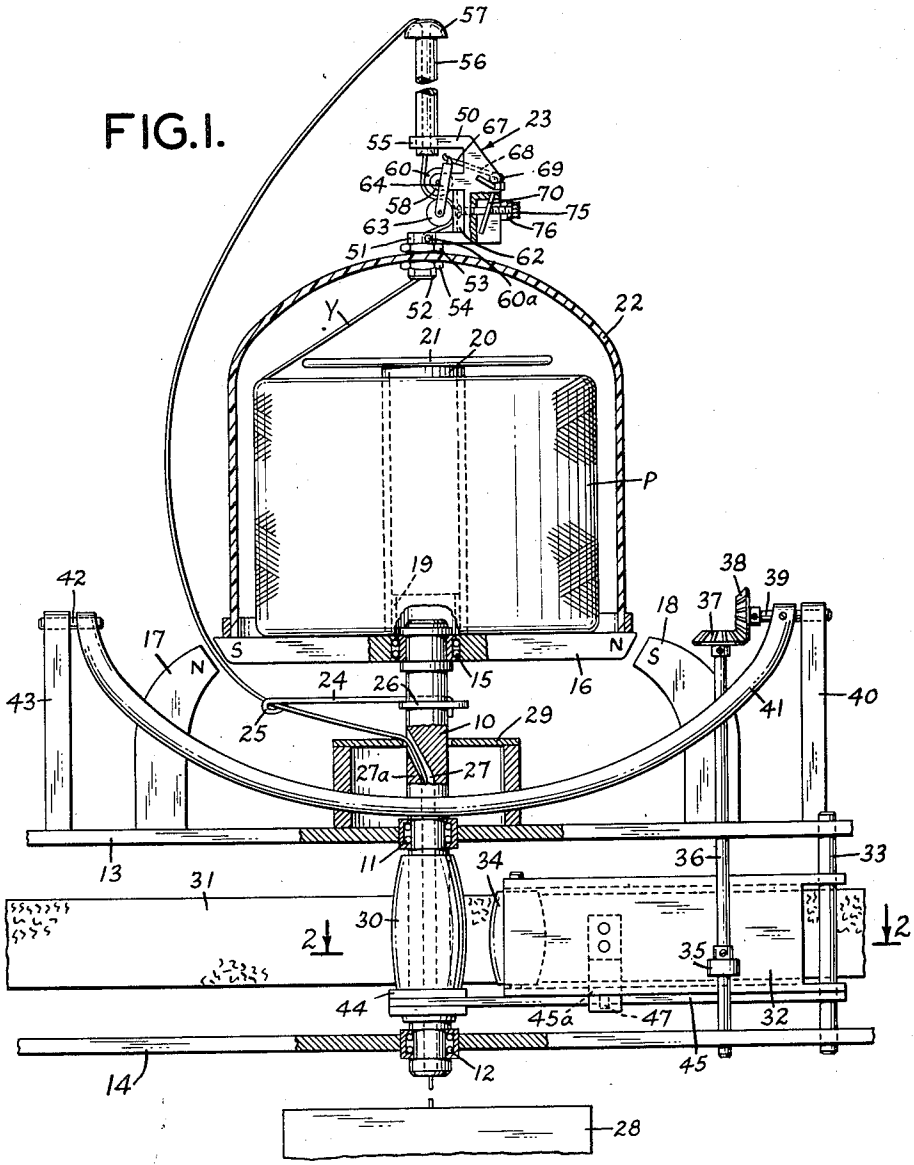
March 9, 1954 N. E. KLEIN 2,671,305

YARN TWISTING AND TENSIONING DEVICE

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FIG.1.



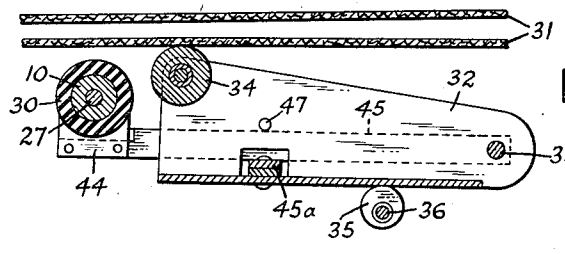


FIG.2.

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YARN TWISTING AND TENSIONING DEVICE

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FIG.3.

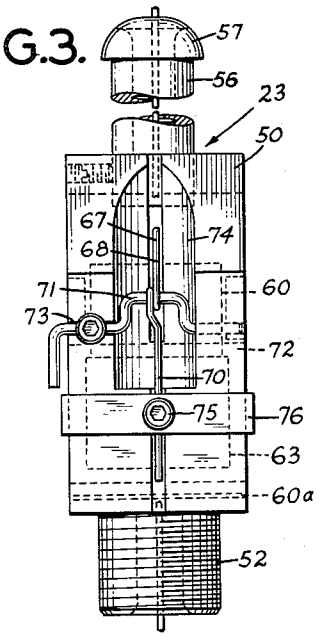


FIG.4.

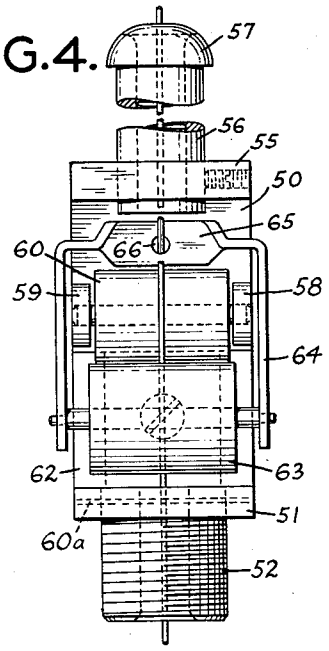


FIG.6.

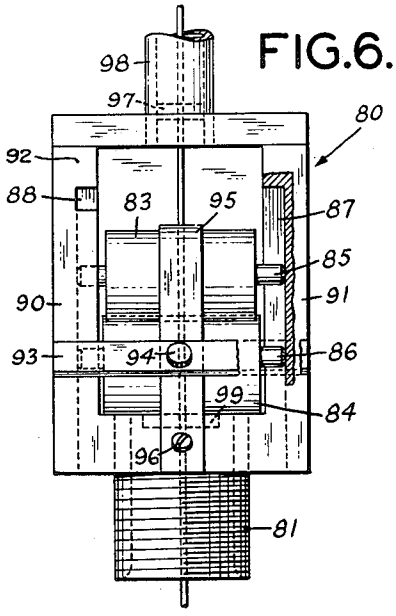
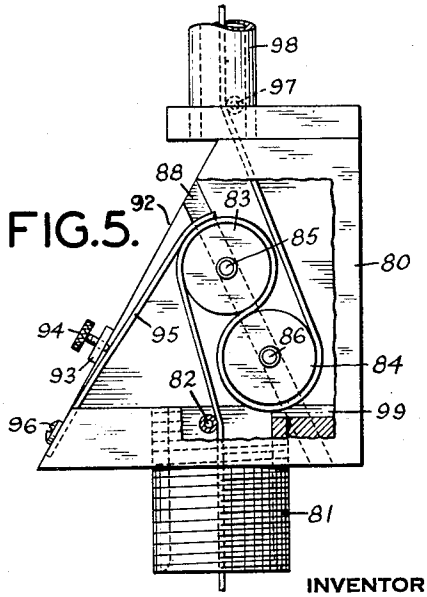


FIG.5.



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2,671,305

UNITED STATES PATENT OFFICE

2,671,305

YARN TWISTING AND TENSIONING DEVICE

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Application August 12, 1949, Serial No. 109,877

7 Claims. (Cl. 57—58.83)

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This invention relates to improvements in devices for spinning, twisting and doubling yarns, filaments and the like and it relates particularly to improvements in devices of the type disclosed in my copending application Serial No. 777,389, filed October 2, 1947, now Patent No. 2,549,821.

Devices of the type referred to above, namely, the so-called "two-for-one" twisters, impart two twists to a segment of yarn or the like for each revolution of a spindle which carries a flyer through which the yarn passes in its movement from a supply spool to a receiving spool or reel. In such twisters, the yarn being twisted is formed into a loop, one leg of which is held against rotation at a point adjacent the supply spool. The other leg of the loop is held against rotation at the receiving spool and is rotated by a flyer mounted on the spindle about the first leg or point. In this way, two twists are imparted to the yarn for each complete revolution of the second leg, one twist being introduced between each respective relatively fixed point and the rotary point.

As disclosed in my copending application Serial No. 777,389, filed October 2, 1947, now Patent No. 2,549,821, the essential elements of such a twister are a rotatable spindle upon which a flyer is supported for engagement with the yarn, a supporting member upon which a supply package is mounted, and a mechanism for holding the supply package stationary so that the leg of the loop can be spun by the flyer about the package to form a so-called "balloon." Also, a most important element of the device is a means for regulating the tension in the yarn as it is drawn from the supply package so that breakage of the yarn, and variation in the shape of the balloon will not occur.

My earlier devices are the first twisters of this type which are capable of imparting twist to zero twist or low twist yarns of low tensile strength. The reason that my earlier devices are capable of handling yarns of this character is that the yarn passes only through a 180° change in direction thereby reducing materially the number of tensioning points and preventing breaking or damage to weak yarns and the like. Through the use of a suitable tensioning device, moreover, my earlier twisters control the tension to reduce the tendency of the yarn balloon to vary in size and shape. Moreover, the tension can be reduced so that there is less possibility of the yarn filaments breaking so that shutdowns of the machines to repair breaks and the like are substantially eliminated.

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The present invention relates to an improved form of twisting device generally of the type disclosed in my above-mentioned application but differing in structural features which make it more convenient in use. The present device differs from my prior devices in being an upright down flow, two-for-one twister in which the supply package is mounted above the flyer so that the yarn first moves upwardly from the supply package through a tensioning device, then downwardly through a flyer which forms the balloon and through the spindle which supports the flyer to the receiving reel below the twister. The total change of direction of the yarn in passing from the package to the receiving reel is about 180°.

An additional feature of my new form of twister is an improved and simplified drive mechanism for the spindle and flyer whereby the flyer can be started and stopped quickly by means of a conveniently located handle. The new drive mechanism does away with complicated clutch mechanisms and eliminates involved and expensive gearing for driving the flyer.

The new form of twister also includes as an element an improved form of yarn tensioning device which may be generally of the type disclosed in my copending application Serial No. 41,580, filed July 30, 1948.

This type of tensioning device permits a readily controlled and predetermined tension to be applied to the yarn varying from a minimum tension to a maximum depending upon the characteristics of yarns and the like being twisted and also assuring that a constant tension is imparted to the yarns under substantially all conditions of operation.

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which:

Fig. 1 is a view in front elevation of a typical twister embodying the present invention, parts of the device being shown in section to disclose details thereof;

Fig. 2 is a view in section taken on line 2—2 of Fig. 1;

Fig. 3 is a rear view in elevation and partly broken away of the tensioning device disclosed in Fig. 1;

Fig. 4 is a front view in elevation of the tensioning device disclosed in Fig. 1;

Fig. 5 is a view in side elevation and partly broken away of a modified form of tensioning device; and

Fig. 6 is a view in front elevation of the tensioning device disclosed in Fig. 5.

The form of twisting device chosen for purposes of illustration is readily usable with low or zero twist yarns, filaments and the like formed of various types of natural and synthetic fibers and is designed and constructed to impart two twists to each unit length of yarn for each rotation of the spindle of the mechanism hereinafter described while the yarn moves upwardly and then downwardly through a 180° change in direction.

The twister, as illustrated, is capable of imparting twists at high speed to delicate or fragile yarns and thus fills a long felt want for this general type of device.

Referring now to Fig. 1, the twisting mechanism includes a spindle 10 which is rotatably mounted in suitable bearings 11 and 12 in upper and lower frame elements or plates 13 and 14, respectively. While the bearings are illustrated as being of the antifriction thrust type, it will be understood that other types of bearings may be used, if desired.

The spindle 10 supports at its upper end, by means of the antifriction thrust bearing 15, a platform 16 adapted to support a supply package P of yarn, filament or the like to be twisted. The platform 16 includes a magnet having oppositely directed poles cooperating with the curved magnets 17 and 18 to hold the platform 16 against rotation during rotation of the spindle 10. The platform 16 is provided with a tubular collar 19 upon which the package P is received, the latter being in turn mounted upon a tubular guide 20 which fits over and snugly engages the collar 19. The upper end of the guide 20 is provided with a disc-like yarn guide 21 permitting the yarn Y to be stripped smoothly off the package.

The platform 16 also supports a dome shaped cover member 22 which may be formed of transparent plastic or the like to cover the package P and provide a smooth outer surface. A yarn tensioning device 23, described hereinafter, is mounted on the top of the cover 22 in a position to receive the yarn as it is stripped off the package P.

The yarn passes from the tensioning device 23 downwardly to a flyer 24 which, as illustrated, may consist of a wire having a coiled end 25 forming an eye through which the yarn passes. The flyer 24 is fixed to the spindle 10 by passing one of its ends through a diametrical opening in the spindle and then bending the projecting end of the wire downwardly and inserting it in an opening in a counterbalancing device 26 supported on the spindle. The flyer construction referred to above is disclosed more particularly in my copending application Serial No. 777,389, now Patent No. 2,549,821.

The yarn, after passing through the eye 25 of the flyer, passes through an inclined and axial passage 27 in the spindle and emerges at the lower end of the spindle to be wound on the receiving spool 28. The spool 28 may be provided with a yarn traversing device of high speed type (not shown) for applying the yarn smoothly to the spool. In order to reduce the possibility of damage to or drag on the yarn as it enters the passage 27, an annular or ring-like yarn guide 29 is mounted on a transverse frame member 13 to direct or guide the yarn into the passage 27. Inasmuch as the yarn moves with a rotary motion over the surface, it experiences very little tension increase. Also, the inner edge of the guide 29 is located in the cone described by the axis of the inclined portion of the passage 27 so that the yarn enters along the axis of the inclined portion of the passage 27 and makes contact with the wall of the passage only at the shoulder 27a at the junction of the inclined and axial portions of the passage. Such limited contact does not impart any substantial tension to the yarn.

The spindle 10 is driven by means of a convexly curved pulley 30 mounted between the bearings 11 and 12 and engaging one flight of a belt 31. The belt is suitably guided and driven so that one or more spindles such as those described above can be driven by a single belt. Inasmuch as it is contemplated that the belt will be driven continuously, means are provided for disengaging the pulley 30 from the belt in order to stop the spindle for replacement of the supply package and other operations. As shown in Fig. 2, a channel-like member 32 is pivotally supported at one end by means of a shaft or rod 33 extending through the flanges of the member 32 between the frame members 13 and 14. A freely rotatable roller 34 is mounted between the side flanges of the member 32 near its left-hand end. The roller 34 may be moved into engagement with the belt 31 to deflect the latter away from the pulley 30. The plate 32 is moved by means of a cam member 35 fixed to the vertical shaft 36. The shaft 36 is rotatably mounted in the frame members 13 and 14 and carries a bevel gear 37 at its upper end. The gear 37 is driven by a meshing bevel gear 38 which is mounted on a stub shaft 39 journalled at one end in an upright 40 on the frame member 13. The shaft 39 also is connected to one end of an arcuate operating handle and flyer guard rail 41 which carries at its opposite end a stub shaft 42. An upright 43 receives the stub shaft 42 rotatably so that the handle 41 may be rocked up and down thereby rotating the gears 37 and 38 and turning the cam member 35. When the handle is swung from the horizontal position into the position shown in Fig. 1, the cam member 35 is rotated counterclockwise into the position shown in Fig. 2, in which position the roller 34 is forced against the belt 31, thereby deflecting it and disengaging it from the pulley 30.

The above-described belt disengaging mechanism includes a brake member for bringing the spindle to a quick stop. This brake member may consist of a concave block 44 of suitable brake material engageable with the pulley 30 or a portion of the spindle 10 adjacent thereto upon clockwise movement of the plate 32. The brake block 44 is mounted on the end of a lever 45 extending parallel with the edge of the plate 32 and supported pivotally on the rod 33. A leaf spring 45a on the plate 32 engages the back of the lever 45 to permit relative movement of the plate 32 and the lever. Clockwise movement of the brake member relative to the plate 32, as viewed in Fig. 2, is limited by means of the pin 47 on the plate member 32. In this way, when the plate 32 moves toward the belt 31, the brake block 44 engages the pulley 30 and the roller 34 can advance still further to disengage the belt 31 from the pulley 30.

Referring back to the tensioning device 23 (Figs. 1 and 4), it may consist of a frame member 50 having a lower horizontal leg or base 51 provided with an externally threaded downwardly extending sleeve 52 which extends through an opening in the top of the cover 22. The sleeve 52 is secured to the cover 22 by a pair of nuts 53 and 54. The frame 50 also includes a parallel arm 55 in which is mounted a tubular trumpet 56 having a dome shaped end 57 through

which the yarn is guided in passing to the eye 25 of the flyer. The frame 50 further includes a pair of centrally located parallel arms 58 and 59 between which a yarn guiding roller 60 is mounted for rotation. Below the arms 58 and 59 in the recess between these arms and the base 51 of the frame is a block of braking material 62 formed of polished metal or the like. The central portion of this block may be cut partially away to form a depressed portion of shallow depth.

Cooperating with the brake block 62 is a second roller 63 which is supported between the end arms of a yoke member 64. The upper mid-portion of the yoke member 64 is twisted to form a generally vertically extending flat portion 65 having a centrally located opening 66. The yoke 64 is supported by means of one arm 67 of a spring 68 having a coiled center portion 69 and a downwardly extending arm 70. The coiled portion 69 of the spring is supported upon a crank-like pivot member 71 which has its opposite ends rotatably mounted in openings 72 and 73 in the back of the frame member 50. As best shown in Fig. 3, the back portion of the frame is cut away and slotted as at 74 to permit movement of the crank member 71 about its axis and also movement of the lower arm 70 of the spring 68.

The lower arm 70 of the spring is threaded to a set screw 75 which is threaded into the frame 50 and engages the mid-portion of a bowed spring member 76 straddling the back of the frame 50.

The set screw 75 and the crank member 71 afford a very precise means for adjusting the tension of the yarn, inasmuch as the set screw can be adjusted to vary the tension of the spring 68 and the crank member 71 can be adjusted to vary the up anad down and fore and aft positions of the spring 68.

As shown in Fig. 1, the yarn is drawn upwardly from the supply package into the lower end of the sleeve 52, over a traversing pin 60*a* then beneath and behind the roller 63, then between the rollers 60 anad 63 and then upwardly through the trumpet 56. The yarn is in contact with the rubber roll through an arc of about 90° and with the lower roll through an arc of about 180°. With the elements in the position shown in Fig. 1, the roller 63 bears against the block 62, the yarn passing through the groove or cut away portion in the brake block so that it will not be squeezed between the roller and the brake block. The spring 68 urges the roller 63 against the brake block and also toward the roller 60 so that the yarn is nipped firmly between them.

As explained in greater detail in my copending application Serial No. 41,580, the action of the above-described tensioning device is such that when the tension of the incoming yarn and the outgoing yarn is at a normal value, the tensioning device exerts a predetermined tension thereon depending upon the position of the crank member 71 and the adjusted position of the set screw 75. If the input or the output tension increases momentarily, the tension on the yarn will tend to draw the roller 63 away from the brake block 62, thereby reducing the component of tension contributed to the output yarn by the tension unit roller assembly. The overall or output tension will thus not rise as rapidly as it otherwise would.

For best results, the rollers should have certain friction characteristics and in a practical example of the device, the upper roller 60 may be formed of or provided with a covering of rubber while the lower roller may be formed of nylon or other similar hard, smooth material. The above-described tensioning device applies and maintains a suitable tension on the yarn in order to maintain the yarn balloon produced by rotation of the flyer constant in size.

The form of tensioning device used in my twisting mechanism can be varied considerably, and, in fact, any of the tensioning devices disclosed in my copending application Serial No. 41,580, may be used, if desired, with generally similar results as explained in that application.

The simplified form of tensioning device shown in Figs. 5 and 6 is equally useful in maintaining the proper tension on the yarn or the like.

Referring to Figs. 5 and 6, the yarn tensioning device may consist of a box-like frame 80 having an externally threaded tubular collar 81 in its base for reception in the supply package cover 22 as explained above. The collar 81 may be provided with a cross member 82 of cylindrical form near its upper end for guiding and traversing the yarn smoothly through the collar 81 to the uppermost roller 83 of the tensioning device. The upper roller 83 and the lower roller 84 are provided with shafts 85 and 86 which are slidably and rotatably received in inclined grooves 87 and 88 in the side members 90 and 91 of the frame 80. The front 92 of the frame member 80 is open and may be inclined relative to the axis of the collar to permit easy insertion and removal of the rollers 83 and 84.

The inclined front 92 of the frame is provided with a cross bar 93 into which is threaded a screw 94. The screw 94 is used to adjust the pressure of a leaf spring 95 against the yarn passing around the roller 83 and also to urge the rollers down the grooves to press the lower roller 84 against the bottom of the frame. The lower end of the leaf spring 95 is secured to the base of the frame by a screw 96 or in any other way. In use, the yarn is threaded upwardly through the collar 81 over and in back of the roller 83, forwardly between the rollers 83 and 84, below the latter and then up over the cylindrical guide member 97 in the trumpet 98 which is mounted in the top of the frame 80. Inasmuch as the spring member 95 urges both of the rollers 83 and 84 down toward the base of the frame, the yarn is subjected to frictional restraint because of engagement of the lower roller 84 with the base of the frame. The base may have a groove 99 therein permitting the yarn to move around the roller 84 without abrasion. Moreover, the spring 95 bears against the yarn and exerts an additional drag or tension on the yarn. With this form of tensioning device, if the yarn tension increases, the action will be such as to lift both of the rollers 83 and 84 upwardly, thereby relieving the yarn of part or all of the tension exerted by frictional engagement of the roller 84 with the base of the frame. A slight increase in the tension produced by the spring 95 will result but the overall effect will be to relieve the yarn of tension permitting it to flow out more freely thereby to equalize the overall tension on the yarn.

A particular advantage of the last-described tensioning device is that bearings of the usual kind are not required and the guides and shafts do not have to be fitted closely. As a result, the usual difficulties with lint, dirt and lubrication are eliminated.

From the preceding description, it will be apparent that I have provided a device which, be-

cause of the simplified mechanical arrangement, results in a two-for-one system that can be constructed at low cost and in which there results ease in threading or "putting up an end." Moreover, the open structure of the tension unit provides accessibility for easy adjustment and repair and the arrangement of the component parts thereof provides a minimum of angular bends in the yarn path, thus lowering yarn abrasion and making it possible to handle the so-called "zero-turn" yarns at relatively high twist impartation rates and to give a high rate of production of "low turn" yarns.

It will be understood, of course, that these twisting devices may be used for handling many different types of materials, that they may be used alone or in gangs driven by one or more belts and that they are susceptible to other variations in size and shape as the purpose demands. Moreover, by suitable modification as indicated in application Serial No. 777,389, now Patent No. 2,549,821, the device may be adapted to support two or more supply packages so that a plurality of yarns and the like may be twisted together. Therefore, the form of the invention described herein should be considered as illustrative of the invention and not as limiting the scope of the following claims.

I claim:

1. A two-for-one twister comprising a rotatably mounted substantially vertical spindle, means for rotating said spindle, a support for a package of yarn and the like rotatably mounted on the upper end of said spindle, magnetic means restraining said support against rotation, a yarn tensioning device mounted on and above said support, a flyer fixed to said spindle below said support, said spindle having a passage therein below said flyer, said passage having an axial lower portion and an upwardly and outwardly inclined upper end portion, winding means below said spindle for drawing yarn upwardly from the package through the tensioning device and downwardly through the flyer and said passage, and a ring member concentric with said spindle and below the flyer to guide said yarn substantially axially into said inclined upper end portion of said passage.

2. A two-for-one twister comprising a rotatably mounted substantially vertical spindle, means for rotating said spindle, a support for a package of yarn and the like rotatably mounted on the upper end of said spindle, magnetic means restraining said support against rotation, a dome-shaped cover for said package detachably mounted on said support, a yarn tension regulating device fixed to and on the outside of said cover, and accessible for threading and adjusting from the outside of said cover, said tension regulating device having means therein responsive to variation of tension of the yarn entering said device for varying the resistance to movement of the yarn therethrough to maintain a substantially uniform tension on the yarn, said cover having a centrally located opening in alignment with said tension regulating device through which the yarn moves from the package directly to the tension regulating device, a flyer fixed to said spindle below said support, said spindle having an inclined and axial passage therein below said flyer, and winding means below said spindle for drawing yarn upwardly from the package through the cover opening, the tension regulating device and downwardly through the flyer and the inclined and axial passage.

3. A two-for-one twister comprising a rotatable spindle, a support for a package of yarn and the like carried by said spindle, a cover mounted on said support to enclose said package, magnetic means restraining said support against rotation, a yarn tensioning device fixed to the top of and on the outside of said cover to render it accessible for threading and adjusting from the outside of said cover, said cover having a centrally located opening therein in alignment with said yarn tensioning device through which the yarn moves from the package directly to the yarn tensioning device, a flyer fixed to said spindle below said support, said spindle having a passage therein below said flyer, yarn take-up means below said spindle for drawing yarn upwardly from the package through the tensioning device and downwardly through the flyer and the spindle passage, and means at the lower end of said spindle to rotate said spindle and flyer.

4. A two-for-one twister comprising a rotatably mounted substantially vertical spindle, a support for a package of yarn and the like rotatably mounted on the upper end of said spindle, means for restraining said support against rotation, a flyer mounted on and rotatable with said spindle below said support, a pulley on the lower end of said spindle, a belt having a flight adjacent to said pulley and normally engaging said pulley, means for driving said belt in one direction, a plate member pivoted adjacent to said flight for movement toward and away from the latter, means on said plate member engageable with said flight to disengage the latter from the pulley upon movement of said member toward said flight, a rotatable cam member for moving said plate member toward said flight, a flyer guard rail mounted for pivoting movement around a substantially horizontal axis from a first position in front of said flyer to a second position below said flyer, and means connecting said guard rail to said cam to rotate the latter and disengage said flight from said pulley upon movement of said guard rail from said first position to said second position.

5. A two-for-one twister comprising a rotatably mounted substantially vertical spindle, a support for a package of yarn and the like rotatably mounted on the upper end of said spindle, means for restraining said support against rotation, a flyer mounted on and rotatable with said spindle below said support, a pulley on the lower end of said spindle, a belt having a flight adjacent to and normally engaging said pulley, means for driving said belt in one direction, a plate member pivoted adjacent to said flight for movement toward and away from the latter, means on said plate member engageable with said flight to disengage the latter from the pulley upon movement of said member toward said one flight, a brake element on said plate member for stopping said spindle upon disengagement of said flight from said pulley, a rotatable cam member for moving said plate member toward said flight, an arcuate flyer guard rail member, pivot means at the ends of said guard rail member supporting it for pivoting movement between a first position in front of said flyer and a second position below said flyer, and means connecting said guard rail member to said cam member to disengage said flight from said pulley upon movement of said guard rail member from said first position to said second position.

6. In a twisting device, a rotatable spindle, a flyer fixed to said spindle, a yarn support mounted on said spindle, means for maintaining said

yarn support against rotation with said spindle, said spindle having a passage therein below said flyer and said support, said passage having an axial lower portion and an inclined portion opening through the side of said spindle, and a fixed ring member below said flyer having a circular inner edge for guiding yarn from said flyer substantially axially into the inclined portion of said passage.

7. In a twisting device, a rotatable spindle, a flyer fixed to said spindle, a yarn support mounted on said spindle, means for maintaining said yarn support against rotation with said spindle, said spindle having a passage therein below said flyer and said support, said passage having an axial lower portion and an inclined portion opening through the side of said spindle, a shoulder at the junction of said inclined and axial portions, a fixed ring member below said flyer having a circular inner edge for guiding yarn from said flyer into said passage, said inner edge lying substantially in the cone generated by the axis of said inclined portion to direct the yarn to said shoulder without substantial contact with the remainder of the walls of said passage.

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