Dec. 16, 1947. E. R. SWANSON 2,432,696

TENSION-DEVICE FOR WINDING MACHINES

Filed March 13, 1946 2 Sheets-Sheet 1

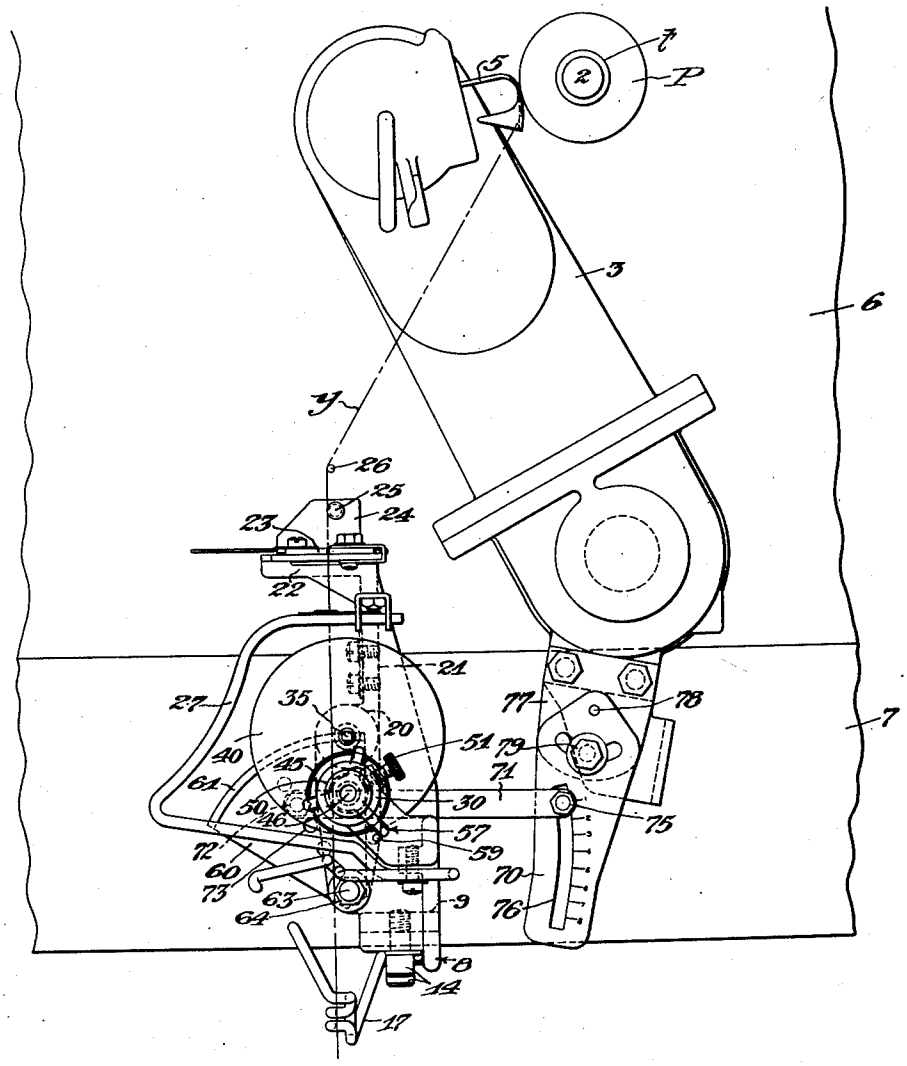


Fig. 1.

Inventor:
Ernest R. Swanson
By Watson, Cole, Grindle + Watson
Attorneys.

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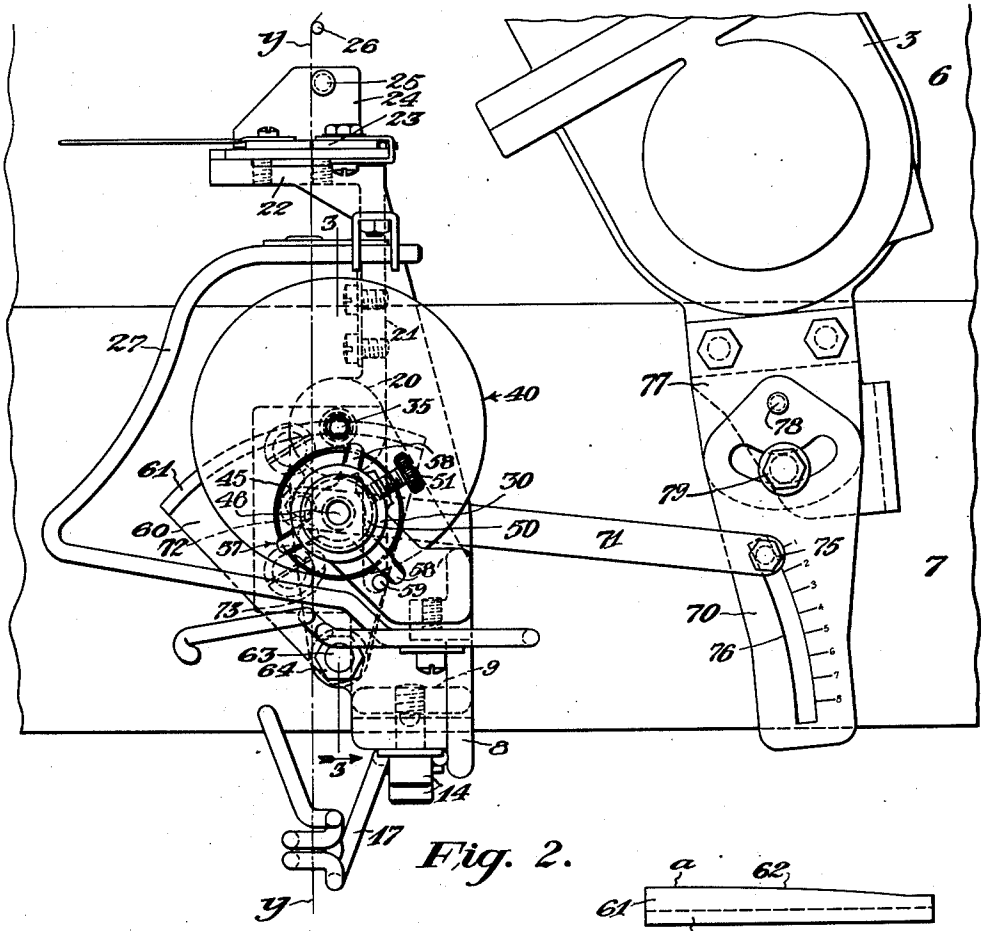


Fig. 2.

Fig. 4.

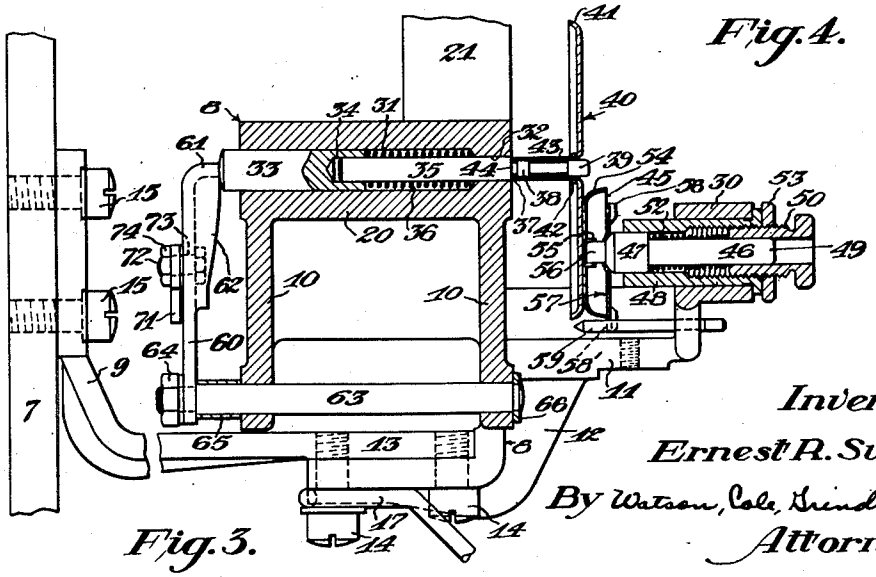


Fig. 3.

Inventor:
Ernest R. Swanson
By Watson, Cole, Grindle & Watson
Attorneys.

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UNITED STATES PATENT OFFICE

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TENSION DEVICE FOR WINDING MACHINES

Ernest R. Swanson, Cranston, R. I., assignor to Universal Winding Company, Boston, Mass., a corporation of Massachusetts

Application March 13, 1946, Serial No. 654,018

12 Claims. (Cl. 242—150)

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This invention relates to improvements in tension-devices for tensioning strand materials such as yarn, thread or the like during their delivery to winding machines or in other transfer processes used in various arts.

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

One object of the present invention is to provide a so-called differential tension-device adapted to operate automatically to regulate the tension on the yarn during the winding or other operation in its transfer.

Another object is to provide a self-cleaning tension-device having a novel construction and arrangement of the yarn-contacting elements to prevent clogging by lint and foreign particles and further to reduce the wear thereon during continuous use.

Another object is to provide a tension-device of the type indicated comprising tension-disks of greater and lesser diameter rotatably mounted in eccentric relationship with their opposed faces arranged to press against a running strand.

Another object is to provide a tension-device of the type indicated in which the opposed tension-disks are adapted for independent rotation under the influence of the passage of the strand between their opposed faces.

Another object is to provide a tension-device in which the pressure of the tension-disks against the strand is automatically reduced during the growth in diameter of the package being wound to provide for a substantially constant tension on the yarn as its linear rate of draft increases.

Another object is to provide a tension-device of simple construction, economical to manufacture, and durable in use over long periods of time.

Further objects of the improvements are set forth in the following specification which describes a preferred embodiment of the invention, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is an elevational view of the essential elements of a conventional type of winding machine illustrating the present improved tension-device as applied to use therewith;

Fig. 2 is an enlarged elevational view of the tension-device showing it connected to the traverse-frame of the winding machine to adapt the movement of the latter to vary the pressure of the tension-disks on the running strand to gradually relieve the tension thereon as the rate of feed of the yarn increases;

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Fig. 3 is a similarly-enlarged part-sectional side view of the tension-device taken on line 3—3 of Fig. 2; and

Fig. 4 shows a development of the edge of the cam which operates to reduce the pressure of the tension-elements on the running strand.

The present invention is concerned more particularly with tension-devices for winding machines in which the winding spindle is rotated at a constant speed so that during the winding of a package thereon the rate of linear travel of the yarn increases progressively with the increase in circumference of the wound mass. As is well known to those skilled in the art, in winding machines of the present type as the winding progresses and the package increases in circumference the yarn must feed thereto at a progressively accelerated rate; that is with an increasing linear speed and, therefore, unless controlled, the ultimate tension on the running yarn will be augmented from this cause. Various means have heretofore been proposed to provide for gradually relieving or reducing the applied tension on the yarn as its rate of feed increases during the growth of the package. The present invention provides such means acting on a tension-device of novel construction and arrangement which of itself presents certain features of improvement as hereinafter more particularly set forth.

Fig. 1 of the present drawings illustrates the essential elements of a known type of winding machine comprising a rotary winding spindle 2, a pivoted traverse-frame 3 arranged to swing away from the winding spindle during the growth of the package wound thereon and a reciprocating thread-guide 5 carried by the traverse-frame. The thread-guide 5 is reciprocated by means, not herein shown, mounted on the frame 3 to traverse the yarn back and forth longitudinally of the axis of the winding spindle 2; such a type of winding machine being illustrated and fully described in United States Letters Patent No. 2,328,-344 to C. H. Jones, dated August 31, 1943. The winding elements of the machine may be mounted on a frame or casing 6 supported on a bed 7 and the tension-device is herein illustrated as being mounted on a bracket 8 fastened to an auxiliary bracket 9 bolted to the side of the bed 7, see Fig. 3.

The lower portion of the bracket 8 is of bifurcated form with a pair of spaced legs 10 and a ledge or shelf 11 projecting laterally therefrom.

Depending from the shelf 11 is an elbow-shaped arm 12 fastened to a horizontal arm 13 on the auxiliary bracket 9 by means of screws 14. The auxiliary bracket 9 is fastened to the side of the bed 7 by means of screws 15 for supporting the tension-bracket 8 in spaced relation to the casing of the machine. A wire "pigtail" 17 is fastened on the under side of the arm 12 by one of the screws 14 to adapt it to serve as a guide for the yarn strand *y* as it leads up through the tension-device. Surmounting the legs 10 of the bracket 8 is a cylindrical bearing 20 and projecting upwardly therefrom is a standard 21 carrying a shelf 22 at its upper end mounting a slub-detector 23 and other elements of the winding mechanism. Rising from the shelf 22 is a plate 24 having a pin or rod 25 projecting forwardly therefrom, and thereabove is a wire 26 forming a part of the breakage lever (not herein shown in detail) which acts to control the stopping mechanism of the machine, the strand *y* leading across these elements to the thread-guide 5 and thence to the package P being wound. The upper portion of the bracket 8 also mounts the connections for a bent wire member 27 which serves as a guide for threading the yarn strand into position between the tension-disks, later described, in preparing the machine for winding; these last mentioned elements being common to winding machines and therefore not herein shown and described in detail. The bracket 8 mounts a second bearing 30 supported above the ledge 11 at the outer end thereof.

The larger bearing 20 is provided with an axial bore 31 extending from its rearward end throughout the greater portion of its length and continuing at its forward end in a smaller bore 32. Adapted to slide in the larger bore 31 is a plunger 33 formed with a counterbore 34 at its end. A spindle 35 projects through the smaller bore 32 with its rearward end fixedly held in the counterbore 34 of the plunger 33. Surrounding the spindle 35 is a helical spring 36 having one end seated against the end of the larger bore 31 and its opposite end bearing against the end of the plunger 33 to exert a force tending to slide the plunger toward the left as viewed in Fig. 3. The spindle 35 has a reduced end portion 37 projecting outwardly from the forward end of the bearing 20 and formed with spaced bosses 38 and 39 which provide a bearing for the larger tension-disk 40. As herein shown the tension-disk 40 is constructed of sheet metal having its peripheral rim flared to provide a curved flange 41, while at its center the metal is flanged inwardly in a hub 42 brazed or otherwise secured to the periphery of a bearing sleeve 43 mounted to rotate on the bosses 38 and 39 on the reduced extension of the spindle 35. By this form of construction the tension-disk 40 is rotatably journaled on the end of the spindle 35 with the end of its bearing sleeve 43 abutting the shoulder 44 at the end of the larger portion of the spindle 35.

Adapted to make contact with the forward face of the disk 40 is a smaller tension-disk 45 mounted to rotate on a spindle 46 in the bearing 30, previously mentioned, with its axis parallel with and in eccentric or spaced relation to the axis of the larger disk 40. The spindle 46 has an enlarged bearing boss 47 slidable in a sleeve or bushing 48 held fast in the bore of the bearing 30 and a reduced extension or shank 49 slidable in a thimble 50 threaded into the outer end of the bearing sleeve. The bushing 48 is secured in the bearing 20 by means of a thumb-screw 51 to adapt it for

longitudinal adjustment relative thereto. Between the end of the thimble 50 and the shoulder of the bearing boss 47 is a helical spring 52 which is held under compression tending to slide the spindle 46 toward the left as viewed in Fig. 3. By turning the thimble 50 the tension of the spring 52 may be adjusted to vary its force tending to slide the spindle 46 and a check-nut 53 on the thimble may be tightened against the flanged end of the sleeve 48 to fixedly hold the parts in adjusted relationship.

The smaller tension-disk 45 is formed with a rearwardly-flanged curved rim 54 and at its center is provided with an inturned flange 55 surrounding a reduced projection or pintle 56 at the end of the spindle 46. The tension-disk 45 is yieldingly pressed toward the larger disk 40 by means of a spider-shaped spring 57 having resilient arms 58, see Fig. 2, bearing against the edge of its flanged rim 54 for the same purpose and in the manner as shown and described in United States Letters Patent No. 2,253,521 to H. W. Hitchcock, dated August 26, 1941. The spider-spring 57 has its hub apertured to receive the reduced pintle 56 at the end of the spindle 46 to adapt it to bear against the beveled or convexed end of the boss 47 whereby the spring 52 acts to apply pressure to the spider-spring to cause its arms 58 to resiliently urge the disk 45 toward the larger disk 40. Both tension-disks 40 and 45 are mounted to rotate freely on their spindles 35 and 46, respectively, and preferably, the spider-spring 57 is restrained from rotation with the disk 45 by the engagement of its longer arm 58' with a pin 59 mounted in a portion of the bracket 8 above the shelf or ledge 11.

Referring to Fig. 1, the yarn strand *y* delivering from a suitable source of supply mounted below the winding machine, but not herein shown, leads upwardly through the pigtail 17 and thence through the slub-detector 23 and across the rod 25 and wire 26 in its course to the thread-guide 5 and thence to the winding package P. It will be observed that the spindle 35 on which the larger tension-disk 40 is journaled is slidable in the bore of the bearing 20 and in accordance with the present invention means are provided for automatically adjusting the position of the plunger against the tension of its spring 36 during the progress of the winding. For this purpose there is provided a pivoted quadrant 60 having an arcuate rim 61 formed with a cam-face 62 bearing against the convex end end of the plunger 33. The cam-quadrant 60 is mounted fast on the reduced end of a shaft 63 by means of a nut 64, the shaft being journaled in bearings at the lower ends of the legs 10 of the bracket 8. A sleeve 65 on the shaft 63 serves to space the quadrant 60 from the rearward side of the bracket 8 and to prevent axial displacement of the shaft in cooperation with a collar 66 riveted to its reduced opposite end.

The quadrant 60 is adapted to be rotated about its axis to cause its cam-face 62, shown in development in Fig. 4, to ride across the end of the plunger 33 by means of its connection to an arm 70 projecting below the hub of the traverse-frame 3, see Fig. 2. This connection may comprise a relatively flat link 71 having a stud 72 at one end engaged through one of a series of holes 73 in the quadrant, see dotted lines in Fig. 2, spaced radially outward from its axis of rotation. The stud 72 may be attached to the quadrant 60 by means of a nut 74 screwed onto its end. At the opposite end of the link 71 is a similar stud

75 engaged in an arcuate slot 76 in the arm 70 on the traverse-frame 3; the slot preferably having numbered graduations at its side for indicating the extent of adjustment of the stud therealong. As shown in Figs. 1 and 2, the arm 70 is adjustably secured to an extension 77 projecting below the hub of the traverse-frame 3, the arm being pivoted to swing about a stud or pin 78 mounted in the extension and held in adjusted position by means of a bolt 79 passing through an arcuate slot 76 in the arm with a washer under its head bridging the sides of the slot. By means of the above described form of construction the arm 70 may be adjusted laterally relatively of the traverse-frame 3 to regulate the position of the quadrant 60 at the start of the winding. Additional adjustment between the arm 70 on the traverse-frame 3 and the quadrant 60 for controlling the rate of movement of the quadrant under the swinging motion of the traverse-frame may be accomplished by shifting the stud 75 at the end of the link 71 in the slot 76 in the arm 70 and by changing the location of the opposite stud 72 on the quadrant 60 by engaging it therewith in the different holes 73.

The construction and arrangement of the tension-device and its operating mechanism having been particularly described above, its method of operation is explained as follows:

The winding machine is prepared for operation by leading the strand of yarn *y* upwardly and threading it through the tension-device in the manner previously explained to cause it to feed between the opposed faces of the disks 40 and 45. When the winding spindle 2 is rotated to wind on the yarn the strand *y* will draw between the two disks 40 and 45 at one side of their axes and resistance to its draft will be applied thereto by the pressure of the disks thereagainst. During the passage of the yarn across the faces of the disks 40 and 45 in a course offset from their axes the friction engendered thereby will cause both disks to rotate in clockwise direction, the disk 40 turning on the reduced end of the spindle 35 and the disk 45 rotating on the end of the spindle 46. During the rotation of the disk 45 the spring 52, acting against the boss 47 on the spindle 46, will apply a force to the spider-spring 57 so that its resilient arms 58 will exert pressure on the rim of the disk to cause it to bear resiliently against the strand *y* feeding between the opposed faces of the disks. During this action the spider-spring 57 is prevented from turning by the engagement of the pin 59 with its longer arm 58' so that it will apply resistance to the rotation of the tension-disk 45 to prevent it from turning too rapidly or "spinning." The amount of pressure applied to the smaller tension-disk 45 may be regulated by adjusting the thimble 50 in the bushing 48 to control the tension of the spring 52. On the other hand, the position of the larger disk 40 in relation to the smaller disk 45 is adjusted automatically to regulate the amount of tension applied to the yarn by sliding the plunger 33 in the bore of the bearing 20. That is to say, the cam-quadrant 60 is rotated under the swinging movement of the traverse-frame 3 to alter the axial position of the plunger 33 and thereby the position of the tension-disk 40 in relation to the smaller disk 45. At the start of winding a package the tension-device is adjusted to apply a maximum degree of tension on the yarn feeding thereto and for this purpose the high point on the edge of the cam-face 62, indicated at *a* in Fig. 4, is positioned in

engagement with the end of the plunger 33 to maintain the disk 40 substantially in the position illustrated in Fig. 3, that is, at a point relatively outward from the face of the bracket 8 to provide for maximum pressure of the smaller disk 45 against its face. The leading portion of the cam-rim 61 may have a substantially straight edge so that during the start of the winding, and for an interval thereafter, the maximum amount of tension is applied to the yarn while the winding mass is of relatively small diameter. As the package increases in size, however, and reaches a substantial diameter the increased rate of draft on the yarn will cause its linear speed to increase and consequently there will be a tendency for the tension device to apply a greater degree of tension on the strand due to its increased speed in feeding therethrough. In other words, the tension applied to the yarn would normally be increased in proportion to the increase in diameter of the winding package and this would have a deleterious effect on the winding, tending in some instance to strain the material and cause the package to bulge at its ends due to the constriction of the outer coils on the inner layers. To prevent such an objectionable effect in the winding it is usually the practice to gradually relieve the applied tension on the yarn substantially in proportion to the increase in its linear rate of feed to the winding package. With the present improved tension-device such a differential adjustment of the applied tension is effected automatically by displacing the plunger 33 under the rotary action of the cam-quadrant 60 as it is operated by the movement of the traverse-frame 3 through its connection by the link 71 with the arm 70. As the traverse-frame 3 swings outwardly away from the winding spindle 2 in counterclockwise direction, the arm 70 attached thereto will be rocked in the same direction and through the link 71 will rotate the cam-quadrant 60 in clockwise direction. Under this action the cam-face 62 on the rim of the quadrant 60 will be moved across the end of the plunger 33 to progressively relieve its pressure thereagainst, whereof the tension of the spring 36 will cause the plunger to be shifted toward the left as viewed in Fig. 3. Stated another way, as the inclined edge or cam-face 62 on the rim 61 of the quadrant 60 slides across the end of the plunger 33 the tension-spring 36 will cause the plunger to be slid toward the left so that the tension-disk 40 at its opposite end will be retracted relatively of the bearing 30 to gradually relieve the pressure of the smaller disk on the yarn as the spring 52 and spider 57 tend to relax. In this way the amount of tension applied to the yarn is progressively relieved as the linear speed of the strand increases during the increase in diameter of the package being wound and a more constant or uniform ultimate tension on the yarn is maintained throughout the winding. After the winding is completed and the package doffed from the spindle 2 the traverse-frame 3 is swung back into position with the thread-guide 5 in contact with the cop-tube *t* on which the winding is performed and under this action the swinging movement of the arm 70 returns the cam-quadrant 60 back to its initial position with the high point, indicated at *a* in Fig. 4, on its cam-face 62 bearng against the end of the plunger 36. At this point the plunger 33 will be held against the tension of the spring 36 with the tension-disk 40 advanced to a greater extent relatively of its bearing 20 so that the spring 52 and spider 57

will act on the disk 45 to apply a maximum amount of tension on the strand *y* drawing between the disks. The device then will be properly adjusted to operate in the manner previously explained to progressively relieve the tension applied to the yarn substantially in proportion to its increasing linear rate of feed to the winding package.

The present invention provides improvements to render the tension device self-cleaning and prevent clogging by an accumulation of lint and other foreign matter on the faces and around the bearings of the tension-disks; such clogging being liable to prevent proper functioning of the disks and to interfere with their rotative motion so as to subject them to extreme wear. That is to say, due to the arrangement of the opposed tension-disks with their axes in eccentric relation the rotation of each disk with respect to its cooperating disk acts to wipe the lint and other foreign matter, such as slubs, motes, broken ends of yarn or the like, outwardly to discharge them from the edges of the disks. In this way, clogging of the disks is prevented so that their opposed faces will not be forced apart and the lint and other matter cannot gather around the axial bearings of the disks to prevent free rotation thereof. Consequently, the present improved tension-device is adapted to function with greater efficiency to apply tension to the yarn or other strand material in accordance with the degree for which it is adjusted and with a progressive reduction in the applied tension during the growth of a winding package to compensate for the increase in linear rate of feed of the yarn. Stated briefly, the improved device operates to maintain a substantially constant tension on the yarn at the point where it delivers to the winding.

While the improved device is herein shown and described as embodied in a preferred form of construction, it is to be understood that various modifications may be made in the structure and arrangement of its parts without departing from the spirit or scope of the invention as expressed in the following claims. Therefore, without limiting myself in this respect, I claim:

1. An improved tension-device comprising a pair of opposed tension-disks mounted to rotate with their axes in eccentric relationship, and means for resiliently applying pressure thereto to cause the disks to bear against a yarn feeding between their opposed faces.

2. An improved tension-device comprising two disks of varying diameters, means for mounting said disks to rotate on axes arranged in eccentric relationship with their faces in opposed relationship, and means to apply pressure to force one disk toward the opposite disk to exert tension on a strand of yarn or the like feeding between the opposed faces of the disks.

3. An improved tension-device comprising a relatively large tension-disk, means for rotatively mounting said disk, a smaller disk arranged with its face in opposed relation to that of the larger disk, means for mounting the smaller disk to rotate on an axis in eccentric relation to the axis of the larger disk, and means to apply resilient pressure to one of the disks to cause it to bear against a yarn drawing between the opposed faces of the disk.

4. In a tension-device, a main disk of considerable diameter, means for mounting said disk to rotate about its axis, an auxiliary disk of considerably less diameter than that of the main disk, means to mount the auxiliary disk to rotate about an axis eccentric to the axis of the main disk with its face in opposed relation thereto, and resilient means for urging one of the disks toward its related disk to press against a yarn strand drawing between the opposed faces of the disks.

5. In a tension-device, a relatively large disk mounted to rotate about a fixed axis, a smaller disk mounted to rotate about an axis parallel with and in eccentric relation to the axis of the larger disk with the faces of the disks in opposed relationship, means for applying resilient pressure to urge one disk toward the opposite disk to tension a strand of yarn or the like feeding therebetween, and means for guiding the strand in a path spaced in offset relation to the axis of the main disk.

6. In a tension-device, a disk mounted to rotate about a fixed axis, an auxiliary disk arranged in opposed relation to the main disk and mounted to rotate on an axis parallel to the axis of the main disk and in eccentric relation thereto, means for yieldably applying pressure to one of the disks to advance it toward the opposite disk, and means for shifting the other disk axially to adjust its relation with the resiliently-pressed disk.

7. In a tension-device, a main disk mounted to rotate about a fixed axis, an auxiliary disk arranged in opposed relation to the main disk with its axis parallel to the axis of the main disk and offset in eccentric relation thereto, means for applying pressure to the auxiliary disk to adapt it to bear against a yarn feeding between the opposed faces of the disks, and means for adjusting the main disk in an axial direction toward or away from the auxiliary disk.

8. In a tension-device, a main disk, means for mounting said main disk to rotate about a fixed axis, a second auxiliary disk mounted in opposed relation to the main disk to rotate about an axis eccentric to the axis of said main disk, resilient means for urging one disk toward the opposite disk to press against a yarn strand feeding between the disks, and means for automatically moving one of said disks axially to cause it to recede relatively of the opposite disk.

9. In a tension-device, a bearing, a spindle slidable in said bearing, a disk rotatably mounted on said spindle, resilient means for axially sliding said spindle in the bearing, a cam for sliding the spindle against the tension of said spring, an auxiliary disk arranged in opposed relation to the first disk and mounted to rotate about an axis in eccentric relation to the axis thereof, and means for resiliently urging the auxiliary disk toward the main disk to adapt it to press against a yarn strand feeding between the opposed faces of the disks.

10. In a tension-device, a main disk, a spindle for rotatably supporting said disk, means for mounting said spindle to adapt it for axial movement, a spring for sliding said spindle, a cam for axially displacing said spindle against the tension of said spring, a second auxiliary disk mounted in opposite relation to the main disk for rotation about an axis arranged eccentric to the axis thereof, means for resiliently urging said auxiliary disk toward the main disk to apply pressure to a yarn strand feeding between the opposed faces of the disks, and means for actuating the cam to cause the tension of the spring to displace the spindle of the main disk to relieve the pressure of the disks on the yarn and thereby reduce the amount of tension applied thereto.

11. In a tension-device, a bearing, a plunger slidable axially in a bore of the bearing and provided with a spindle projecting therefrom, a disk rotatably mounted on said spindle, a second bearing, a second spindle slidably mounted in said second bearing with its axis in eccentric relation to the axis of the first spindle, an auxiliary disk rotatably mounted on the second spindle in opposed relation to the first-mentioned disk, resilient means for sliding the second spindle to urge the auxiliary disk toward the first disk, and means for axially displacing the plunger and spindle for the first disk to retract the latter relatively to the second disk.

12. In a tension-device, a bracket provided with a main bearing and a secondary bearing arranged with their axes parallel and in offset relationship, a spindle slidably mounted in the main bearing, a relatively large disk rotatable on said spindle, a spindle in the secondary bearing, a smaller disk rotatable on the spindle in the secondary bearing, resilient means for urging one disk toward the other disk to adapt the opposed faces of the disks to bear against a strand of yarn or the like feeding between their opposed faces to apply tension thereto, and means for progressively displacing one of the disks to cause it to recede axially in relation to the opposite disk to reduce the amount of tension applied to the yarn.

ERNEST R. SWANSON.