Aug. 14, 1956 T. E. CARLSON 2,758,802

TENSION CONTROLLING DEVICE

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FIG. 1

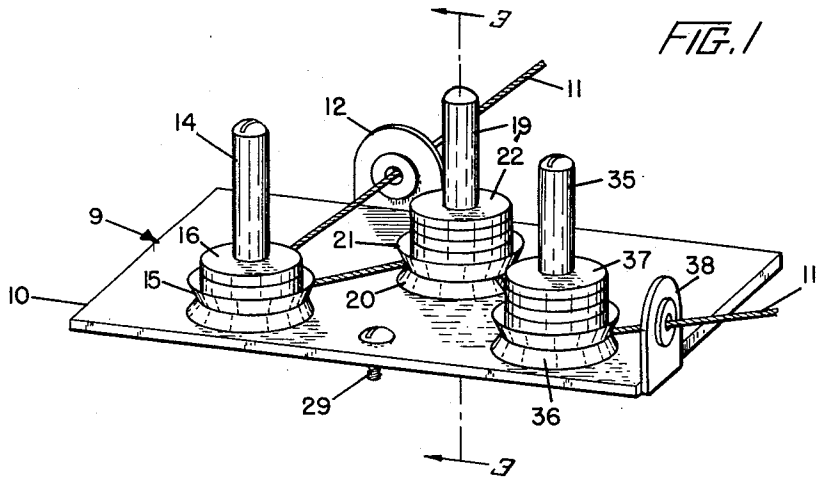
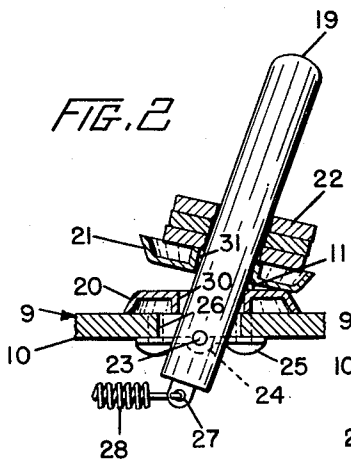


FIG. 2



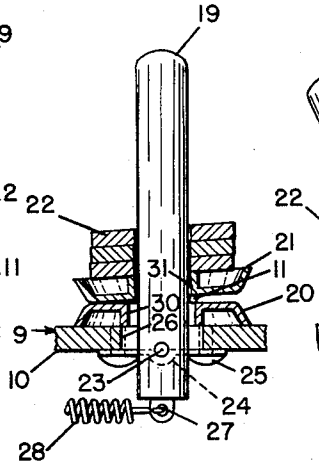
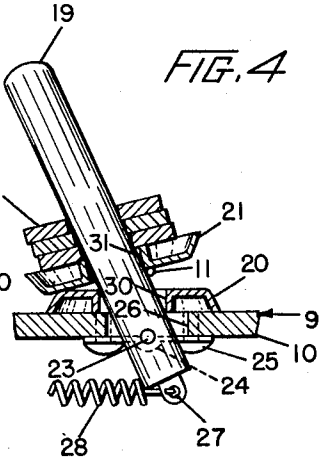


FIG. 3

FIG. 4



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FIG. 6

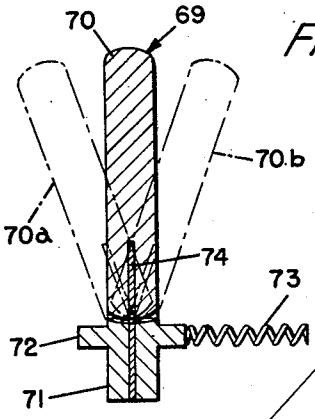
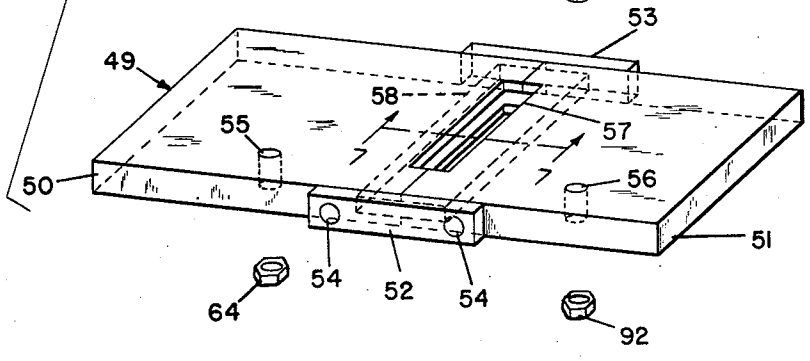


FIG. 5



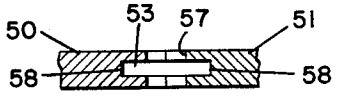


FIG. 7

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TENSION CONTROLLING DEVICE

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This invention relates to a tension control and equalizing device for strandular material being longitudinally advanced after withdrawal from a source of supply under irregular or variable tension. In particular, it relates to an improved tension control and equalizing device for yarn being withdrawn from creels in association with beam warpers and the like.

In beam warping it is advantageous to have all the ends of yarn, or of similar strandular material, withdrawn from the individual supply packages of a creel under substantially equal and constant tension. Such a procedure insures a smooth and even beam; one without objectionable high and low points forming ridges because some of the ends were originally collected under non-uniform delivery tensions. A poorly tensioned warp beam may result in an undesirable product unless intermediate tension corrective steps are taken. Also, a non-uniformly wound beam of heavier denier yarn for use in tires and other reinforced fabrics may be a source of considerable difficulty in dipping in latex, gums, etc. Irregularly tensioned warp ends may receive an imperfect treatment due to the above mentioned conditions.

In the usual creel operation, each end of standular material, such as yarn, being withdrawn from an individual supply package which itself may be imperfectly wound is delivered under, generally, a predetermined tension which will vary with the fullness of the supply package. Yarn being withdrawn from full supply packages is under a lesser tension than yarn from nearly empty supply packages. The tension increases in proportion to decreases in diameter of the yarn supply, increasing to a maximum when the supply is of smallest diameter. Invariably the individual supply packages of a creel do not run out at the same time and the ends are beamed from such supply packages in various states of depletion under, of course, varying and irregular degrees of tension.

The generally employed tensioning devices in creels are frequently of the type which snub the yarn so as to add drag tension to the tension already effected due to withdrawal from the package. The snubbing is generally accomplished by weighted objects or other compressive means applied to the yarn passing through the devices and by the frictional resistance encountered in passing about posts and between the faces of tension discs which may bear the weighted objects. While each warp end may be beamed in a taut condition, the degree of tautness, or tension, under which each end of the yarn is collected will still vary considerably from the minimum tension experienced in withdrawal from a full supply package to the maximum tension from a substantially empty package, as well as from imperfect winding of the supply package.

The tension device of the present invention controls and equalizes to a greater degree the tension of each end being withdrawn from a supply package over all diameter and other changes and delivers to the collection point at the beam an end of yarn under a substantially fixed and constant tension. The device includes a guide, which

may be in the form of a post, pivotally mounted in a support having an aperture, which is yieldable by movement about a pivot to variation in tensions in a strandular material passed about it in an angular path. The degree of movement about the pivot of the tilting-guide or post is proportional to increments of tension imposed upon the strand. Thus, increasing tension is continually equalized and compensated for during delivery by proportional decrease of frictional contact of the strandular material about the tilting-guide or post. Advantageously, a pair of freely rotatable tensioning discs can be utilized to further tension the advancing yarn. These are, of course, positioned about the tilting-post. The upper disc is made to more closely fit the guide or post, and it is adapted to be weighted. This disc is angularly elevated from the lower disc by the inclination of the guide or post, being thereby raised from its strand compressing position. These discs cooperate with the tilting-post to impart a tension on the strandular material by means of compression of the yarn or strand and by generation of maximum contact friction when the tensions in the strand are such as to cause no yielding movement of the tilting-post itself. Conversely, a minimum tension is imparted by the discs on the strand when the tilting-post has yielded due to tensions in the strand and minimum contact friction developed by advance of the strand thereabout. Thus, an increase in unwinding tension of the strand is proportionally equalized by the release of compressive tension of the discs and less resistance about the yielded post to deliver the strand under a more uniform and constant tension. Preferably, a strand guiding means are affixed to the support in such a relative disposition from the tilting-post to provide for an angular passage thereabout.

Further, in accordance with the present invention, more than one tilting-post may be provided, if desired, on the supporting member with the path of the strandular material inter-progressing therebetween. The posts can be used with or without tension discs and one or more can be positioned in a slotted aperture on the support to move yieldably therein as well as angularly to varying tensions in the strandular material.

The tension device of this invention is described further in detail in the following specification in connection with the accompanying drawing, in which

Figure 1 is a perspective front view of the strand tensioning device adapted to control and equalize tension in advancing strandular material;

Figures 2, 3 and 4 are views of the tilting-post taken along section line 3—3 of Figure 1; these illustrate the reaction of the post to various yarn tensions;

Figure 5 is an exploded perspective front view of a modification of the strand tensioning device;

Figure 6 is a cross-sectional view of the slidable tilting-post taken along section line 6—6 of Figure 5;

Figure 7 is a cross-sectional view of the support having a slotted aperture taken along section line 7—7 of Figure 5.

With reference to Figure 1 of the drawing, the tensioning device 9 comprises a flat support 10 having an aperture 26, a tiltable post 19 mounted therein, and two other posts 14 and 35. The portion of support 10 including the aperture 26 is cross-sectionally designated in Figures 2, 3 and 4. The support 10 is disposed in a substantially horizontal plane although it can be readily adapted to various angular mounting. The yarn 11, after being unwound from a supply package (not shown), is initially directed through a guide-eye 12 to and about the rigid post 14 perpendicularly fixed on the support 10 through a pair of tension discs 15 positioned about post 14. The discs 15 are adapted to being weighted by weights 16. From post 14, the yarn 11 is angularly passed to and about the tilting-post 19 positioned in the aper-

ture 26 and pivotally mounted on the support 10 on the swivel pin 23. The pin 23 is supported in the aperture by the bracket 24 fastened to the underside of the support 10 by rivets or screws 25. After leaving the tilting-post 19, the yarn is passed about the third post 35 between, if desired, tension discs 36 which may be weighted by washers 37.

The tilting-post 19 is coutnerbalanced at its lower extremity by means of the spring 28 attached at one end through the eye 27 and secured at the other end to the underside of support 10 by a suitable means, such as the screw 29. A pair of tension control discs 20 and 21, between which yarn 11 is placed, may advantageously be positioned about the tilting-post 19. As mentioned, the tension control discs cooperate with the tilting-post to more effectively equalize and stabilize tensions in yarn in contact with the tilting-post. The tilting-post 19 is yieldable to increased tension in the yarn by movement on its pivot 23. This movement lessens contact on the surface of the post and decreases the effect of frictional snubbing caused thereby. From the post 35 the yarn 11, under substantially constant tension, is delivered to a warp beam (not shown) to be collected thereon. Guide means 38 may be provided on the support 10 to direct the yarn to a warp beam.

Figure 2 illustrates the reaction of the device to yarn under minimum unwinding tension that occurs with a full supply package. The tilting-post 19 under such a condition is inclined backward in the apexial direction of the angular path defined for the yarn. In this position, the angularity of the path of travel of the advancing yarn is of such nature as to effect maximum peripheral contact with the tilting-post 19 and the rigid posts 14 and 35, and maximum interfacial contact between the discs 15 and 36 which also may be weighted. The snubbing effect of the tilting-post due solely to frictional contact is greatest when unwinding tension is at a minimum. With tension control discs 20 and 21, and the weights 22, about the tilting-post 19, the snubbing effect can be appreciably increased.

The lower tension control disc 20 has an aperture 30 of sufficient size to loosely fit about the tilting-post 19 so that it can advantageously remain flat upon the surface of support 10 throughout pivoting movements of the tilting-post. The upper tension control disc 21 has aperture 31 which conforms sufficiently close to the periphery of tilting-post 19 so that it will follow the tilting movements thereof so as to be angularly elevated from the face of disc 20. Thus, when the tilting-post 19 is in the backward tilted position as illustrated in Figure 2 the discs 20 and 21 are tightly engaged at their peripheral portions and do not freely rotate about the post in the direction of the advancing yarn with the result that frictional contact of the yarn between the disc faces is at a maximum. Further, since the center of gravity shifts directly over the yarn between the disc faces when tilting-post 19 is in such position, a positive compressive effect is realized which amplifies the snubbing. The cooperative snubbing effect of the discs with the tilting-post can be magnified by the addition of weights 22 upon the upper tension control disc 21.

As the diameter of a supply package decreases, the unwinding tension of the yarn 11 increases, gradually overcoming the counterbalance of the spring 28 effecting a pivotal movement of tilting-post 19; finally at some intermediate tension it will assume an upright position, then a forward tilted position, as illustrated in Figures 3 and 4. In the upright position the angularity of the path of travel of the yarn about the posts serves to lessen the attendant peripheral and disc interfacial frictional contact. Further, as tilting-post 19 approaches the upright position, discs 20 and 21 are rendered more easily rotatable further diminishing the disc interfacial friction. Also, the compressive action of the discs on the yarn advancing therebetween is relaxed as tilting-post 19 approaches the upright position and the disc faces become disposed in more parallel relationship.

With emptying of the supply packages, the unwinding tension increases to a point at which the tilting-post 19 has completely yielded to assume a position as illustrated in Figure 4. In such a position, yarn frictional contact on the post peripheries and between the disc interfaces is at a minimum due to the approach of a more linear path of travel through the device. With the post in such a position, the tension control discs 20 and 21 assume an angular position which eliminates compressive action on the yarn by the disc faces and any of the weights 22 positioned on upper disc 21. The device 9 thereby exerts a minimum snubbing effect to counter and to equalize maximum increase in tension developed. When the package empties and the yarn is again withdrawn from a full package the tilting-post automatically returns to the position illustrated in Figure 2 which is normal for minimum unwinding tension.

Figure 5 illustrates a modification of the tension control and equalizing device 9. As indicated, generally, by the reference numeral 49, the tension device comprises a support of two half sections 50 and 51, having apertures 55 and 56 respectively. The support halves are recessed and T-slotted at their opposing edges so as to form, when joined, a slotted aperture 57 having therein the slide grooves 58. The support halves 50, 51 are joined by the brackets 52 and 53 fastened thereto by rivets or screws 54. Mounted rigidly on the support half 50 is post 60 fastened to the support by the threaded bolt 63 which extends through the support aperture 55 to be secured to the nut 64. Positioned about the post 60, are the tension discs 61 and the weights 62. The post 88 is rigidly mounted on the other support half 51 by the threaded bolt 91 extending through the support aperture 56 to be secured to nut 92. Positioned about the post 88 are the tension discs 89 and weights 90. Yarn (not shown) leaving a supply package (not shown) is directed through the tension discs 61 about the post 60, then about the slidable tilting-post 69 and finally through the tension discs 89 about the post 90 from where it is delivered for collection under a substantially constant tension.

Tilting-post 69 consists of an upper section 70 pivotally mounted upon the lower section 71. The lower section 71 is provided with the flat slide support 72, which engages slidably in the slide grooves 58 within the slotted aperture 57. A spring 73 is positioned within each of the slide grooves 58 between the support-halves 50, 51 and the slide support 72 so as to retain the tilting-post at the end of the slot when strand tension is at a minimum and cause the yarn to advance about the tilting-post in a path of least angularity. The tilting-post 69 is slidably yieldable to varying tensions in the advancing yarn. The upper section 70 is mounted so as to be tiltably yieldable about its pivot point to the lower section 71. A pair of tension control discs are positioned about the tilting-post 69. The lower disc 80 fits loosely about the tilting-post. The upper disc 81 fits more closely about the tilting-post and carries weights 82. These discs cooperate with tilting movements of the tilting-post to effect strand snubbage as hereinbefore described.

Figure 6 illustrates means by which the tilting-post 69 may be rendered pivotally yieldable, and also the tilting reactions of the post to the various unwinding tensions. The upper section 70 of the tilting-post 69 is pivotally secured to the lower section 71 by the flat spring 74 embedded in each section. Dotted portion 70*a* represents the backward tilted position of the upper section 70 of the tilting-post under minimum unwinding tension. In this position, as previously explained, maximum snubbing is provided. The spring 74 is adapted to retain the tilting-post in this backward tilted position under minimum yarn tension. Dotted portion 70*b* represents the tilting-post as it reacts to a maximum tension in the advancing yarn. As previously explained minimum snubbing is provided in such position.

Figure 7 illustrates a cross-sectional view of the support halves 50, 51 including the slotted aperture 57 containing the slide grooves 58. The tilting-post 69 is held in the slotted aperture 57 with the slide support 72 slidably engaged in the slide grooves 58. The tilting-post is slidably yieldable against the springs 73 under varying tensions in advancing yarn. When the tilting-post 69 yields slidably to increasing tension, it moves in the slotted aperture in a direction away from the apex of the angular path of the advancing yarn, causing the angularity of the yarn about the posts to describe a more linear path. This decreases the frictional contact of the yarn in the device. The sliding action of the tilting-post 69 may be arranged to cooperate simultaneously or in any desired sequence with the tilting action about the pivot so as to decrease the snubbing effect and constantly deliver the yarn under a substantially fixed tension. Whenever an empty supply package is replaced by a full one and the unwinding tension reverts to a minimum the device automatically positions and readjusts itself to exert maximum snubbing and begin repetition of the tension control and equalizing cycle.

If desired, the tilting-post of the present invention may be counterbalanced by any suitable means in addition to springs, such as by weights attached to the lowermost portion thereof.

As indicated, the tilting-post may be employed with or without cooperating tension control discs and weights although it is preferable to employ them for the usual creeling operation.

As is apparent, the present invention is highly useful in association with creels during beam warping of yarn. However, tilting-post devices are adaptable to control and equalize tension in any flexible strandular material, including yarn, wire, cable, and the like of textile, metallic or other composition, being advanced from any source of supply to any point of delivery under a variety of conditions which present inherent problems of varying and fluctuating tension. It is to be understood therefore that the foregoing specification is to be taken as merely illustrative of the invention and in no sense limiting since various embodiments and modifications may be entered into which in no way depart from the spirit and scope of the invention as particularly pointed out and described in the appended claims.

I claim:

1. A device for the control and equalization of tension in advancing strandular material comprising; a support having a slotted aperture; a tilting-post positioned in said slotted aperture; means connecting said tilting-post and said support to slidably and pivotally mount said tilting-post in said aperture; a resilient means between said post and said support to restrain sliding movement of said post in said aperture, another resilient means counterbalancing said post; said post being slidably and tiltably yieldable to varying tensions in said advancing material; and strand guiding means on said support spaced from said tilting-post to form an angular path therewith for said strandular material.

2. A device to control and equalize tension in advancing strandular material comprising; a support having an aperture; a tilting-post positioned in said aperture; means pivotally mounting said tilting-post on said support in said aperture; resilient means counterbalancing said post to maintain it yieldable to varying tensions in said advancing material when passed around in contact with said post; a pair of tension control discs between which said strandular material passes, positioned freely rotatably about said tilting-post, the upper of said discs adapted to be weighted; and strand guiding means on said support spaced from said tilting-post forming an angular path therewith for said strandular material.

3. In a device according to claim 2, wherein the lower of said tension control discs remains flat upon the surface of said support throughout tilting of said tilting-post; and wherein the upper of said tension control discs is angularly separated from the face of the lower disc when said tilting-post is tilted.

4. In a device according to claim 2, wherein said strand guiding means pass strandular material in an angular path about said tilting-post, said means being guides rigidly positioned on said support, each guide having a pair of freely rotatable tension control discs between which said strandular material passes.

5. In a device to control and equalize tension in advancing strandular material, a support having a slotted aperture, a tilting-post positioned in said aperture; means connecting said tilting-post and said support to slidably and pivotally mount said tilting-post in said aperture; a resilient means between said post and said support to restrain sliding movement of said post in said aperture; another resilient means counterbalancing said post; said post being slidably and tiltably yieldable to varying tensions in said advancing material; a pair of tension control discs between which said strandular material passes positioned freely rotatably about said tilting-post; and strand guiding means on said support spaced from said tilting-post to form an angular path for said strandular material, said tilting post resisting change in the angular path of said strandular material by a change in its position in said slot and tilt.

6. In a device according to claim 5 wherein the lower of said tension control discs has a larger opening permitting it to remain on the surface of said support throughout tilting movements of said tilting-post; and wherein the upper of said discs has a smaller opening so as to bind it to the said post to be angularly elevated from the face of the lower disc when said tilting-post is tilted.

7. A device to control and equalize tension in advancing strandular material comprising; a support having an aperture; a tilting-post, pivotally mounted on said support, positioned in said aperture; said post being yieldable to varying tensions in said advancing material when passed around in contact with said post; a pair of tension control discs about said tilting-post between which said strandular material passes; said discs being freely rotatable about said tilting-post; the lower of said discs adapted to remain flat upon the surface of said support throughout tilting of said tilting-post; the upper of said discs adapted to be weighted and further adapted to move with said tilting-post and be angularly separated from the face of the lower disc when said tilting-post is tilted; and strand guiding means on said support spaced from said tilting-post to form an angular path therewith for said strandular material.

8. In a device to control and equalize tension in advancing strandular material, a support having a slotted aperture, a tilting-post slidably and pivotally mounted on said support, positioned in said aperture; said post being slidably and tiltably yieldable to varying tensions in said advancing material; resilient means restraining said tilting-post against sliding movement in said slotted aperture; a pair of tension control discs about said tilting-post between which said strandular material passes; said discs being freely rotatable about said tilting-post; the lower of said discs having a larger opening permitting it to remain on the surface of said support throughout tilting movements of said tilting-post; the upper of said discs having a smaller opening so as to bind it to the said post to be angularly elevated from the face of the lower disc when said tilting-post is tilted; and strand guiding means on said support spaced from said tilting-post to form an angular path for said strandular material, said tilting-post resisting change in the angular path of said strandular material by a change in its position in said slot and tilt.

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