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APPARATUS FOR TENSIONING YARN

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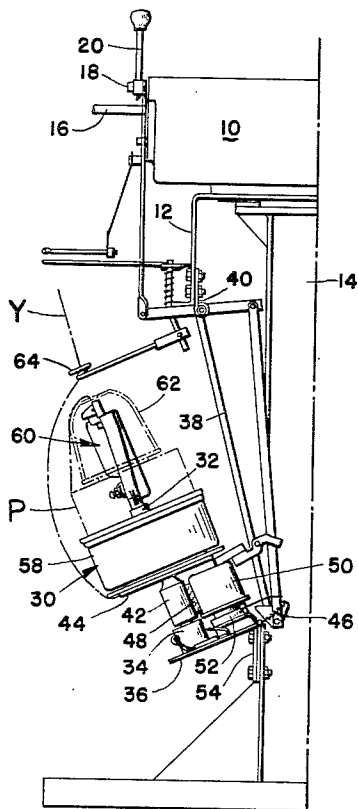


FIG. 1

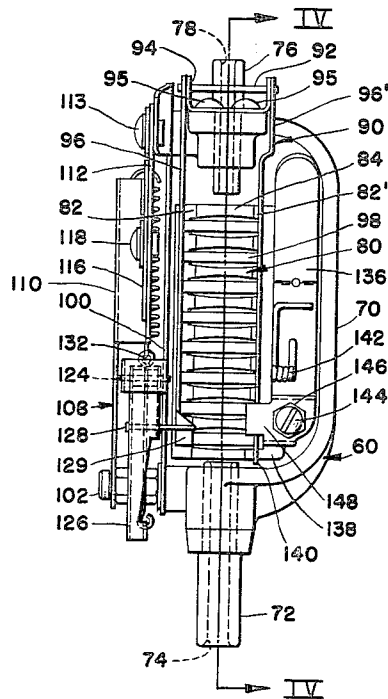


FIG. 2

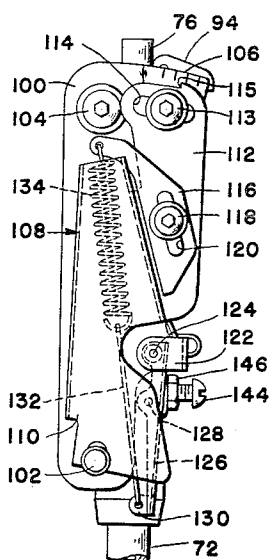


FIG. 3

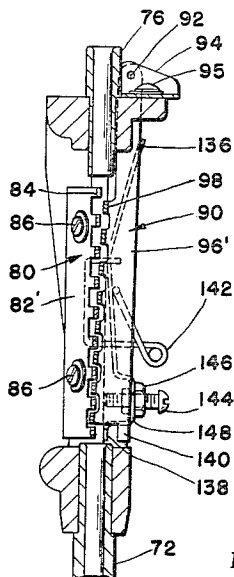


FIG. 4

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APPARATUS FOR TENSIONING YARN

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Continuation of application Ser. No. 198,367, May 28, 1962. This application Feb. 11, 1964, Ser. No. 344,105

4 Claims. (Cl. 242—154)

This application is a continuation of co-pending United States application Serial No. 198,367 filed May 28, 1962, now abandoned.

The present invention relates to a textile machine and relates, more particularly, to a novel tension device for use with a textile machine.

In the following specification and claims the term "yarn" is employed in a general sense to relate to all kinds of strand material, either textile or otherwise, and the designation "package" is intended to mean the product of a winding or twisting machine, whatever its form.

Tension devices of the so-called "gate" type are well-known to those skilled in the art of tensioning yarns. Customarily, such devices are employed for the purpose of applying a drag or resistance on the yarn as it is advanced to a utilizing source. Unfortunately, gate type tension devices of the prior art have not been capable of responding to irregularities in the initial strand tension, i.e., the tension in the yarn in the zone between the supply and the tension device arising from sources externally of the tension device per se, such as those arising from the character of the yarn itself or the manner in which it is wound onto the supply package. Thus, previously, if the tension in the yarn varied in the afore-mentioned zone on the supply side of the tension device due to some irregularity, this variation was not compensated for by the tension device. Rather the output tension on the yarn emerging from the tensioning device was actually the product of the tension in the strand as it entered the tensioning device and the multiplying factor of said tensioning device.

Thus, it is one object of the present invention to provide an improved tension device capable of imparting a constant tension value to yarn.

Another object of the present invention is to provide a tension device capable of imparting a constant tension value to yarn irrespective of externally induced tension variations.

A further object of the present invention is to provide a tension device which is responsive rapidly to compensate for externally induced tension variations in yarn to thereby maintain the yarn tension constant.

Still a further object of the present invention is to provide a tension device capable of being easily and rapidly set to yield a predetermined value of tension in yarn.

Yet, another object of the invention is to provide a tension device capable of use with a wide variety of textile machines.

Another object is to provide a tension device which is inexpensive to manufacture and durable and reliable in use.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the present invention, reference should be had to the following detailed description taken in connection with the accompanying drawing wherein:

FIG. 1 is an elevational view of a textile machine em-

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bodiment of an improved tension device made in accordance with the present invention;

FIG. 2 is an enlarged front elevational view of the improved tension device of FIG. 1;

FIG. 3 is a side elevational view of the tension device of FIG. 2 with parts broken away; and

FIG. 4 is a view taken along lines IV—IV of FIG. 2 viewing in the direction as indicated.

From a broad or general point of view the present invention may be characterized as follows. A pair of plates or "gates" are provided in connection with a principal frame member. One of the gates is fixed to the member and the companion gate is pivoted at its upper extreme for swingable movement relative to the fixed gate. Each plate is provided with a plurality of tension fingers so staggered that the tension fingers of one plate enmesh with the tension fingers of the other. Further, the pivoted gate is fixed so that its longitudinal axis is obliquely disposed relative to the longitudinal axis of fixed gate when the fingers are meshed whereby the tension fingers most remote from the pivot point of the swingable gate are most fully engaged with the fingers of the fixed gate and there is a gradual lessening of the degree of engagement or interdigitation of the fingers of the two gates with each other as the pivot point is approached. Guide means are provided to direct the yarn between the alternate tension fingers thereby establishing a tortuously defined path through the tension device. The movable gate is arranged in cooperative relationship with a stressed extension spring through a connection having a link and pivoted arm. Thus, the uppermost end of the spring is secured to a fixed point and the lower or distal spring end is connected to the pivoted arm through the link. This arm, in turn, is arranged on a pivot and communicates with the lower end of the movable gate. The stressed extension spring is arranged in essentially an "over-center" relationship with respect to the pivoted arm and movable gate so that any increase in tension in the yarn on the supply side of the tension device will urge the gates apart by swinging the movable gate out to rock the spring closer to the pivot point of the pivoted arm thereby lessening the effective closing force of the spring on the gate. Additionally, the tension fingers at the upper section of the movable gate will pass out of mesh with the fingers of the fixed gate and move out of contact with the yarn and the fingers in the lower section of the gate will have a gradually reducing surface of contact with the yarn. Hence, the equilibrium balance in the tension device with respect to the yarn will be re-established at some new value reduced from the initial value to thereby exert less impedance or resistance to the yarn. This lessening of tension from the tension device is in proportion to the tension added at the input side thereby maintaining the output tension constant.

Conversely, if there is a lessening of external strand tension the movable gate will close or become further enmeshed with the fixed gate. The spring shifts further from its "center" thus exerting a greater closing force on the gate. Hence a new equilibrium value is established and the output tension of the yarn is again held constant.

Referring now to FIG. 1 wherein is disclosed a preferred embodiment of the improved tension device of the present invention incorporated in a winding machine of the type disclosed in U.S. Patent 2,769,299 to John V. Keith for "Twisting and Winding Machine" and issued November 6, 1956. Only so much of the structure of that machine has been set forth in the drawing as is necessary to a full understanding of the relationship between that machine and the present invention. Further, while the detailed description of the present invention is directed to its association in connection with the machine of the

cited patent it will be readily apparent that the invention is capable of adaption to various other types of winding machines.

In the machine of the cited patent, as illustrated in FIG. 1, a winding unit is provided comprising a housing 10 which is secured to a channel member 12 which forms a bed supported by legs 14. A traverse mechanism, not shown, together with a spindle 16 are journaled in housing 10 and are driven by a source of power located adjacent one end of the machine, all in the manner explained in the above-cited U.S. Patent 2,769,299. A shaft 18 is journaled in housing 10 with one of its ends projecting from the front thereof and is manually rockable by means of a handle 20. The inner end of shaft 18 is connected to a clutch, not shown, for coupling the yarn traverse mechanism and spindle 16 to start the operation of the winding mechanism.

A multiple twist spindle 30 of a type well known in the art is located below housing 10 and generally comprises a spindle 32 secured in a spindle bolster 34 which is connected by any convenient means to one end of an arm 36. Arm 36 is connected to a shaft 38, which, in turn, is secured to member 12 by a bracket member 40. A whorl 42 and disc-like flyer 44 are fixedly secured to spindle 32. The weight of the multiple twist spindle 30, augmented by a spring 46, tends to urge arm 36 rearwardly to bring whorl 42 into contact with a spindle driving belt 48 which extends in a generally horizontal plane along the front of the unit. Belt 48 is driven from any convenient source of power, such as an electric motor, located at one end of the machine. Contact of whorl 42 with belt 48 rotates flyer 44 in the manner old and well known in the art. A plurality of spaced idler pulleys 50 are carried by horizontal rail 52, each of the pulleys 50 being situated in back of belt 48 to guide the belt and apply a force opposing the thrust of whorl 42. The horizontal rail 52 is fixed to legs 14 by brackets 54.

The upper portion of spindle 32 is provided with an axial bore which connects with a radial bore formed in flyer 44, but not herein illustrated, to provide a yarn passage in the manner common in multiple twist spindles. A holder 58 for carrying a package of untwisting yarn P is journaled on spindle 32. A tension device 60, to be more fully described hereinafter, is disposed in the axial bore in spindle 32 and a cap or bonnet 62 is fitted over the tension device 60 to provide a suitable lint-protecting means for the tension device and to afford a guard so as to prevent entanglement of the yarn Y as it is advanced from package P. Bonnet 62 has a central aperture through the top thereof in alignment with the yarn receiving portion of tension device 60 for passage of yarn Y.

The winding unit illustrated herein is threaded for operation by having a strand of yarn Y withdrawn from package P and passed downward through tension device 60 and continuing in a downwardly direction through the axial bore a spindle 32. Upon emergence therefrom the yarn is directed through the radial bore in flyer 44, thereafter being drawn upwardly through a suitable guide 64, supported from member 12, and onto winding spindle 16. In operation, the winding mechanism is started by rocking handle 20. Flyer 44 is thereupon rotated to swing a loop of yarn around package P in a manner well known in the art to impart two turns of twist into the yarn for every rotation of the spindle. Winding spindle 16 is rotated to draw the yarn Y upwardly to wind it into a package.

The several components just described, and their mode of operation are old and well known and are presented to illustrate but one apparatus for utilizing the present invention, it being understood that the present invention is readily adaptable to many other apparatuses of the type wherein controlled tension is required.

As stated above a tension device 60 is advantageously disposed to act on the yarn being withdrawn from pack-

age P. In accordance with the usual practice the yarn is directed downwardly through the tension device where a predetermined drag or resistance is imparted thereto. To this end, and in accordance with the novel construction of the tension device of the present invention a C-shaped metal member 70 is provided which serves as the principal frame for the tension device. Member 70 is arranged with an elongated depending shank 72 fitted through the lower wall thereof, and which is received snugly within the top of the axial bore of spindle 32. As seen in FIGS. 2 and 4 shank 72 has an axial aperture 74 extending therethrough. Further, shank 72 is provided preferably with a locating keyway adapted to engage a radially projecting mating key in spindle 32, neither the key or keyway being illustrated herein, but both of which cooperate to prevent rotation of the tension device relative to spindle 32.

At the distal end of member 70 from that supporting shank 72 there is provided a bore into which an elongated tube 76 is securely seated. The bores 74 and 76 of tubes 72 and 76 respectively are aligned and act as yarn guides. Thus, a threadline is defined medially through the confines of the C-shaped member 70, extending between the apertures 74 and 76.

A fixed plate or gate 80 is located within the confines of the C-shaped member 70 occupying generally the full region therein. Gate 80 is somewhat U-shaped in plan, having a pair of opposed wing-like supporting sides 82 and 82' which extend rearwardly, and a forwardly projecting web constituted as a grid of rib-like members or tension fingers 84 disposed between supporting sides 82 (see FIG. 4). For securing the member 80 in position a pair of screws 86 are passed through the side 82' of plate 80 and threaded into frame member 70. As best seen in FIG. 2 tension fingers 84 are straight and are aligned in space, parallel relationship between opposing sides 82 and 82', the ends of each of the fingers blending in with sides 82. Desirably, tension fingers 84 are chrome-plated both for providing a wear-resistant surface as well as affording a suitable frictional surface for the yarn.

A second plate or gate 90 is pivotally supported from a pintle 92 carried on a bracket 94 fixed on top of member 70 by screws 95. Thus, gate 90 is pivotal or swingable to the axis of gate 80 and the threadline of yarn Y. Gate 90, in a manner similar to plate 80, includes a pair of oppositely disposed side walls 96 and 96' between which a plurality of parallel spaced tension fingers 98, preferably chrome-plated, are positioned. By virtue of the fact that each of the tension fingers 98 are staggered with respect to tension fingers 84, and because the walls 96 and 96' are sufficiently spaced apart to swing inwardly past tension fingers 84 and contact the rearwardly extending sides 82 and 82' of gate 80, the tension fingers 98 are permitted to pivot inwardly and interdigitate or enmesh with tension fingers 84. As a further feature of the novel construction of the present invention the pintle 92 about which gate 90 pivots is located forwardly of the gate 80 so that the longitudinal axes of the two gates are at an acute angle when they are meshed. However, the tension fingers of each gate are parallel with respect to each other. Because of the acute angle of contact of the gates 80 and 90 it will be seen that the tension fingers 98 will tend to enmesh with the tension fingers 82 to a greater extent in the lower regions of the two gates 80 and 90 than will be the case in the upper regions of the gates as illustrated in FIG. 4. In order that the angularity of gate 90 with respect to gate 80 may be adjusted the slots of bracket 94 which receive screws 95 may be elongated so that pintle 92 can be shifted to alter the pivot point of said gate 90.

A flat plate forming a wall 100 is mounted at its lower end on the inner end of a stud 102 embedded in and extending from one end of C-shaped member 70. Wall 100 bridges the open side of C-shaped member 70 and is securely held to the opposite end of said member 70 by

screw 104. For purposes to be explained hereinafter a series of graduations are scored along a portion of the upper edge of member 100 as indicated at 106.

A movable housing element 108 comprising a lower somewhat U-shaped section 110 and an upper section projecting as a wing plate 112 is pivoted on the outer end of stud 102. The upper portion of plate 112 is provided with an extended horizontal slot serving to permit limited pivotal movement of element 108 and the screw acting to secure the plate 112 in position. Further, the uppermost margin of plate 112 has a shoulder formed therein which serves as an indicator 115 in conjunction with the graduations 106.

An angular arm 116 is supported by a screw 118 against the outside wall of plate 112. A vertically extended slot 120 is formed through arm 116 to afford limited vertical shifting of the arm. The outer end of arm 116 projects in a rearwardly direction terminating above and in alignment with the aperture defined by the upper section of U-shaped housing element 108 and plate 100.

The lower section of wall 100 has a laterally extending U-shaped tab 122. A pin 124 is pierced through tab 122 and the side of wall 100 spanning the space therebetween. A lever 126 is mounted for free swingable movement on pin 124 between wall 100 and the outer side of tab 122. As viewed in FIG. 3 counterclockwise movement of lever 126 is limited by contact with tab 122 while, clockwise movement thereof is restricted by a pin 123 projecting inwardly from the side of lever 126 and engageable with tab 129 formed on wall 96.

The lower end of lever 126 is provided with a tab 130 which has a hole therein for receiving the lower end of a link 132. The upper end of link 132 is looped to engage the lower end of an extension spring 134. In turn, the upper end of tension spring 134 is connected to the outer end of arm 116.

In order that the gate 90 may be separated manually from gate 80 an angular pressure lever 136 is connected on the side of member 70 and closely adjacent gate 90. Lever 136 is generally V-shaped along its main body (see FIG. 4) such that pressure on its upper extension will cause the lower end of the lever to rock outwardly, or counterclockwise as viewed in FIG. 4, with respect to frame member 70. The lower end of lever 136 has a lateral finger 138 which projects inwardly toward gate 90. As seen in FIG. 2 the wall 96' of gate 90 has a depending lineal extension or appendage 140 which is positioned forwardly of finger 138 and in alignment therewith. Thus, on outward rocking motion of finger 138, said finger will contact appendage 140 and carry it out swinging it away from gate 80 about pintle 92. A spring 142 is engaged at one of its ends in frame member 70 and is coiled so that its opposite end presses against the outer surface of lever 136 in a manner to bias the lever clockwise.

A set screw 144 is inserted through the lower end of lever 136 so that it bears against the side of frame member 70. Jamb nut 146 acts to hold the screw 144 in a fixed location. Adjacent jamb nut 146 on the lower end of lever 136 is a tab 148 which projects laterally inwardly toward plates 80 and 90. Tab 148 spans transversely across the front of appendage 138, normally remaining free of engagement with said appendage. However, tab 148 is normally maintained in close proximity to appendage 138 to prevent undesired separation of gate 90 from gate 80.

The foregoing apparatus operates in the following described manner. Preliminary to introducing a strand of yarn into the tension device of the present invention element 108 is moved to its furthestmost clockwise position as limited by screw 113. With element 108 so disposed arm 116 is shifted vertically a distance sufficient to extend spring 134 an amount necessary to exert a force through lever 126 and pin 123 onto gate 90 which will represent the minimum output tension in the gate required for the yarn to be tensioned. At this position lever 126 will be

disposed closely adjacent the side of pin 124. With spring 134 so stressed element 108 may be relocated to some new position, in effect, finely adjusting the tension device to the particular yarn to be tensioned. Such relocation is achieved by moving element 108 about its pivot, stud 102, in a counterclockwise direction. Graduation 106 in conjunction with indicator 115 serve as a convenient means for determining the degree of pivot of element 108. Movement of element 108 serves to increase gradually the moment arm between link 132 and pin 124. As this moment arm is increased the resultant effect of spring 134 on the operation of gate 90 is likewise proportionately affected. Thus, when link 132 is at its furthestmost point from pin 124, i.e., when plate 112 is swung to its counterclockwise limit, the moment arm is greatest. Hence, the force from spring 134 acting to urge tension fingers 98 into mesh will be at its greatest. Conversely, as link 132 approaches pin 124 the moment arm is diminished resulting in a proportionately diminished effect of the spring on gate 90. It is to be appreciated that the tension, i.e., the drag or resistance imparted to the yarn by tension device 60 is actually, a function of the degree of contact of the yarn with the surface of the tension fingers 84 and 98. In turn, the regulating of the degree of contact between the yarn and tension fingers is by means of spring 134. As spring 134 acts to control the swinging movement of gate 90, not only is the degree of tortuosity of the yarn controlled, but further, the number of tension fingers with which the yarn comes in contact may be altered. This is due to the angular contact between gates 80 and 90. In the initial set-up it is desirable that the spring 134 be so positioned that it produces a condition of equilibrium wherein the spring force against gate 90 is equal to the opposing force induced by the advancing yarn tending to urge the gate 90 open.

In operation the strand of yarn to be advanced is threaded through tube 76, being led downwardly between gates 80 and 90, the yarn eventually passing through bore 74 and outwardly from the tension device. To the end that the unit may be rapidly threaded finger pressure is exerted on lever 136 to rock the lever counterclockwise, see FIG. 4. As the bottom lever 136 rocks outwardly finger 138 engages appendage 140 and swings gate 90 away from gate 80. A threading wire having a hooked end may readily be inserted between the gates to draw the yarn therethrough. Upon release of gate 90 from lever 136 tension fingers 84 and 98 will urge the yarn in a tortuous course as it zig-zags and laps against the faces of the staggered tension fingers. The degree of tortuosity of the yarn will increase as the yarn descends from the upper tension fingers to the lower tension fingers of the two gates. This results from the angular contact of plate 90 with plate 80 as hereinbefore described which permits the lower tension fingers of plate 90 to enmesh to a greater extent with the tension fingers of plate 80 than is the case with the tension fingers in the upper region of the plate 90.

With the yarn thus established in a threaded path through the tension device, the winding of yarn may be commenced by rotating flyer 44 in the manner previously described. As previously related, the tension device will be set initially to impart a predetermined tension into the winding strand Y at the output side of the tension device 60 as measured by a tensiometer. During the winding operation it may occur that irregularities in the yarn will cause a rise in the yarn tension in the zone between the tension device 60 and the yarn supply P. In this event the tension device will respond to compensate for the rise in tension in the following manner. Gate 90 will swing away from gate 80 in response to this tension build-up with the result that the yarn path will become less tortuous to reduce the surface of contact between the tension fingers 84 and 98 and the yarn. As a concomitant to such action spring 134 will shift to a new position through the movement of lever 126 transmitted by pin 123 whereby the

link 132 is drawn closer to pin 124. So positioned the spring will exert less closing force on gate 90. The resultant is a new equilibrium value for the strand tension being established such that the output tension is held constant. Advantageously, sufficiently high tension above the pre-established equilibrium value will actually cause the upper tension fingers of plate 90 to move out of contact with the yarn. However, the yarn will be gripped at all times by at least the lowermost fingers of plates 80 and 90. This is insured by the fact that set screw 144 is so located that tab 148 is held closely adjacent appendage 140 in a position whereby the lower end of plate 90 cannot spring away from plate 80 and lose contact with the yarn Y completely. Yet, there is provided a limited gap between the tab 148 and the appendage 140 for some swingable movement of gate 90 away from gate 80.

Should it occur that tension in the yarn in the zone between supply package P and tension device 60 drops, said tension device will adjust to maintain the output tension at the pre-established constant value as gate 90 closes further and its tension fingers 98 become further enmeshed with tension fingers 84 by the force of spring 134. This will result in the yarn becoming further lapped about the tension fingers thereby increasing yarn tension. Moreover, the moment arm between pivot pin 124 and link 132 will increase thereby causing the spring 134 to exert a stronger force on gate 90 to hold it enmeshed with gate 80. A new equilibrium is thereby established between the closing force of the spring and initial yarn tension serving to maintain the yarn output from tension device 60 substantially constant.

It will be understood that spring 134 will always exert some closing force to bias gate 90 toward gate 80. Since link 132 is prevented from passing beyond pin 124 or "over-center" it will always tend to pivot lever 125 clockwise, as seen in FIG. 3 and thereby continuously influence the movement of gate 90 toward its companion gate 80.

Since certain changes may be made in the foregoing apparatus without departing from the scope of the invention herein involved it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in the limiting sense.

What is claimed is:

1. Apparatus for tensioning yarn comprising:

a first member,
a second member,

each of said members having a yarn input and a yarn output end and a plurality of yarn engaging fingers therebetween,

said fingers of said first and said second members being alternately spaced with respect to each other to thereby intermesh and apply tension to an advancing strand of yarn,

pivot means connecting said second member with said first member at the input ends thereof to afford pivotal movement of said second member relative to said first member,

a lever having an inner end pivotally supported intermediate the ends of said second member and having an outer end which extends beyond the output end of said second member,

a pin positioned on said lever and arranged to engage said second member intermediate the inner end of said lever and the output end of said second member to pivot said lever in response to movement of said second member,

the outer end of said lever being movable in a path proportionately greater than that of said second member when pivoted by said second member, and

a resilient element connected at the outer end of said lever and arranged to exert a force to bias said pin against said second member to urge the fingers of said second member into mesh with the fingers of said first member,

said resilient element acting through an effective moment arm to increase the biasing force as said fingers of said first and second members mesh to an increasing degree, and to decrease the biasing force as said enmeshing decreases, the length of said moment arm being controlled by movement of said lever.

2. Apparatus as set forth in claim 1 wherein said yarn engaging fingers intermesh to a progressively greater degree from said input ends to said output ends of said first and second members.

3. Apparatus as set forth in claim 1 wherein said pivot means is adjustable to vary the degree of intermeshing of said yarn engaging fingers.

4. Apparatus as set forth in claim 1 including stop means for limiting the pivotal movement between said first and second members.

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