generally in the form of rings, to confine the balloon to a limited peripheral zone of the spindle. When individual spindles are emptied, moreover, the thread tension drops sharply and the thread is no longer able to entrain the traveler ring so that the coiling of the thread upon the core terminates or is carried out with limited efficiency. In fact, when the machine or individual spindles are immobilized, the thread length which finds itself immediately between the traveler ring and the spindle is completely tensionless and the thread tends to form loops or curls in the region directly adjacent the traveler ring as a result of the twist imparted to the threads. The problem is heightened by the fact that the tensionless thread, in the region of the traveler ring, is kinked substantially at right angles. When the machine is again started or the individual spindles are again rotated, these loops or curls produce defective yarn or give rise to thread breakage. The problem with respect to undesired loops and curls is even more pronounced when a high number of twists per unit length is to be imparted to the thread.

It is known to mitigate these difficulties by rapidly braking the spindle upon slowdown of the machine but these systems lead to problems deriving from the fact that the traveler ring may run ahead of the spindle upon rapid braking of the latter without winding the thread upon the core. Again a length of thread remains loose and untensioned and may be kinked or bent in the region of the traveler ring so as to provide the basis for loop and curl formation. Here as well, the restarting of the machine or the individual spindle may result in the disadvantages described earlier, namely, defective yarn or thread breakage. In practice, it is also known to reduce the disadvantages by manually taking up, at each spindle, the loose length of thread by gently, for example, rotating the spindle while the traveler ring is held stationary. The loose thread end is thus wound upon the core and the thread tightened. This operation is time-consuming and requires skilled personnel so that the productivity of the apparatus is relatively low. In spite of this procedure, moreover, the yarn quality is often poor.

OBJECTS OF THE INVENTION

It is the principal object of the present invention to provide an improved apparatus for the twisting or twining of threads which will obviate the aforementioned disadvantages.

It is another object of the invention to provide an improved traveler-ring twisting or twining machine in which curl formation and loop formation is limited or eliminated.

It is also an object of the invention to provide, in a twisting or twining machine of the character described, improved means for eliminating the effect of loose threads upon termination of rotation or slowdown of the spindle.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter, are attained in accordance with the present invention by providing between the supply rolls, which deliver the yarn to the spindle, and the traveler-ring assembly of the spindle, a thread-tension sensor which is so arranged and constructed that it automatically raises the thread tension upon a substantial drop in the tension applied by the balloon or upon standstill of the spindle. Preferably, the thread sensor has a labile or unstable condition at which it applies only a limited tensioning force to the yarn which is readily overcome by the normal thread (balloon) tension but automatically tends to move into a stable position at which its tensioning force is sufficient to take up any loosening of the thread developing upon standstill of the spindle as noted earlier.

According to an important feature of this invention, the thread sensor is rotatably mounted upon a thread-guide rod over which the thread or yarn passes from the feed rollers, preferably through an arc in excess of a quadrant of this rod while the sensor is rotatably mounted upon the latter and is formed with a thread-guide eye which, in its unstable state, lies along a tangent to the rod and in alignment with the guide eye of the twisting assembly. The sensor may have a weight counterbalancing the eye-carrying shank and so disposed as to create the unstable condition when the eye of the sensor is aligned with this tangent and the guide eye of the twisting assembly. Upon loosening of the thread, therefore, and the creation of a tension in the latter which is insufficient to overcome the force of the counterbalancing weight, the sensor moves into its stable condition wherein its eye is disaligned from the tangent joining the eye of the twisting assembly and the thread-guide rod.

The device is further constructed such that the force applied by the sensor to the yarn is adjustable according to the gauge of the yarn, i.e. the yarn number. Since the sensor is advantageously a lever fulcrumed upon the thread-guide rod and having a load arm constituting the aforementioned shank and eye, the counter-balancing weight can be provided upon the force arm and the moment of this weight can be adjusted in accordance with the yarn number by providing means enabling movement of the weight upon the latter arm toward and away from the fulcrum or replacement of the weight by another one.

According to still another feature of the invention, the double-arm lever is provided with a circular

passage receiving the cylindrical thread-guide rod and swingably mounting the sensor upon the latter, the eye-carrying arm lying in an axial plane of this rod which may correspond to an axial plane of the spindle while the eye is offset somewhat from this plane. The other arm or shank of the lever, carrying the weight, may include with the spindle axis or this plane an angle α of 10° – 45° to ensure the unstable condition mentioned earlier. In this case, the arms of the lever will include with one another an angle $\beta = 180^\circ - \alpha$ or an angle between 170° and 135° .

Furthermore, the weight-carrying arm is provided with a guide groove or slot in which the weight is shiftable radially of the thread-guide rod and the fulcrum. The weight retains the thread sensor in an unstable-balance condition in which the unbalancing contribution of the weight is in equilibrium with the normal thread tension under conditions in which the thread is undeflected, the weight thereby exerting only a minimum torque upon the lever in normal thread passage. The thread or yarn is not noticeably stressed or tensioned. Upon standstill of the machine or the individual spindles, this torque is increased by rotation of the lever until the lever reaches a stable balance in which case any thread loops are straightened and the loose thread is taken up. Loops and curls cannot, therefore, form in the yarn.

To permit compensation for the various yarn weights which may be used, e.g. when a fine yarn is substituted for a coarse yarn and vice versa, the weight is adjustable or replaceable in accordance with the yarn number, thereby varying the torque which is applied in the unstable condition in accordance with the thread tension.

According to another feature of the invention, the double-arm lever, in one embodiment, is formed from a wire having the eye unitarily provided in a leg bent from the wire and extending from a pair of loops by which the wire is swingably mounted upon the thread-guide rod. A bight is formed between these loops to define the radial groove in which the weight is shiftable. Furthermore, a respective weight can be used for each of the various unstable torques and, to this end, I prefer to provide the weight in two parts and to connect them with a screw, at least one of the parts having a guide formation receivable in the groove. Advantageously, the groove or slot is closed at its end remote from the fulcrum. It has also been found to be advantageous to provide the weight and the weight-carrying arm with indexing means enabling a rapid setting of the weight for the particular thread type.

To prevent axial movement of the thread sensor, I may provide the thread-guide rod with a flange, ring or shoulder which is axially fixed and is received between legs of the lever. I may also provide the axial retaining means in the form of rings or shoulders engageable with flanks of the lever, especially when the latter is composed of synthetic resin or light metal. It has been found to be advantageous, in the latter case, to form the opening unitarily in the weight-carrying arm and to provide the weight within the opening and with a threaded spindle for the accurate adjustment of the weight. Alternatively, the slot may be formed as a channel within the weight-carrying arm, the floor of the channel having a slot through which a screw extends for clamping of the weight in any desired position. In

addition, the axial retaining ring or shoulder may be provided with a stop pin engageable with the eye-carrying arm to limit rotation of the thread sensor in one direction. In still another construction, the pin may be provided on the lever and may be engageable with an abutment on the thread-guide rod.

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a vertical cross-sectional view through the spindle bank of a twisting machine, showing one twisting assembly provided with a thread sensor, according to the present invention, the sensor being in its unstable condition consistent with normal operation of the twisting device;

FIG. 2 is a front elevational view of the thread sensor;

FIG. 3 is a view similar to FIG. 2 showing the sensor after it has tightened the loose thread;

FIG. 4 is a view taken in the direction of FIG. 2 of a thread sensor but illustrating another embodiment of the invention;

FIG. 5 is a front view of the thread sensor of FIG. 4;

FIG. 6 is a view similar to FIG. 4 of another thread sensor; and

FIG. 7 is a front view of the embodiment of FIG. 6.

SPECIFIC DESCRIPTION

In FIGS. 1–3, I have shown a twisting system in which the supply device comprises a driven roll 10' and an idler roll 10 through which the thread 12 is passed for feeding to the spindle. The thread 12 passes over a thread-guide rod 14 of cylindrical configuration, the rod 14 being engaged by the thread 12 over at least a quadrant of its length, especially in the operating position of the apparatus. The thread 12 then passes through the eye 16 of the thread sensor, the eye being formed as a bent-wire turn on the arm or shank 18 of a double-arm lever (FIG. 2) bent from a single piece of wire. The shank 18, in the unstable state of the apparatus, lies in a vertical plane P of the axis of rod 14 which defines a fulcrum at A for the thread sensor 20. The plane P also is a plane of the axis B of the spindle which will be described in greater detail hereinafter. Hence, the thread 12 in the region 12' lies tangent to the thread-guide rod 14 and parallel to the plane P while passing through the eye 16 which is here aligned substantially with an eye 36 forming part of the twisting assembly, but is offset from the plane P.

The double-arm lever forming the thread sensor 20 is provided with a pair of wire turns 22 and 22' on the respective legs 22a and 22b of a bight 28 forming the other arm of the lever. The loops 22 and 22', therefore, provide journals by means of which the double-arm lever is swingably mounted upon the rod 14.

The axial constraint for the thread sensor 20 is provided by an axially fixed abutment ring 23 which is received between the legs 22a and 22b and is provided with an axially extending pin 26 (FIG. 2) engageable with the arm 18 to limit the swing of the lever and prevent the latter from swinging out of its unstable state

in the counterclockwise sense as seen in FIG. 1. The arm 28 includes an angle α with the plane P of 10° to 45° in the unstable operating condition of the apparatus and hence the arms 28 and 18 include an angle $\beta = 180^\circ - \alpha$ as already indicated. The arm 28 is formed, between the legs 22a and 22b, with a guide slot 29 in which the legs 22a and 22b form rails for the parallel guidance of a weight 30, 30' and 34 radially of the fulcrum as represented by the arrow C. At least one of the two weight parts 30 and 30' is provided with a guide boss 32 extending longitudinally in the slot 29 and preventing rotation when the screw 34, interconnecting these parts, is turned. When the screw 24 is tightened therefore, the weight parts 30 and 30' clampingly engage the legs 22a and 22b. However, upon loosening of the screw, the weight may be shifted to change the distance L of the weight from the fulcrum and hence the moment of the weight. Alternatively, the moment may be changed by replacing the weight via larger or smaller mass inasmuch as the moment is the product of the mass and a distance proportional to L.

The twisting assembly comprises a wire-thread guide 36 which may be carried by a fixed part or a movable support rail 38 and is located above the spindle and inwardly of the orbit of the traveler ring 42. The thread 12, after passing through the wire-thread guide 36, normally forms a balloon 54 which is confined by a balloon-limiting ring 40 mounted upon a support rail 50 and located above the traveler ring 42. The latter surrounds the spindle core 44 and is carried by an annular rail 46 which may be mounted on the ring bank 48. The rail 50, carrying the balloon-limiting ring, is movable proportionally to the member 48 or can be provided with means for independent movement. The vertical displacement of member 48 is effected by conventional means, e.g. a thread or screw mechanism and carries the traveler ring upwardly and downwardly (arrow D) as the ring orbits the spindle generally represented at 52. The spindle 52 is driven by an endless belt via conventional means not otherwise illustrated. As already noted, between the thread guide 36 and the traveler ring 42, there is formed in the twisting operation the usual thread balloon 54.

Upon slowdown or standstill of the machine or the individual spindle, the thread balloon 54 collapses and the thread between the supply mechanism 10, 10' and the spindle or the yarn-package core 44 becomes tensionless. The thread sensor 20 thereupon swings in the clockwise sense (FIG. 3) into a stable condition, lifting the loose thread until it is again under some tension to prevent the formation of loops or curls.

In FIGS. 4 and 5 parts which are functionally similar to those of FIGS. 1-3 have been identified with similar numerals increased by 100 whereas parts of FIGS. 6 and 7 which are similar to those described earlier are designated by numerals increased by 200. In the systems of FIGS. 4 and 5, the thread sensor 120, which is used in a system of the type shown in FIGS. 1 and 3, is composed of synthetic resin or a light metal and may be die-cast or injection-molded.

The arm 128, whose center line includes the above-mentioned single β with the arm 118, is formed with a groove-like opening 56 with flanks 70 and 70' defining a radial guide for a weight 130 which has parallel flanks 68, 68' cooperating with the flanks 70 and 70', the

flanks also preventing rotation of the weight within the groove. A threaded spindle 58 extends centrally of the groove and has a stub 60 received in a bore 64 while the outer end of the screw is journaled at 64 in the arm 128 but is prevented from axial movement by the shoulder 72. The end of the screw projecting beyond the arm 128 is provided with a knurled head 66 which is angularly fixed to the spindle 58. Hence, as the spindle 58 is rotated, the weight 130, through which it threadedly passes, is shifted radially. The arm 128 may also be provided with indexing markings 74 cooperating with either end of the weight or a further mark provided on the latter to permit ready positioning of the weight in accordance with the thread number.

The arm 118 is formed unitarily with the arm 128 and a hub 120' is provided between them, the hub rotatably mounting the thread sensor upon the thread-guide rod 114. On one side of the thread sensor, the rod 114 is provided with a positioning ring 76 to prevent axial movement to the left while the other flank of the hub is engaged by an abutment ring 124 carried by the rod 114. A pin 78 is provided in the arm 118 for engagement with a pin 126 carried by the ring 124, the pins being coplanar and extending axially. The pins prevent excessive rotation of the thread sensor in the counterclockwise direction. At the end of the arm 118, of course, a wire-thread guide is provided.

In the embodiment of FIGS. 6 and 7, which can be die-cast from a light metal such as aluminum, or injection-molded from a synthetic resin, the double-arm lever 220 is channeled so as to be open on one side, i.e. to the right in FIG. 6. Within the thread sensor 220, i.e. in the channel of its arm 228, I provide a weight 330 which has a screw traversing a slot 80 in the floor 82 of this channel. The head 84 of a knurled screw may be rotated to loosen the weight and permit it to be moved along the arm 228. It will be apparent that in this embodiment as in the embodiment of FIGS. 1-3, a suitable scale can be provided to indicate the position of the weight.

Also within the thread sensor 220 and upon the thread-guide rod 214, I provide a ring 86 upon which the double-arm lever is mounted and which carries a radial pin 88 engageable with abutments 90 and 90' to limit the angular displacement of the threadsensing lever. The legs 222a and 222b flanking the ring 86 cooperated with it to prevent axial movement of the thread sensor.

The improvement described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the invention except as limited by the appended claims.

We claim:

1. A thread-twisting apparatus comprising:

a rotatable upright spindle;

a traveler ring orbiting said spindle and shiftable vertically relative to said spindle therealong within the length of said spindle to deposit a coil of thread thereon;

thread-guide means including a stationary eye axially aligned with said spindle and located thereabove for feeding thread downwardly to said traveler ring;

a thread-supply device for feeding said thread downwardly normally on a straight line path through said eye; and

a thread sensor engaging the thread between said eye and said device and effective to tighten said thread only upon loosening thereof with reduction of tension in the thread and standstill of said spindle, said thread sensor including an arm normally parallel to said thread path and provided with a thread engaging eye.

2. In a thread-twisting apparatus comprising a supply device for feeding a thread to a thread-twisting assembly including a spindle through a traveler ring orbiting said spindle, the improvement which comprises a thread sensor engaging the thread between said traveler ring and said supply means and effective to tighten said thread only upon the loosening thereof with reduction of tension in the thread and standstill of the spindle, and a thread-guide rod between said supply means and said traveler ring, said thread passing over said rod, said thread sensor being pivotally mounted on said bar and having an unstable condition in which said thread is lightly engaged during normal tensioning, said sensor being automatically swingable into a stable position wherein said thread is straightened upon decrease in the tension applied to said thread by the spindle.

3. The improvement defined in claim 2, further comprising means for adjusting the force with which said sensor bears upon the thread.

4. The improvement defined in claim 3 wherein said thread sensor is a double-arm lever fulcrumed on said rod and having a first arm extending generally perpendicular to said rod and parallel to the axis of said spindle in the unstable condition of said sensor and engaging said thread, and a second arm including an angle of substantially 10° to 45° with the axis of said spindle in said unstable condition of the sensor, said second arm being provided with a weight, said means for adjusting

the force with which said sensor bears upon said thread including means for shifting said weight along said second arm relative to said fulcrum, the last-mentioned means including a groove extending longitudinally of said second arm and receiving said weight.

5. The improvement defined in claim 4 wherein said double-arm lever is formed from a single piece of wire and including a thread-guide eye formed at the end of the first arm, a pair of loops encircling said rod and pivotally mounting said lever thereon and a bight bridging said loops and forming said second arm, said bight having a pair of parallel legs, said weight having a formation longitudinally guided between said legs and means for clamping said weight against said second arm.

6. The improvement defined in claim 5 wherein said weight comprises two parts clamping said legs between them and screw means interconnecting said parts.

7. The improvement defined in claim 4 wherein said groove is constituted as a slot having parallel flanks extending radially of said rod, said weight having parallel flanks cooperating with the flanks of said slot for longitudinally guiding the weight therein, said sensor further comprising a threaded spindle engaging said weight and rotatable to shift said weight along said slot.

8. The improvement defined in claim 4 wherein said second arm is formed with a channel receiving said weight, the floor of said channel being formed with an elongated slot, and screw means traversing said slot and engaging said weight for adjustably positioning said weight along said channel.

9. The improvement defined in claim 4, further comprising at least one annular abutment on said rod engaging said lever for preventing relative axial movement between said rod and said lever.

10. The improvement defined in claim 4, further comprising abutment means on said lever and said rod engageable for restricting the angular displacement of said sensor on said rod.

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