July 3, 1934. E. J. ABBOTT 1,965,363

TENSION DEVICE

Filed Oct. 28, 1930 2 Sheets-Sheet 1

Fig. 1.

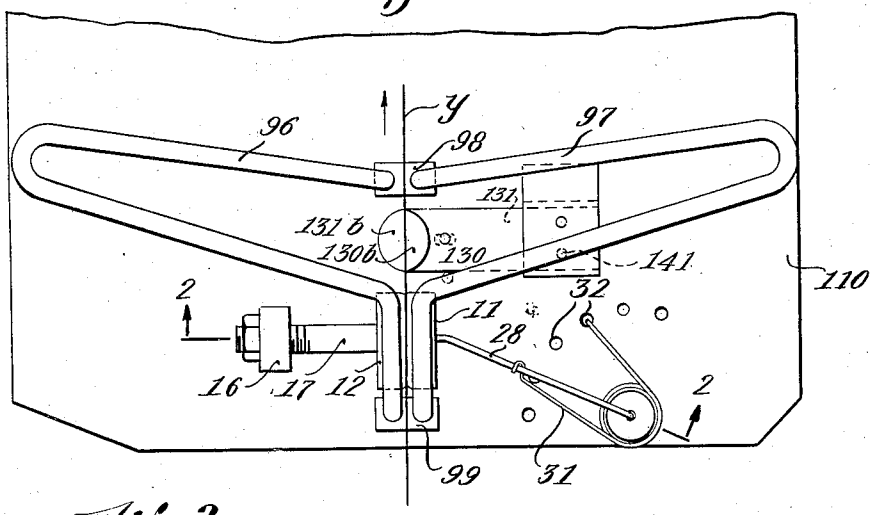


Fig. 2.

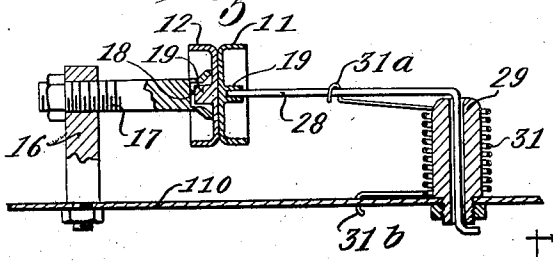


Fig 2a.

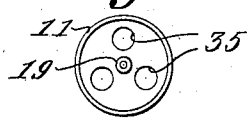


Fig. 3.

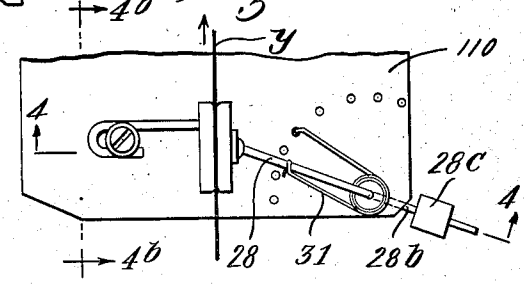


Fig 4a.

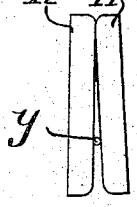
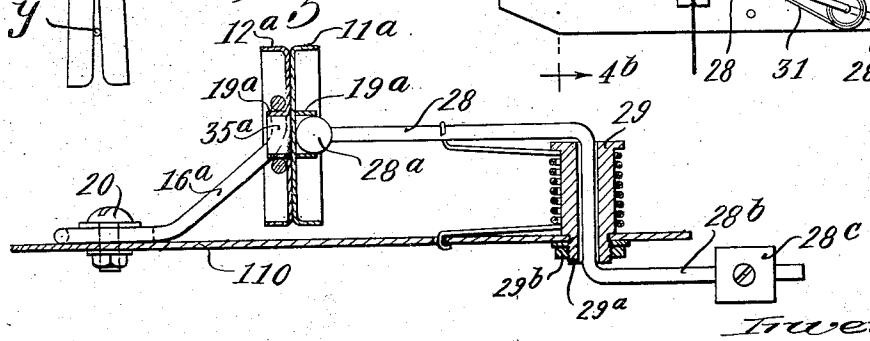


Fig. 4.



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TENSION DEVICE

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Fig. 6.

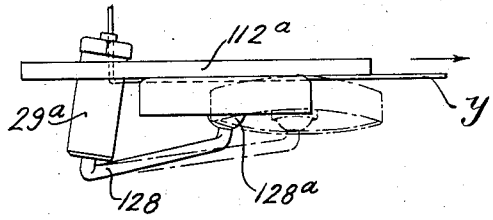


Fig. 5.

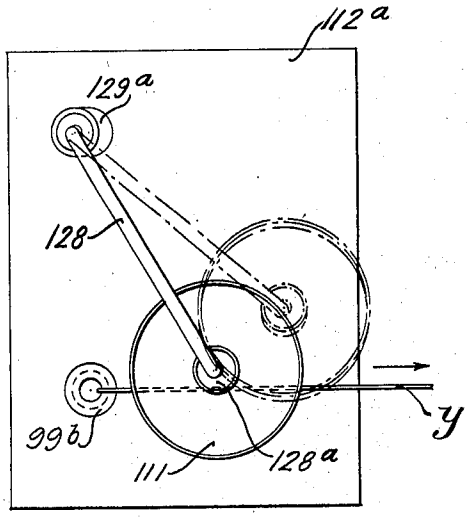


Fig. 7.

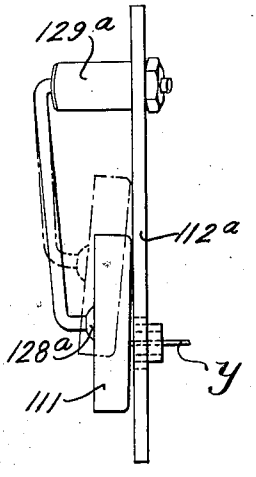


Fig. 4b.

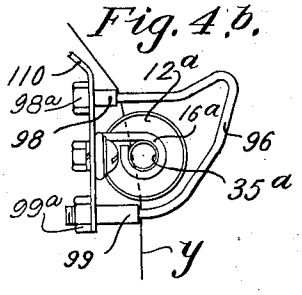
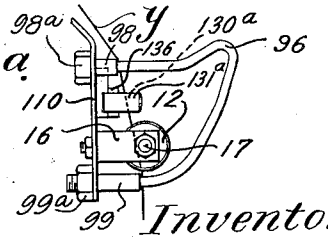


Fig. 1a.



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Patented July 3, 1934

1,965,363

UNITED STATES PATENT OFFICE

1,965,363

TENSION DEVICE

Edward J. Abbott, Wilton, N. H., assignor to Abbott Machine Company, Wilton, N. H., a corporation of New Hampshire

Application October 28, 1930, Serial No. 491,705

14 Claims. (Cl. 242—150)

This invention relates to strand tension devices, more particularly tension devices useful in textile apparatus, and has for its objects to provide for tensioning a strand, (for example of yarn) more delicately than heretofore, to provide a device adapted satisfactorily to tension yarn having numerous imperfections without causing breakage of the yarn as these imperfections are encountered; to provide a tension device having opposed tension elements so arranged as to relieve tension upon the yarn by movement of one of the tension elements in a path predominantly parallel to the path of yarn travel, and to provide a device which is easy to rethread and from which the strand of yarn may easily be removed, for example, in connection with such replenishment operations as tying in broken strands.

Other objects of the invention, advantages and structural improvements will be apparent from the explanation herein of typical species of my invention, shown in the accompanying drawings by way of example only.

In the drawings:

Fig. 1 is an elevation of a tension device, according to my invention, mounted on the cover plate of a movable carrier of a winding machine such as is described in my copending application, Serial No. 476,776, filed August 21, 1930;

Fig. 1[a] is a fragmentary left side elevation of the device of Fig. 1;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 2[a] is a right side elevation of the swinging disk of the tension device of Fig. 2;

Fig. 3 is a view similar to Fig. 1 showing a modification of the tension device of that figure, certain parts of the device of Fig. 1 being omitted for clarity of illustration;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 4[a] is a diagrammatic view corresponding to Fig. 4, and showing a yarn strand passing between the tension disks;

Fig. 4[b] is a fragmentary left side elevation of the device of Fig. 3;

Fig. 5 is a front elevation of another embodiment of my invention;

Fig. 6 is a plan view of the device of Fig. 5; and

Fig. 7 is a right side elevation of the device of Fig. 5.

The illustrated preferred embodiments of my invention make use of the principle of applying a compressive and retarding force to a moving strand in a direction rearwardly inclined toward the line of strand travel. Such application of the force is preferably attained by suitably mounting a tension element (through which the braking action is applied), to move toward and away from an opposed tension element along a line having components of motion parallel to and perpendicular to the opposed tension element and the line of strand travel. By virtue of the direction of application of the resultant compressive and retarding force, frictional drag of the moving strand on one of the tension elements is enabled partially to offset the maximum compressive force which the device is capable of applying to the strand. Thus as preferably constructed and arranged the tension devices of my invention apply less compression to the moving strand as the frictional drag of the yarn increases. In this way an approximately uniform tension may be obtained in spite of variations in the frictional characteristics (such as roughness) of the strand.

Referring to Fig. 1, a strand of yarn y is shown as passing in the direction of the arrow between opposed tension elements in the form of sheet metal disks 11 and 12 which apply the requisite friction thereto. As shown in Fig. 2, the disk 12 may conveniently be supported from the cover plate 110 of a winding machine by means of an outstanding block 16 affixed to the cover plate and an adjusting bolt 17 threaded into block 16 and having a recess 18 in its end adapted to receive a cylindrical central projection 19 on the rear side of the tension disk 12.

Means is provided for forcing the opposed tension disk 11 toward the tension disk 12 and concomitantly in a direction predominantly opposite to the direction of movement of the yarn y. In the form of the device shown in Figs. 1 to 4 this result is obtained by constraining tension disk 11 to movement in an arcuate path such that disk 11 has components of movement parallel to and perpendicular to disk 12, the component of motion parallel to disk 12 and to the line of yarn travel being the predominant component so that the plane of the path of the movable disk makes an acute dihedral angle with the plane of the other tension member. For this purpose an arm 28 is pivotally mounted in a bushing 29 fast on the cover plate, the free end of the arm 28 being inserted in a recess at the central projection 19 of tension disk 11. The relation of this arm 28 and its pivotal bearing 29 to the movable tension disk 11 is preferably such that, as shown, the direction of extent of the arm makes an acute angle with the plane of the strand-engaging surface of the stationary disk 12. A suitable coil spring 31 is preferably provided for yieldingly forcing

the arm 28 in a counterclockwise direction in Fig. 1, and this spring 31 may conveniently be coiled about the bearing 29 with one of its free ends 31^a hooked over the arm 28 and with its opposite free end engaged in one of a plurality of openings 32 in the cover plate. The arrangement of the parts just described is such that a relatively small force, tending to swing the disk 11, results in the application of a larger compressing force to a yarn strand extending between the opposed disks. The tension of the spring 31 may be adjusted to suit different yarns and yarn speeds by changing the position of the end 31^b of the spring with respect to the series of holes 32.

As the yarn *y* passes between the opposed tension disks, the position of the movable disk 11 is determined by the opposing actions of the frictional drag of the yarn upon the disk and the tendency of the spring 31 to force the disks together. Thus the disk 11 is capable of moving in a generally arcuate path against the action of the spring when the frictional drag of the strand on the disk increases. Viewed in a slightly different aspect, frictional drag of the yarn on disk 11 tends to neutralize the force exerted by the arm 28 and spring 31 on disk 11 and hence lessen the compressive force applied by the disk to the moving yarn strand. Thus to a certain degree the frictional characteristics of the yarn (such as its roughness) regulate automatically the amount of compressive force exerted thereon, increases in roughness of a portion of the strand causing the compressive action of the disk to diminish. With a spring 31 of suitable tension, an approximately constant tension may be obtained in the strand even though various portions of the strand vary considerably in their frictional characteristics. Likewise the condition of the face of disk 11 as regards coefficient of friction is automatically compensated for by the capability of the device to increase transverse compressive force on the strand in accordance with diminution of frictional drag on disk 11.

The direction of movement of the disk 11, namely, predominantly parallel to the line of yarn travel, enables the tension disks to accommodate permissible imperfections in the yarn without breakage, a small imperfection in the yarn, upon being frictionally engaged between the disks 11 and 12, drags disk 11 a sufficient distance slightly to rotate arm 28 and thus to allow disk 11 to separate slightly from disk 12 and permit the imperfection to pass between the disks without such excessive friction as would break the yarn. Preferably, as shown in Figs. 1 and 2 the disks 11 and 12 are provided with peripheral flanges which are rounded into the friction surfaces of the disks to provide a throat through which yarn imperfections are guided between the disks, thus avoiding the breakage of the strand by short hard imperfections therein striking sharply against edge surfaces of the disks. The moving parts of the device are preferably of light weight so as to have but little inertia. The bolt 17 may conveniently serve to adjust the disk 12 with respect to the path of disk 11, to accommodate various yarns or yarn speeds.

In the modified form of device of Figs. 3 and 4, the opposed tension disks 11^a and 12^a are preferably substantially identical, each being provided near its center with an annular flange 19^a. The annular flange 19^a of the stationary disk 12 is preferably engaged by a supporting wire 16^a of which one end is looped around this annular flange and of which the other end is adjustably engaged by a clamping screw 20 on the cover plate 110.

The annular flange 19^a of the swinging disk 11^a is suitable to be engaged by a ball 28^a which is preferably provided on the free end of the pivotally mounted arm 28. This arrangement permits disk 11^a universally to tilt with respect to disk 12^a. Fig. 4^a illustrates the manner in which the swinging disk 11^a may tilt to accommodate a strand of yarn *y* passing between the disks at one side of their centers. The swinging disk 11^a is in addition capable of tilting with respect to the arm 28 to maintain approximate parallelism with the disk 12^a for various sizes of yarn, or during the passage of yarn imperfections.

Tension devices such as described are intended to be capable of use on machines which are subject to considerable vibration set up by the rotating parts which serve to drive the yarn. In order to prevent this vibration from interfering with the evenness of tension applied to the yarn, (for instance by setting up vibration of the arm 28 and disk 11^a about the pivot point of the arm), this arm 28 is preferably extended to the opposite side of its pivot point, as indicated at 28^b and either alone, or with the addition of a suitable adjustable weight 28^c, constitutes a mass which balances the tension disk 11^a and the arm 28 about the pivot point of this arm. This has the effect of suppressing vibrations which would ordinarily be imparted to the arm and disk by winding machinery in which the tension device is used.

Preferably one of the tension disks of each of the above described devices is provided with an opening to permit the exit of lint, fly or the like, from between the disks. In the device of Figs. 1, 2 and 2^a, three such openings 35 (Fig. 2^a) are shown as provided in the swinging disk 11, while in the device of Figs. 3, 4, 4^a, and 4^b, the relatively stationary disk 12^a is shown as provided with a single opening 35^a included within the annular flange 19^a. It will be understood that the above-described swinging disks 11 and 11^a are adapted to be rotated by passage of the yarn *y* and are preferably caused thus to rotate by passing the yarn between the disks at a distance from the centers of the disks. This rotation of the disks has the effect of causing lint, fly and the like, to leave the device by passing through one of the openings 35 or 35^a, or by working radially outward to the periphery of the disks.

For guiding the yarn strand *y* with respect to the tension disks, the devices are shown (Figs. 1, 1^a and 4^b) as provided with a pair of oppositely disposed wires 96 and 97 having their ends set into blocks 98 and 99 affixed to the cover plate 110 by nuts 98^a and 99^a and defining projecting angles in the line of yarn travel. In Fig. 3, these wires are omitted for clarity of illustration. The intermediate portions of the wires are shown as bent outwardly in the form of wings, each comprising a double width of wire and collectively defining a V-shaped guide or troughlike channel for centering yarn engaged thereby. The lower ends of the two guide wires 96 and 97 lie close together (Fig. 1) and parallel at a point directly in front of the opposed tension disks, and from this point extend to the block 99 and together define a generally vertical entrance for properly centered yarn passing between the tension disks. The upper end portions of the two wires 96 and 97 likewise converge somewhat above the tension device and extend horizontally to the block 98, thus defining between them a passage for the yarn leaving the tension device at block 98.

The above described arrangement of the guide wires is such that yarn laid indiscriminately across either of the wing portions of the wires will be caused by the pull of a yarn-using device (for example a rotating yarn package onto which the yarn is winding) to be diverted to the central channel defined by the end portions of the wires, and then between the opposed vertical tension disks. My copending application, Serial No. 476,776 entitled Machine and method for preparing yarn packages, filed August 21, 1930, discloses the above described tension device and strand guides associated with a rapidly traversing eye positioned for laying the yarn on a rotating package in quick-pitch spirals, in which use the traverse eye may contribute to or may furnish the pull exerted on the yarn while the latter is being guided into the central channel of the guide wires.

The guide wires 96 and 97 just described are advantageously used to convey the yarn strand *y* between opposed slub-catching, detecting or breaking elements. The device of Fig. 1 is shown as provided with a slub catcher constructed, for example, according to the invention of my copending application, Serial No. 484,993, filed September 29, 1930, entitled Slub detector, catcher or breaker now Patent No. 1,905,259, dated April 25, 1933 (and disclosed also in my copending application Serial No. 476,776, filed August 21, 1930, for Machine and method for preparing yarn packages). Referring to Figs. 1 and 1[a], the slub catcher preferably comprises front and rear blades 130 and 131 respectively having transversely bent portions 130[a] and 131[a], which define between them a yarn-receiving throat which is long in the direction of travel of the yarn and through which the yarn is shown as passing in Fig. 1. To facilitate insertion of the yarn strand *y* in the throat of the slub catcher after the guide wires 96 and 97 have brought the yarn strand approximately to the central plane, the end portions of the opposed blades are preferably flared outwardly, as indicated at 130[b] and 131[b].

The relation of the two blocks 98 and 99 to the centers of the tension disks is preferably, as shown, such that yarn *y* passing over these blocks, as shown in Figs. 1[a] and 4[b], is guided between the disks along a line to one side of the centers of the disks so that the yarn strand has less than the maximum length of contact with the disks. Obviously, yarn passing between the disks along such path encounters somewhat less resistance than in passing diametrically across each disk. The rotatable mounting of one or both of the tension disks, as in preferred form of my invention, also contributes to this result. In traversing a path removed from the center of rotation of the rotatable disk (for instance disk 11[a]), the yarn strand is able to rotate the disk thus to reduce the friction encountered by the strand. On the other hand, a strand of yarn passing diametrically across the center of the rotatable disk is ineffective to rotate the disk and is subjected to greater friction. Accordingly the tension disks by applying greater friction to the strand in the event that the strand approaches the center of the disks resist any tendency of the yarn to pass the center of the disks and whip out of the device. However, the yarn strand may when desired be inserted between or removed from the disks from the opposite side of the disks. The feature of the tension elements securely holding the yarn strand in place is of particular utility in enabling the device effectively to tension yarn being rapidly unwound over the end of a bobbin, in which case a large and rapidly moving balloon is formed tending to whip the yarn strand out of the device.

The path of the swinging disk 11[a] with respect to the relatively stationary disk 12[a] is preferably rendered adjustable by forming the lower end 29[a] (Fig. 4) of bushing 29 eccentric with relation to the hole in the bushing in which arm 28 is pivotally mounted. Thus by loosening nut 29[b] which secures bushing 29 to the cover plate 110, and turning the bushing, the path of disk 11[a] may be caused to approach or recede from disk 12[a].

The modified form of tension device of Figs. 5, 6 and 7, employs a swinging arm 128, and a movable disk 111 corresponding in general function to the arm 28 and disk 11 of the device of Figs. 1 and 2. In this modified form of device, gravity is utilized (in place of the spring previously described) to provide a restoring force effective to swing the movable disk into frictional engagement with the moving yarn *y*. Referring to Fig. 5, the bearing 129[a] within which the arm 128 is pivotally mounted is affixed to a plate 112[a] comprising one of the tension elements, at a point somewhat above the line of yarn travel and at an inclination to the plate 112[a] such that downward swinging of the arm 128 and disk 111 causes the disk 111 to approach the plate 112[a]. As in the above-described embodiments of the invention the movement of the tension disk 111 is in a path having components parallel to and also perpendicular to the line of yarn travel, the component of movement parallel to the line of yarn travel being predominant.

Referring to Fig. 5 the yarn *y* is shown as passing through a guide eye 99[b] and thence across the tension plate 112[a] in the direction of the arrow. While the full line positions of the arm 128 and the disk 111 show these parts in their normal relation to the yarn, frictional drag of the yarn *y* upon the disk 111 caused by movement of the yarn, and to a greater extent by the occurrence of enlargements in the yarn, tends to swing the disk 111 from its full line position in Fig. 5 toward the dotted line position in Fig. 5 against the action of gravity. The extent to which disk 111 and arm 128 move depends upon the speed of the yarn, the yarn diameter and the size of enlargements in the yarn. As the disk 111 is thus raised, the path of movement of the ball 128[a] on the end of the arm 128 is such as to permit the disk 111 to be moved away from the tension plate 112[a] as shown in Figs. 6 and 7. Where the tension plate 112[a] is mounted in a vertical position as shown, the disk 111, upon being raised by the arm, will rest against the plate 112[a] at the upper part of the disk as shown in Fig. 7, thus permitting yarn imperfections to pass through the tension device. However, the force of gravity constantly tends to swing the arm 128 and disk 111 in a clockwise direction as viewed in Fig. 5, so that tension is continuously applied to the moving yarn. Preferably, as shown in Fig. 5, the arm 128 and disk 111 are so arranged with respect to the tension plate 112[a] that in the normal running position, the yarn *y* passes between the disk 111 and the plate 112[a] at a point somewhat removed from the center of the tension disk. With this arrangement the disk may rotate about the ball 128[a] under the influence of the moving arm, this movement constantly presenting fresh portions of the tension disk to the yarn.

All of the tension devices disclosed herein present the advantage of offering much more resistance to movement of the yarn in a reverse direction than to such movement in the forward intended direction. Thus the movable tension element of the present device tends to approach the opposed tension element and clamp the yarn strand positively against backward movement upon stoppage of winding, thus to prevent sagging of the strand in rear of the device. On the other hand the ease with which the movable tension element is caused to diverge from the opposed element upon forward motion of the strand, permits a light and delicate tension to be applied to the forwardly moving yarn strand.

While I have hereinabove made reference to a "yarn" as the strand which is tensioned by engagement with the devices herein disclosed, I wish it to be understood that this term has been used merely for convenience and without any intention of restricting the use of the improved tension devices to spun yarns, or in fact to any specific strand or material.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Strand tension device adapted to tension moving yarn comprising a pair of tension elements affording opposed friction surfaces, one at least of said tension elements being bodily movable with reference to the other, and means, including an arm operatively connected with said movable tension element and pivotally mounted above said latter tension element about an axis inclined with respect to the friction surface of the other tension element, for yieldingly urging said movable tension element toward the other tension element against the frictional drag of the strand.

2. A tension disk having an annular flange on its rear side near its middle located about a hole through the disk, in combination with means engaging the exterior of said annular flange for mounting said disk.

3. Tension device comprising a member defining a strand-engaging friction surface, a movable tension disk cooperating therewith to tension a strand, and a movably mounted arm for preventing said disk from moving directly away from the said member in a direction perpendicular thereto, while permitting separation of the disk from said member by movement in an arcuate path having its major component of motion parallel to the path of the strand over the other member, under frictional drag of the strand.

4. Strand tension means having a normally fixed tension element, a relatively movable tension element, and means for supporting the movable tension element comprising an arm pivoted to swing about a fixed axis, the arm normally extending from its axis in a direction making an acute angle with the strand-engaging surface of the fixed tension element, and means providing a universal joint connection between said movable tension element and the end of its supporting arm.

5. Tension device comprising a member affording an approximately plane surface for engaging a strand, a tension disk adapted to cooperate with said strand-engaging surface, a member for supporting the disk, a pivotal mounting means for pivotally mounting said supporting member about an axis located to permit said disk to swing through a path convergent with said surface, and means for adjusting said axis to alter the path of said disk.

6. Tension device comprising opposed relatively movable tension elements, means for yieldingly forcing said elements together to engage strand moving therebetween, one of said elements being mounted for rotation under the influence of the moving strand, and strand guiding means for defining a path of strand travel at one side of the center of rotation of the rotatable tension element, and for preventing the strand from moving out from between the tension elements at said side of the center of rotation, the device being arranged to permit the lateral insertion of a strand between said tension elements from the opposite side of said center of rotation.

7. Tension device comprising opposed relatively movable tension elements, means for yieldingly forcing said elements together to engage a strand moving therebetween, means for mounting one of said tension elements for universal tilting with respect to the other element, and strand guiding means for defining a path of strand travel at one side of the center of tilting of said tilting member and for preventing the strand from moving out from between the tension elements at said side of the center of tilting, the parts of the device being arranged to permit the lateral insertion of a strand between said tension elements from the opposite side of said center of tilting.

8. Strand tension device comprising a pair of relatively movable elements affording opposed friction surfaces across which the strand is adapted to travel, one of said elements having an opening for the exit from between the friction surface of lint, fly and the like, and means for constraining one of the elements to move in a path converging with the friction surface of the other element and for yieldingly urging it along said path in a direction generally opposite to the direction of movement of the strand over the other element.

9. Strand tension device comprising a pair of relatively movable elements affording opposed friction surfaces across which the strand is adapted to travel, one of said elements having an opening for the exit from between the friction surfaces of lint, fly and the like, means for mounting one of the said elements for rotary movement under the influence of the moving strand, and means for constraining one of the elements to move in a path converging with the friction surface of the other element, and for yieldingly urging it along said path in a direction generally opposite to the direction of movement of the strand.

10. Strand tension device comprising a pair of relatively movable elements affording opposed friction surfaces across which the strand is adapted to travel, means for mounting one of the said elements for rotary movement under the influence of the moving strand, said rotatably mounted member having a plurality of openings for the exit from between the friction surfaces of lint, fly and the like, and means for constraining said rotatably mounted member to move in a path converging with the friction surface of the other element and for yieldingly urging it along said path in a direction generally opposite to the direction of movement of the strand.

11. Tension device comprising tension elements affording opposed strand-engaging surfaces between which a strand is adapted to move in con-

fact therewith, a rotatable connection for at least one of said elements permitting rotation of its strand-engaging surface in the plane of the strand travel, and means for causing one of said elements to approach the others on a line which makes an acute angle with the plane of travel of the strand over said other surface.

12. Strand tension device comprising a pair of tension elements affording opposed friction surfaces between which the strand travels, and means for yieldingly causing one of said elements to swing in a path having a major component parallel to and in the opposite direction from the movement of the strand over the other element and having a smaller component approaching the strand at right angles thereto.

13. Strand tension device comprising a pair of tension elements affording opposed friction surfaces between which the strand travels, a stationary mounting for one of the elements, means including a rotatable arm connected to the second element for causing said second element to swing toward the first element, the arm being mounted to provide an arc of travel having a major component parallel to and in the opposite direction from the movement of the strand over the first element and a smaller component approaching the strand at right angles thereto.

14. Strand tension device comprising a pair of tension elements affording opposed friction surfaces between which the strand is adapted to travel and means for yieldingly causing one of said elements to swing in a path having a major component parallel to and in the opposite direction from the movement of the strand over the other element and having a smaller component approaching the strand at right angles thereto, said means including a rotatable arm carrying said swinging element, the rotatable arm being pivoted above said other element.

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