Oct. 16, 1951 P. J. BURNS 2,571,678

YARN TENSIONING DEVICE

Filed Aug. 23, 1947

FIG. 1.

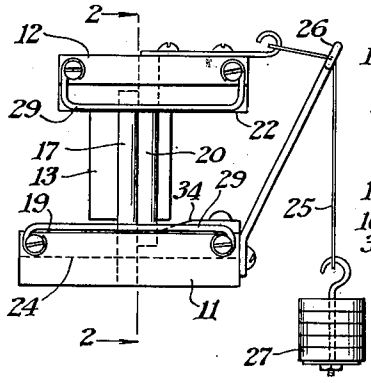


FIG. 2.

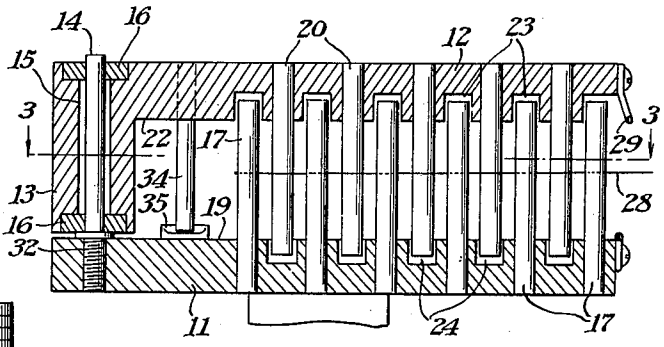


FIG. 3.

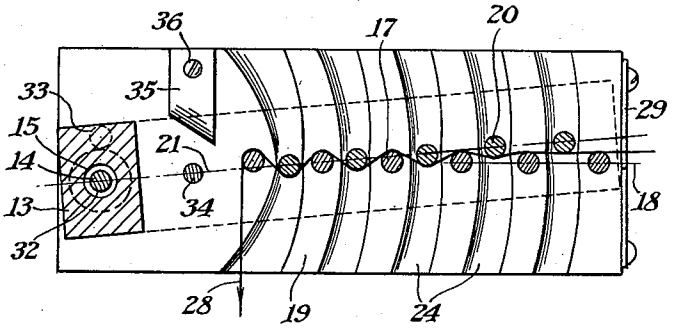


FIG. 4.

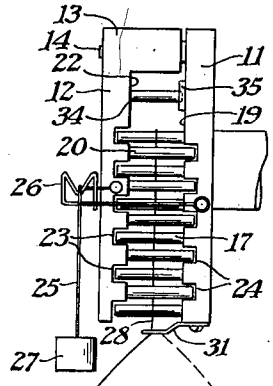
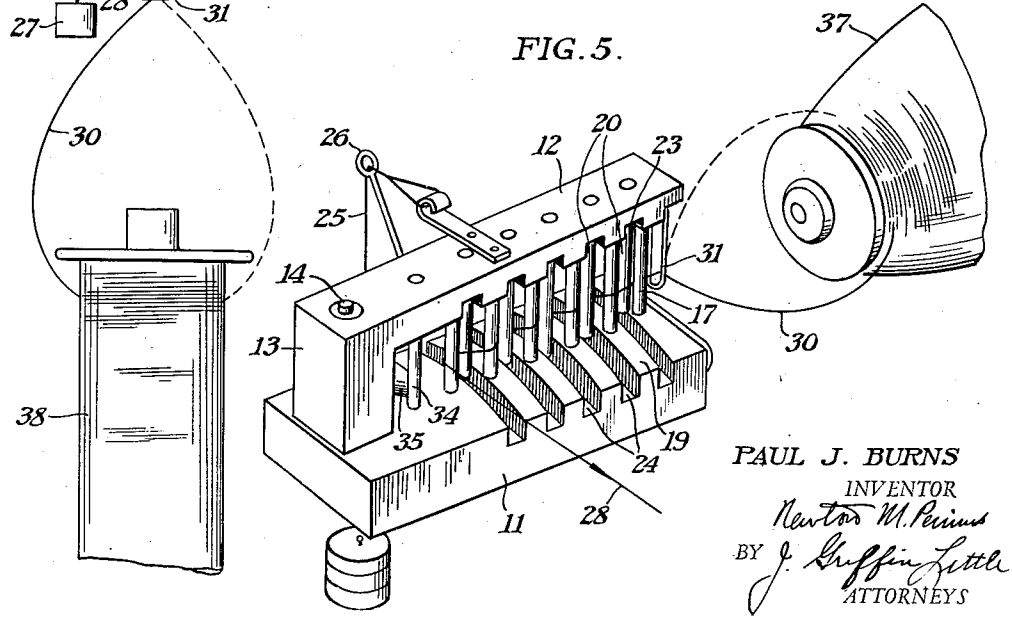


FIG. 5.



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YARN TENSIONING DEVICE

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10 Claims. (Cl. 242—154)

1

The present invention relates to a yarn-tensioning device, and more particularly to an improved finger tension device for applying tension to a yarn during the warping or winding operation.

Tension devices normally used are of the finger or disc type. The finger device has intermeshing fingers, and the degree of intermeshing determines the amount of tension applied to the yarn. These finger devices, however, employ curved fingers which constrain the yarn to a very narrow path through the fingers. This constraint of the yarn to a straight path causes excessive wear, and, therefore, makes the tension gauge useless after the groove is worn into the fingers. The wear is magnified when continuous filament yarn having little or no twist is used since a relatively flat band of filaments is acted upon by the curved fingers.

In the tension devices of the disc type, one or more sets of discs are used. Tension is applied by running the yarn between the discs. The amount of tension is, therefore, determined by the number of discs the yarn is run through and the weight of these discs. When continuous filament yarn having little or no twist is run through a disc tension, it is very difficult to prevent the formation of filament "loops" or broken filaments. The pressure applied on the yarn by the disc flattens the band of filaments out so that practically every individual filament is acted upon by the disc. If the disc rotates or if the yarn is bent at a different angle while being run through the discs, individual filaments are acted upon differently so that filament loops result. As an example: Yarn having little or no twist is run through a disc tension around the post holding the disc at 90° to some take-up device. The weight of the disc on the yarn causes a flattening of the filament band. The disc revolves as a result of the yarn take-up, and one or more of the individual filaments are caught and rolled over the remainder of the filaments. The filament or filaments would, therefore, break or form a loop depending upon the degree of action of the disc.

A finger tension has proved to be far more satisfactory for continuous filament yarn having little or no twist. With this type of tension device, a uniform tension is applied to the band of fibers. However, with the ordinary finger tension the fingers are curved to form a path for the yarn to run in and the fingers are usually allowed to intermesh by having one set of fingers fixed and the other set movable. The movable

2

set of fingers is hinged at or opposite one end of the fingers in a plane perpendicular to the axis of the fixed fingers. This arrangement allows the movable fingers to move into the spaces between the fixed fingers to apply tension to the yarn when it is run between the fixed and movable fingers.

In order to overcome these difficulties, the present invention provides a tension device of the finger type which employs straight fingers which progressively mesh with varying degrees so as to apply tension to the yarn gradually and increasingly. Also the tension device is made in such a manner as to permit the yarn to oscillate freely through the fingers.

The present invention has, therefore, as its principal object, the provision of a yarn tension device which employs straight yarn-engaging fingers which imparts the desired tension to the yarn.

Another object of the invention is the provision of a finger tension device in which the fingers are arranged to apply the tension gradually and increasingly.

Still another object of the invention is the provision of a tensioning device of the class described in which the yarn is not constrained to a single path but allowed to oscillate freely between the fingers substantially the full length thereof to prevent excess wear of the fingers.

Yet another object of the invention is the provision of such a device in which the tension is gradually applied to the yarn so that the entire bundle of yarn filaments will be more evenly acted upon, and so that there will be less possibility of chatter as each finger puts on a different amount of tension.

Also an object of the invention is the provision in such a device of a curved stop which is used to prevent the fingers from opening completely to allow overshoots, but which will allow the fingers to be opened with minimum effort for threading.

To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is an end view of a yarn tensioning device constructed in accordance with the present invention;

Fig. 2 is a longitudinal sectional view through the device illustrated in Fig. 1, showing the relation of the parts;

Fig. 3 is a horizontal sectional view through the device illustrated in Fig. 2, taken substantially on line 3—3 thereof, showing the varying intermeshing relation of the fingers, and the offset pivotal connection;

Fig. 4 is a front elevation view of a portion of a winding machine showing the relation of the finger tension device arranged in connection with vertical operation; and

Fig. 5 is a perspective view of the tension device and the yarn spool, showing the arrangement of the parts and the guide for the yarn when the parts are arranged for horizontal operation.

Similar reference numerals throughout the various views indicate the same parts.

The device of the present invention comprises a fixed member 11, and a movable member 12 positioned above and in parallel relation to the member 11, as clearly illustrated in Figs. 1, 2 and 5. One end of the member 12 is provided with a down-turn portion 13 adapted to receive a steel pin 14 threaded into the member 11 to provide a pivoted connection between and at one end of the members. Thus, the member 12 is pivoted at one end to the member 11 so that it may be moved parallel thereto. The pin 14 extends through an enlarged hole 15 in member 12 and through a pair of spaced bushings 16 which form a frictionless bearing surface, all as clearly illustrated in Fig. 2. The fixed member 11 is provided with a plurality of spaced, straight, cylindrical fingers 17 which are arranged in aligned and parallel relation along the center line 18, and extend upwardly from the surface 19 of the member 11, as best shown in Figs. 2 and 5. Similarly the movable member 12 is provided with a plurality of spaced, straight, cylindrical fingers 20 arranged in aligned and parallel relation along the center line 21 of the member 12, and depending from the surface 22 thereof. The fingers 17 and 20 are offset longitudinally relative to each other, as shown in Figs. 2, 3 and 5, so that the fingers may be moved into intermeshing relation, in a manner and for a purpose to be later described.

The surfaces 19 and 22 are formed with grooves 24 and 23, respectively, into which the ends of the fingers 20 and 17 project, as shown in Fig. 2. These grooves are arcuate in shape, with the holes 32 and 33 as centers, and are made with just sufficient clearance to allow the fingers to move without rubbing the sides or bottoms of the grooves. These grooves are particularly useful when the yarn is allowed to become slack when the take-up is stopped. The yarn then lies along the surface 19 so that when the yarn is taken up, it is engaged by the fingers and is not allowed to slip over the ends thereof, the disadvantage of which will be readily apparent to those in the art.

In order that tension may be applied to the yarn, the fingers 20 are moved between and into intermeshing relation with the fingers 17 to cause the yarn to follow a tortuous path, as shown in Fig. 3. To secure this result, a string 25 is attached to the movable member 12 by means of a hook or other suitable fastening means. The string passes over a support 26 which is fastened in any location other than to the top member, for example, to the fixed member 11, as best shown in Fig. 1. The support has a V-notched or string engaging edge which should be in approximately the same plane as the member 12, as shown in Figs. 1 and 5, so as

to exert a level pull. This support can be mounted on either side of the device. A weight 27 is attached to the end of the string 25 to provide the necessary pull to move the member 12 about the pivot pin 14 to position the fingers 20 in intermeshing relation with the fingers 17 to engage the yarn to cause the latter to follow a tortuous path between the fingers so as to impart the desired tension to the yarn.

Wire guides 29 are fastened to the adjacent ends of the members 11 and 12 to prevent the yarn balloon 30 from rubbing or becoming caught on either of the members 11 and 12 where the yarn enters the device. These guides are just one method of constraining the yarn balloon. Other equally satisfactory methods may be used. For example, the end of the upper member 12 may carry an elongated shaped guide 31. The important thing is that the guide or guides should be large enough to allow the balloon sufficient freedom to move along the fingers, but small enough to prevent the yarn from striking either member 11 or 12.

The movable member 12 is offset at an angle to the fixed member 11 so that the fingers 17 and 20 do not intermesh evenly, as best shown in Fig. 3. This result is accomplished by pivoting the member 12 to one side of the center line 18 of the fixed member 11. For this purpose, two holes 32 and 33 are bored and tapped off the center line 18 to accommodate the pivot pin 14. With this arrangement, the device can be used as either right-hand or left-hand tensioning device on a creel, for example, with only minor changes. This arrangement also allows the yarn to be introduced to the device from the end, as described above, or from the opposite end by adding guides to constrain the balloon.

As an added preventive for overshoots, an extra pin 34 is mounted on the movable member 11. No groove is provided for this pin in the fixed member 12. Instead, a stop 35 is mounted on the member 11 in the path of the pin 34. This stop is in the form of a curved member or cam so that upon engagement of the stop by pin 34, the member 12 is cammed over the stop when the tension gate is forced open for threading. During normal operation, however, there is not sufficient force applied to the member 12 to allow the pin 34 to be cammed up and over the cam 35 to allow overshoots. The stop is pivoted on screw 36 so that the stop may be adjusted to any desired position to maintain the desired minimum tension to prevent overshoots. If this stop is set so that a tension equal to approximately ⅓ the total desired tension is applied when the weight 27 is removed, no flexibility will be lost, but overshoots will be prevented.

Fig. 5 shows a tension gate used with yarn paths in a horizontal plane and the yarn being unwound from a horizontally-arranged spool or bobbin 37. However, the device is equally well adapted for use in a vertical position for use in connection with a vertical yarn path in which the yarn is being unwound from a vertically-positioned spool 38. To adjust the device for either vertical or horizontal operation, it is only necessary to change the support 26 so that the string and weight will move the movable member 12 to bring the fingers 20 thereof into intermeshing relation with the fingers 17 of member 11.

The operation of the above-described tensioning device is as follows: The device is mounted so that the yarn path and the axis of its supply

package are in the same general plane. This allows a maximum oscillation of the yarn between the fingers 17 and 20. The yarn balloons off the supply package such as a bobbin, spool, tube, or cone, as shown at 37 and 38. The yarn balloon 30 is not allowed to hit the rough surfaces by guides 29 or 31. The yarn moves alternately up and down between the fingers 17 and 20 as the result of the balloon over the supply package. The fingers 17 and 20 are straight to allow maximum oscillation, and are preferably made of suitable ceramic material which has little friction but a longer life than steel or other metallic fingers. The fingers are intermeshed the desired amount by the force of the weight and string arrangement attached to the movable upper member 12. The member 12 is pivoted at pin 14 through the hole 32. This allows the degree of intermeshing or angle of contact to be increased gradually to the last finger where the maximum is reached, as shown in Figs. 3 and 5.

Other factors being equal, the tension is proportional to this degree of intermeshing or angle of contact. If the yarn is to be run in the opposite direction after leaving the last finger, the movable member 12 is pivoted at hole 33 to achieve the same result. This gradual increase in tension serves a two-fold purpose. Yarn having little or no twist is difficult to process in that the filaments separate and are consequently acted upon individually rather than as a complete yarn. This gradual tension increase tends to apply very little tension originally when the filaments are loose, but tends to hold the filaments together until the next increase in tension has been accomplished. This process is repeated until the maximum tension has been applied.

This gradual increase in tension also lessens the possibility of chatter. This chatter is an oscillation of the movable fingers caused by sudden changes in tension. A sudden application of tension, such as a trapped end in a bobbin, causes the yarn to be stretched slightly and the fingers to spring open. The withdrawal loosens the trapped end or other cause, wherein the yarn acts as a rubber band and shoots a slight amount of yarn out of the take-up. When the fingers suddenly close, the yarn is stretched slightly again and the process repeated. In order to combat this condition, a dashpot is usually used. The friction caused by the dashpot makes it difficult for the fingers to open and close; therefore, this oscillation is damped. Another method of combating this is by maintaining a slight amount of tension on the yarn at all times. This prevents overshoots by holding the yarn so that it is not shot on to the take-up package after the yarn is stretched. The gradual increase in tension illustrated in Figs. 3 and 5 combats chatter in the following manner; a sudden change in tension causes the fingers to open. In order to compensate for the sudden change, all fingers do not open the same amount since none of the fingers apply the same amount of tension. Therefore, the last finger may not open completely so that it is not out of contact with the yarn as will be apparent from an inspection of Fig. 3. The tension is then released and the fingers close again. Instead of all the fingers hitting the yarn at the same time, as is the conventional method, the fingers hit the strand of yarn consecutively, beginning with the finger nearest the pivot. Therefore, it is much easier for the fingers to gradually move the yarn to its proper path, than with the conventional tension device wherein all the fingers act on the yarn at the same time to force it into the normal zig-zag path. This gradual movement of the yarn path therefore lessens the possibility of chatter.

In order to obtain oscillation of the yarn between the fingers, it is necessary that the fingers be straight and parallel to each other under all conditions of tension. With the tension devices commonly used, the movable fingers being pivoted opposite the ends of the fixed fingers make it impossible to keep the fingers parallel at all times to allow oscillation of the yarn.

The present invention is particularly adapted for beaming or warping processes. However, it is equally applicable to any winding process where the yarn is withdrawn over the end of the supply package. Since the oscillation of the yarn between the fingers is dependent upon the balloon created by withdrawing the yarn over the ends of the supply package, no oscillation will be obtained if the yarn is constrained before entering the first fingers. In order to obtain a longer life and better oscillation, straight ceramic fingers are preferably used. These fingers wear longer and expose surfaces with the same friction characteristics when worn. Whereas, steel becomes polished and causes more friction. However, this should not be construed to mean that ceramic fingers are necessary to the successful operation of the device. Steel, as well as other metals, or compounds, will work satisfactorily. However, materials with low friction characteristics, such as ceramics, allow maximum oscillation.

The tension device of the present invention may be used to apply as little as two grams tension or more than fifty grams tension. However, the most satisfactory results are those obtained with about five grams. The length of the fingers may vary over several inches but with a preferred length of about one inch. The diameter of the fingers also may be varied over rather wide limits; however, a diameter of about ⅛ inch is preferred. The fingers are set as close together as practicable to allow free movement without touching. Using ⅛ inch diameter fingers; the preferable distance between fixed fingers is ⅜ inch. This distance may be increased. However, a distance as great as ¾ inch makes it difficult to control the amount of tension on the yarn. This distance allows so much yarn between the fingers that the fingers close entirely.

As many as twenty fingers may be used; however, a total of between seven and eleven seems to give most satisfactory tension control and oscillation. For most uniform results there is one more fixed finger than movable.

The degree of offset of the movable fingers will vary with the number of fingers used. Generally this offset should be such that when the last movable finger is along the center line of the two adjacent fixed fingers, the finger acting on the yarn initially just touches the yarn.

While, in the disclosed arrangement, a string and weight are used to apply force to the movable fingers, thereby applying tension, this invention is not restricted to this method for applying tension and dampening chatter. A dashpot could be used with equally effective results. The string and weight will accomplish the same results in theory as does the dashpot and is much simpler.

In order to dampen oscillation of the movable fingers, the friction of the string on the support working with the offset fingers is sufficient to prevent chatter to a considerable extent.

The most important use of this invention is in the beaming or warping operation. In this operation, the device is mounted with the fingers vertical and the axis of the supply package in line with the fingers. This finger tension can also be used, however, in any winding operation where tension must be applied to the yarn.

The chief advantage of this tension device over previous finger tensions is that the yarn is allowed to oscillate between the fingers. This oscillation prevents excessive wear and grooving of the fingers, especially when using continuous filament yarn having little or no twist. The yarn is allowed to oscillate between the fingers by the use of straight fingers and the manner of mounting these fingers. In the usual finger tension device, the movable fingers are curved and pivoted opposite one end of the fixed fingers. With this arrangement the curved fingers constrict the yarn to a very narrow path. Even if straight fingers were used mounted opposite the ends of the fixed fingers as in the usual finger tension, this still would not allow maximum oscillation of the yarn. With the fingers mounted in this manner, the movable fingers can be parallel to the fixed fingers at only one point. Any oscillation, therefore, would be restricted by the angle caused by the fixed and movable fingers. With the device of the present invention, the movable and fixed fingers are straight and parallel at all times since the movable fingers are mounted parallel to the fixed fingers and pivoted in a plane perpendicular to the axes of the fixed fingers.

Other advantages of this tension device are the results of the manner of applying tension. The movable fingers are pivoted so that the initial finger puts on very little tension, and each consecutive finger puts on an increasing amount until the maximum is reached on the last finger. This allows the loose bundle of low twist filaments to be consolidated into the complete yarn strand without unduly harming the filaments until the tension has been applied.

This method of applying tension also lessens the possibility of "chatter" for minor tension changes. After the movable fingers have opened, they can return to the normal operative position more easily than in the conventional manner. In this invention the fingers hit the yarn strand and force it into position individually. It is much easier to gradually bend the yarn to its zig-zag path, than to force it into this path with a like amount applied on all fingers at the same time. With the latter, the fingers spring open again and the cycle is repeated.

For major tension changes, the stop **35** is fixed to the bottom member with a screw **36**. The stop can be fixed in any position with this screw so that the desired minimum tension to prevent overshoots may be obtained. This stop prevents the fingers from opening completely to allow the yarn to overshoot. Because of the curved surface, however, the top member can be opened completely. The pin fastened to the top member engages the curved surface of the stop and cams the top member up to allow it to move over the stop. This stop can be adjusted so that any minimum desired degree of intermeshing of the fingers will be maintained at all times.

The yarn engaging fingers **17** and **20** have been designated as straight and cylindrical. The term

"cylindrical" is used in its generic sense. While, in the preferred construction the cylindrical fingers are circular in cross-section to form fingers which are right circular cylinders, it is contemplated that the fingers may be oval or oblong in cross-section.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. This application is, therefore, not to be limited to the precise details discussed, but is intended to cover all variations and modifications falling within the scope of the appended claims.

I claim:

1. A tensioning device for use in a yarn machine comprising, in combination, a pair of pivotally connected members adapted to move relatively in parallel relation, a group of upstanding aligned parallel fingers carried by each of said members and extending toward the other member, means for moving said members relatively to position said groups of fingers in parallel intermeshing relation and in engagement with said yarn to apply tension thereto as the yarn moves over said intermeshing fingers, and means for guiding said yarn to said fingers to permit the yarn to oscillate freely over the full length of the fingers to prevent excessive wear thereof.

2. A tensioning device for use in a yarn machine comprising, in combination, a pair of members adapted to move in parallel relation, a group of upstanding straight, smooth aligned parallel fingers of equal length carried by each of said members and extending toward the other member, an offset point connection between said members, means on said members cooperating with said fingers to retain the yarn thereon, and means for moving said members relatively about said connection to arrange said groups of fingers in parallel intermeshing relation and engaging said yarn, said pivot connection serving to position said groups in varying degrees of intermeshing to gradually and increasingly apply tension to said yarn.

3. A tensioning device for use in a yarn machine comprising, in combination, a pair of spaced members arranged in parallel overlying relation, a group of upstanding straight, smooth aligned parallel yarn engaging fingers of equal length carried by each of said members, the fingers of one member extending toward the other member and being offset longitudinally from the fingers of the other member so that said fingers may be arranged to engage the yarn in intermeshing relation, means for pivotally connecting one end of said members in alignment with the fingers of one member but offset from alignment with the fingers of the other member so that said fingers will intermesh in varying degrees to apply the tension gradually and increasingly to said yarn, each of said members being formed with grooves in alignment with and adapted to receive the ends of the fingers of the other members to retain the yarn in position on said fingers, means for moving said members about said connections to position said fingers in intermeshing relation and in contact with the yarn, and means for adjusting the degree of such intermeshing to control the amount of tension applied.

4. A tensioning device for use in a yarn machine comprising, in combination, a pair of spaced members arranged in parallel overlying relation, a group of upstanding aligned parallel yarn engaging fingers carried by each of said members,

the fingers of one member extending toward the other member and being offset longitudinally from the fingers of the other member so that said fingers may be arranged to engage the yarn in intermeshing relation, means for pivotally connecting one end of said members in alignment with the fingers of one member but offset from alignment with the fingers of the other member so that said fingers will intermesh in varying degrees to apply the tension gradually and increasingly to said yarn, each of said members being formed with arcuate groove substantially concentric with said pivot for receiving the ends of the fingers of the other means to retain the yarn on said fingers, and means both for moving said members relative about said connection to position said fingers in intermeshing relation and in engagement with said yarn and to regulate the degree of intermeshing to control the amount of tension applied.

5. A tensioning device for use in a yarn machine comprising, in combination, a pair of members adapted to be moved in parallel relation, a group of upstanding straight aligned parallel fingers carried by each of said members, the group of one member extending toward the other member, means for moving said members to arrange said fingers in intermeshing relation to engage the yarn to apply tension thereto, and means for guiding the yarn to said device to permit the yarn to oscillate freely between said fingers.

6. A tensioning device for use in a yarn machine comprising, in combination, a pair of members adapted to move in parallel relation, a group of upstanding straight aligned parallel yarn engaging fingers carried by each member and extending toward the other member, the fingers on said members being longitudinally offset so that when said fingers are moved into yarn engaging relation they will intermesh to tension the yarn, means for moving said members, means for regulating the degree of intermesh to control the tension, and yarn guide means carried by said device for directing said yarn to said fingers but permitting the yarn to oscillate between the fingers and over substantially the full length thereof.

7. A tensioning device for use in a yarn machine comprising, in combination, a pair of spaced members arranged in parallel overlying relation, a group of upstanding straight aligned parallel yarn engaging fingers carried by each of said members, the fingers of one member extending toward the other member and being offset longitudinally from the fingers of the other member so that said fingers may be arranged to engage the yarn in intermeshing relation, means for pivotally connecting one end of said members in alignment with the fingers of one member but offset from alignment with the fingers of the other member so that said fingers will intermesh in varying degrees to apply the tension gradually and increasingly to said yarn, means for moving said members about said connections to position said fingers in intermeshing relation and in contact with the yarn, each of said members being provided with a series of grooves adapted to receive and in which the ends of the fingers of the other member move when said members are moved about said connection, and means for adjusting the degree of intermeshing of said fingers to control the amount of tension aplied to said yarn.

8. A tension device for use in a yarn machine comprising, in combination, a pair of spaced members arranged in parallel overlying relation, a group of upstanding aligned straight parallel yarn engaging fingers carried by each of said members, the fingers of one member extending toward the other member and being offset longitudinally from the fingers of the other member so that said fingers may be arranged to engage the yarn in intermeshing relation, means for pivotally connecting one end of said members in alignment with the fingers of one member but offset from alignment with the fingers of the other member so that said fingers will intermesh in varying degrees to apply the tension gradually and increasingly to said yarn, means for moving said members about said connections to position said fingers in intermeshing relation and in contact with the yarn, each of said members being provided with a series of grooves adapted to receive and in which the ends of the fingers of the other member move when said members are moved about said connection, means for adjusting the degree of intermeshing of said fingers to control the amount of tension applied to said yarn, and means at the opposite end of said device from said connection for guiding the yarn to said device to permit free oscillation between said fingers and substantially the full length thereof to reduce wear on said fingers.

9. A tensioning device for use in a yarn machine comprising, in combination, a fixed member, a plurality of straight aligned parallel yarn engaging fingers projecting from said member, a movable member arranged in overlying parallel relation with said fixed member, a plurality of straight aligned parallel yarn engaging fingers projecting from said movable member, the fingers of each member extending toward the other member and offset longitudinally from the fingers thereof so that said fingers may be arranged in intermeshing relation with the yarn to apply a tension thereto, a pivotal connection between said members to permit relative movement therebetween, said connection being in alignment with the fingers of one group but offset from the line of fingers of the other group, means formed on each member substantially concentric with said pivot and cooperating with said fingers of the other member to retain the yarn in engagement with said fingers, means for moving said movable member relative to said fixed member to bring said fingers of said members in varying intermeshing relation so as to apply tension to the yarn gradually and increasingly and cooperating elements on said members adapted to engage to limit the movement of the movable member of said yarn.

10. A tensioning device for use in a yarn machine comprising, in combination, a fixed member, a plurality of straight aligned parallel yarn engaging fingers projecting from said member, a movable member arranged in overlying parallel relation with said fixed member, a plurality of straight aligned parallel yarn engaging fingers projecting from said movable member, the fingers of each member extending toward the other member and offset longitudinally from the fingers thereof so that said fingers may be arranged in intermeshing relation with the yarn to apply a tension thereto, a pivotal connection between said members to permit relative movement therebetween, said connection being in alignment with the fingers of one group but offset from the line of fingers of the other group, means for moving said movable member relative to said fixed mem-

ber to bring said fingers of said members in varying intermeshing relation so as to apply tension to the yarn gradually and increasingly, means for positioning said movable member to control the amount of tension applied to said yarn, laterally extending grooves formed in each of said members in alignment with the fingers of the other member to receive the ends of said fingers to prevent the passage of the yarn over said ends, means positioned at the end of said device opposite said pivotal connection for guiding the yarn to said device so that it may oscillate freely over the length of said fingers while passing thereover, a pin carried by said movable member, an adjustable cam mounted on said fixed member and positioned in the path of said pin to be engaged thereby to limit the movement of said movable member by said yarn, and means for adjusting the position of said cam.

PAUL J. BURNS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,027,140	McKean	May 21, 1912
1,063,992	McKean	June 10, 1913
1,111,500	Schautz et al.	Sept. 22, 1914
1,375,568	Cunniff	Apr. 19, 1921
1,762,476	Houghton	June 10, 1930
1,882,539	Anderson	Oct. 11, 1932

FOREIGN PATENTS

Number	Country	Date
461,614	France	Jan. 7, 1914