

April 30, 1963

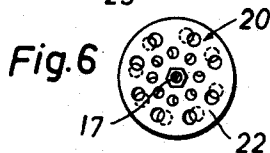
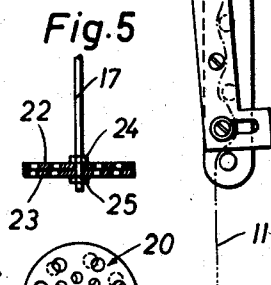
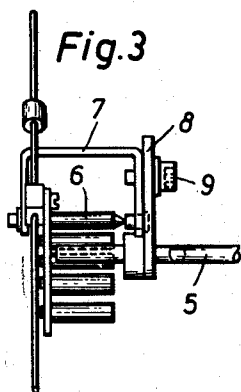
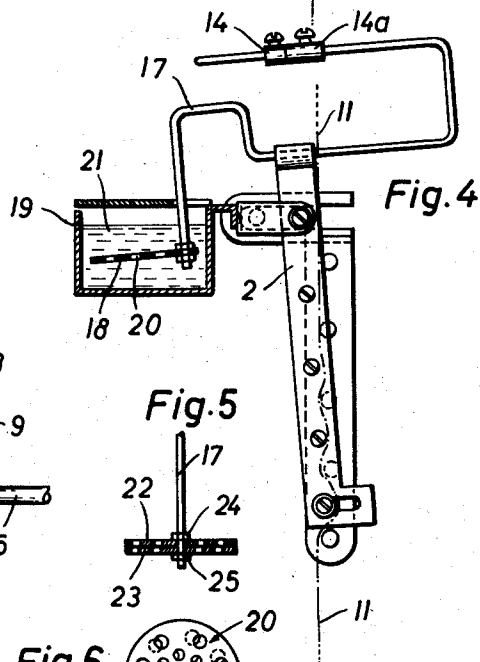
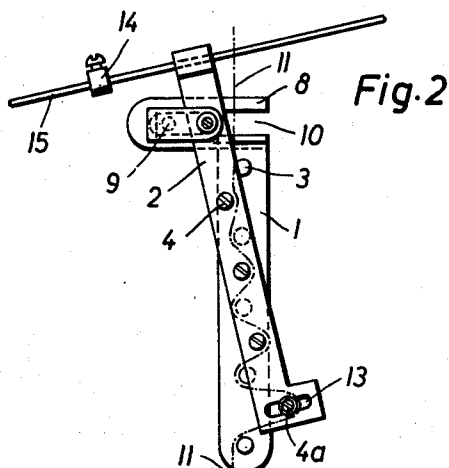
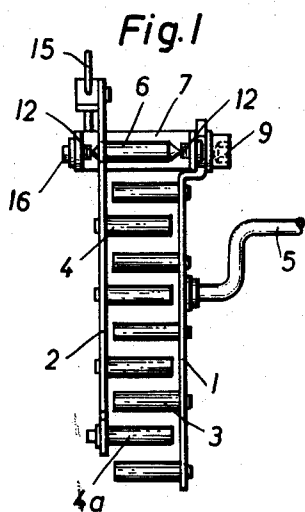
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3,087,689

THREAD TENSIONING MEANS FOR TEXTILE MACHINES

Filed June 2, 1960

3 Sheets-Sheet 1



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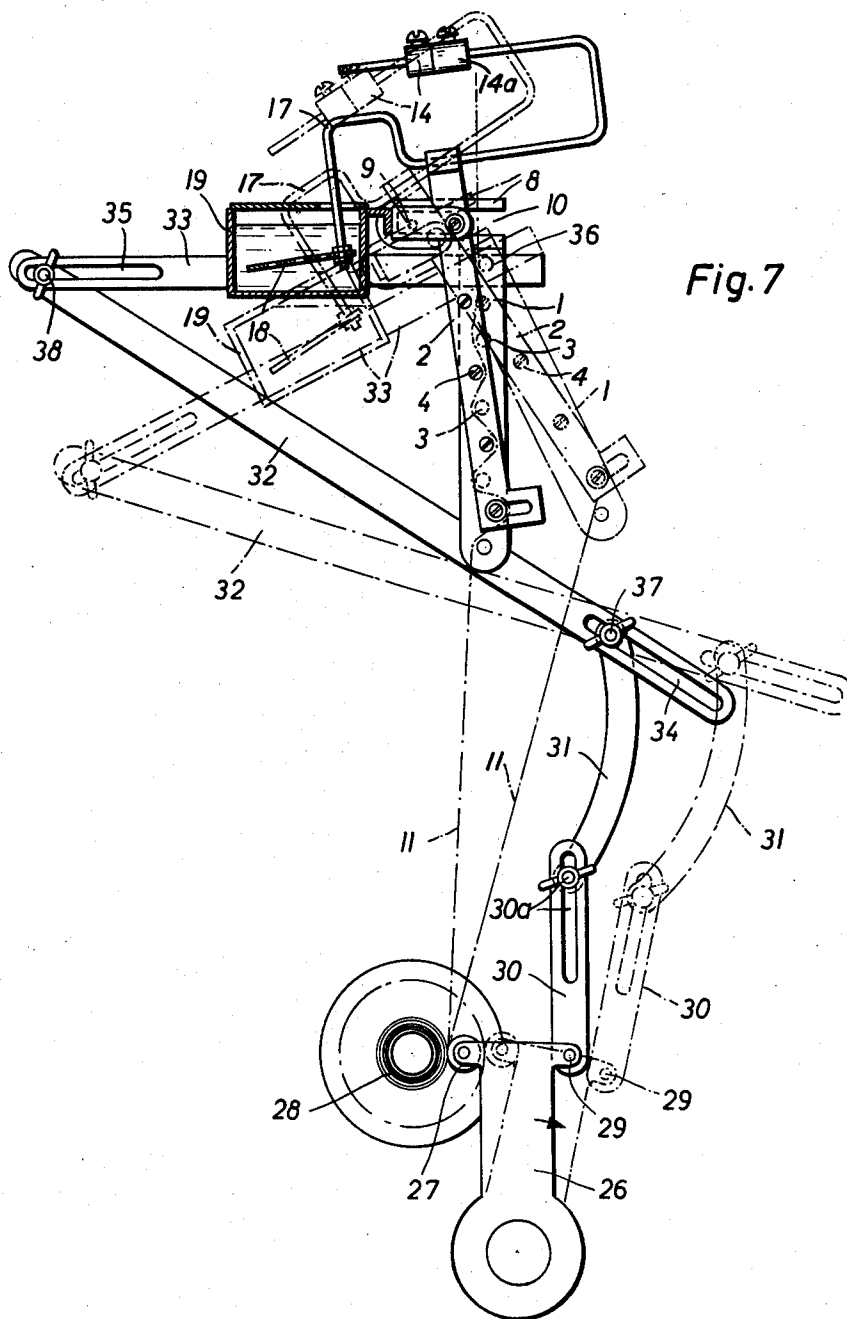
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Fig.8

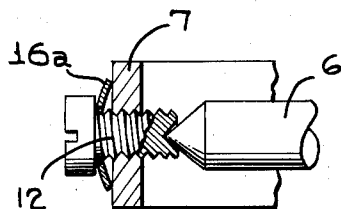
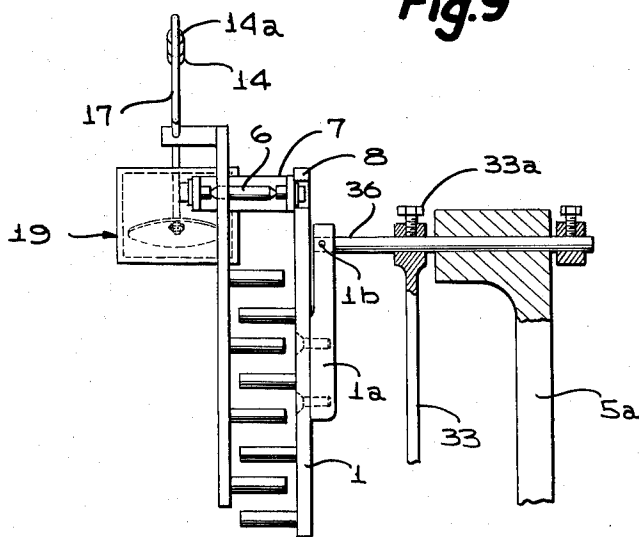


Fig.9



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THREAD TENSIONING MEANS FOR TEXTILE MACHINES

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This invention relates to yarn and thread tensioning means, herein referred to as yarn tensioning means, for textile machines, and especially for spooling machines.

The purpose of the invention is to keep the thread under a determined tension. It is of importance, particularly in the spooling of synthetic yarns, to keep the tension as constant as possible, in order that the yarns may not be unevenly stretched, as they are very liable to be, by variations in tension, or even snapped by excessive tension. Differences in tension in one spool or even between different spools make themselves unpleasantly noticeable in subsequent operations on the yarn, for example in weaving, dyeing and the like. The thinner the yarns the less must be the tension during winding and the greater the effect of minor changes in tension. Whether the spool be a cylindrical one or a cross-wound conical one, or a simple or double cone spool, or a so-called pineapple spool, if it rotates at a constant number of revolutions per minute the rate of draw-off of yarn increases as the diameter of the wound spool increases layer by layer, and the frictional action of the yarn bending elements and therefore the tension increase in like measure.

In yarn tensioning means the yarn passes between and rubs upon yarn bending elements which deflect it more or less, and either once or many times to and fro, from its direct path. It is the sliding friction which tensions the yarn and such friction depends on the angle of contact between the yarn and the yarn bending elements, and is adjusted at the beginning of winding.

The total drag exerted on the yarn is determined by the sum of the angles of contact with the yarn bending elements, by the roughness of their surfaces and by the speed of the yarn. In a tensioning means built into a machine the roughness of the surface cannot be modified during winding. In usual tensioning means the sum of the angles of contact remains constant after initial adjustment. If the speed of rotation in revolutions per minute is constant, the speed of the yarn increases during spooling and so therefore does the tension. It is usual to adjust to an average value of tension, which at the beginning of winding is too small and at the end is too great for the kind of thread, and is correct only in the middle. That leads to an undesirable build of spool, the inner part being softer than the outer part. The result is that the outer layers under too high tension press outward the too soft inner layers so that the conical ends of the finished spool bulge into a more nearly spherical shape than is permissible. It is difficult to unwind such spools in further working, especially because the too high tension in the outer layers of yarn causes the yarn to slip down the coned end of the spool onto its spindle. Such slips lead to breaking of the yarn. Attempts have been made to overcome this difficulty by diminishing the speed of rotation of the spool, with a view to keeping the speed of yarn draw-off constant and such practice entails expensive electrical or mechanical devices.

In the heavy spools used in the modern textile industry there are such considerable differences between the internal and external diameters of the spools, and at the high speeds at which winding is now done the difference in tension at the beginning and end of a spool is so great,

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that variation of speed with a setting of tension to average value is no longer satisfactory, and reduction of speed becomes more and more difficult.

The principal object of the invention is to provide improvements in and development of yarn tensioning means of the kind mentioned. The distinctive feature of such improvement is that the angle of contact between the yarn and the yarn bending elements is made dependent on the yarn tension by making the yarn bending elements relatively movable under that tension. By this means the result is attained that as the yarn speed gradually increases, the correspondingly increasing tension of the yarn automatically diminishes the angle of contact of the yarn with the yarn bending elements. This diminution of the angle of contact following instantly upon a momentary increase of tension can be so contrived as to compensate for the change in tension, so that notwithstanding steadily increasing yarn speed the yarn tension in fact remains constant throughout the spooling operation. Since tension is dependent on yarn speed and yarn speed is governed by the process of spooling, automatic regulation of the friction on the yarn follows upon variation of speed with the result that the friction on the yarn diminishes as the speed increases, and the yarn tension remains constant throughout the spooling. By adjustment of the friction, that is of the angle of contact, any desired tension may be imparted to the yarn. Thus the invention makes it possible to wind the finest yarns at a precisely constant tension of magnitude adjusted to the fineness of the yarn, for example, a tension of 1.5 grams or less.

Briefly described, the tensioning device of the invention is preferably constructed of two staggered series of yarn bending elements, hanging from and swinging about a common axis or two different axes and adjustably in their relative angular position. The one series may be stationary, and only the other swing; or both may be made to swing. There are various means of adjusting the tension for winding. The axis of the series of elements which swings may be adjustable transversely to the other series of elements. One or more of the separate yarn bending elements may be adjustable transversely to the mid line of the series, and be clamped in adjusted position. A further means of regulating the tension is to attach to the swinging series of elements a movable load, adjustable transversely to the pivot. The load can also influence the slanting position of the series of elements, acting in opposition to the tension of the yarn.

In order that the tensioning means may not be disturbed and set in oscillation or be maintained in constant vibration by impulsive shocks transmitted to it by the yarn due to momentary increases of tension resulting from irregularities or obstructions, a damping means is provided. This takes up momentary variations of tension which may easily occur so rhythmically as to build up oscillations of the yarn bending elements, without preventing adjustment of the tensioning means under slowly increasing tension so as to maintain constant tension. The damping device is preferably hydraulic. The hanging, swinging frame carrying one series of yarn bending elements may be fitted with a paddle dipping into liquid. The paddle or blade is preferably perforated, and damping may be regulated by making the size of the perforations variable.

Several examples of construction of the invention are illustrated in the accompanying drawing, in which:

FIGS. 1 and 2 show a tensioning device in side and front elevation, respectively;

FIG. 3 is a plan of FIG. 1;

FIG. 4 is a front view of a modified construction of tensioning device, partly in section;

FIGS. 5 and 6 are side elevational and plan views, re-

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spectively, of a modified construction of paddle for the tensioning device of FIG. 4;

FIG. 7 is a front view of another construction in which a frame carrying yarn bending elements is movable in dependence on the increase in diameter of the spool;

FIG. 8 is a detail sectional view; and

FIG. 9 is a fragmentary elevational view, partly in section, showing supports for the frame carrying yarn bending elements.

The tensioning means in all figures is made up of two frames 1 and 2, each respectively carrying one or more yarn bending elements 3 and 4. These elements are cylindrical and may be made of steel or other metal or of glass or ceramic substance. Preferably they are cylindrical sleeves interchangeably mounted on mandrels. However, a series of such elements may be replaced by a sheet of corrugated metal. The frame 1 may be secured to a bracket 5 upon the spooling or other machine and be stationary. The frame 2 carrying the elements 4 is hung from a pivot 6 and can swing. The two series of yarn bending elements 3 and 4 are staggered so that those of one series lie opposite the gaps between those of the other series. The pivot 6 turns in bearings in a bracket 7 which may be attached to a lug 8 on the frame 1 by the screw 9. The screw 9 passes through a slot 10 in the lug 8 so that the distance of the pivot 6 of the swinging frame from the mid line of the series of elements 3 may be varied. By this means the angle over which the yarn 11 contacts with the elements may be initially adjusted.

In order that the frame 2 may swing easily, the ends of the pivot 6 are tapered and are received in coned recesses in the bearings 12, the latter being adjustable by means of a spring clamping ring 16. By tightening the bearings, impulsive deflections imparted to the frame 2 can be damped.

The friction producing tension in the yarn may be further regulated by making one or more of the elements 3 or 4 adjustable transversely to the length of the frame 1 or 2. In FIG. 2 the lowest element 4^a is so made adjustable, being movable in the slot 13 in which it is clamped. Then tension may be further controlled by a weight 14 movable along a rod 15 extending transversely from the frame 2.

FIG. 4 shows another means of damping oscillation of the frame 2. The rod 17 carrying adjustable weights 14 also carries a paddle 18 which dips into liquid of suitable viscosity in the vessel 19. There are preferable perforations 20 in the paddle 18. Because of the great variety of yarns, the impulsive shocks that occur may vary greatly in strength and it is therefore desirable that the damping action should be adjustable. As yarns of widely different properties may follow one another upon the spooling machine at short intervals, and as they must be carefully preserved from soiling with oil, or otherwise, it is not practicable to change the damping liquid for another of different viscosity.

FIGS. 5 and 6 show a simple means of varying the damping. The paddle dipping into the liquid 21 is made of two superposed plates 22 and 23 with similar or different perforations which can be brought more or less into register. The plates are clamped in their adjusted position by the nuts 24 and 25. Preferably the perforations are in circles so that they can be adjusted relatively to one another by relative rotation of the plates.

The tensioning device of the invention operates as follows:

The yarn 11 is drawn downward from above and passed between the elements 3 and 4, the frame 2 swinging freely. The tension is determined by bringing the frame 2 into the requisite inclined position. This determines the relation of the elements 3 to the elements 4, and so determines the total angle of contact of the yarn with the yarn bending elements, and consequently the tension needed to draw the yarn through the tensioning means. The setting of the weights 14 determines the initial inclina-

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tion of the frame 2. The setting of the pivot 6 in relation to the axis of the stationary frame 1 determines the depth to which the elements 4 penetrate between the elements 3. By means of these two settings the angle of contact of the yarn with the several elements can be regulated as desired. If the mid lines of the stationary and swinging frames are inclined at a small angle and intersect at their lower ends the angle of contact of yarn and element increases gradually and steadily from the top downward. The settings may be such that there is no contact between the yarn and the uppermost elements, the yarn passing freely between them, while there is a large angle of contact with the lower elements where the elements 3 penetrate deeply between the elements 4; and this angle may be still further increased by lateral adjustment of one or more of the elements relatively to their frame. These several means of adjusting the angles of contact with the elements make possible precise compensation of any changes of tension due to variations of speed or other causes. Increase of tension will make the yarn more taut and tend to straighten the wavy path it follows. The elements 3 are thus forced outward from between the elements 4 more and more and the angle of contact with the upper elements becomes less and less and finally zero. The friction of the yarn with these upper elements therefore lessens and with it the tension needed to overcome it. Thus variation of tension caused by increase of speed or otherwise automatically alters the relative position of the yarn bending elements and the total angle of contact with them. Change of speed causes change of tension which results in change of friction, so maintaining the tension constant.

When the ratio of initial yarn speed to final yarn speed is exceptionally large due to the great increase in diameter of the spool, it may be convenient not to leave the displacement of the frame 2 and elements 4 from the frame 1 solely to the increase of tension resulting from increase of speed, but to supplement it by positive displacement of the frame 1 and elements 3 by the aid of a roller bearing on the spool. Transfer of this control may be electrical or mechanical.

FIG. 7 shows an example of construction of such positive displacement of the frame 1 and yarn bending elements 3 in dependence on the movement of a yarn guide 26, the frame still cooperating with the freely swinging frame 2 and its yarn bending elements 4.

Upon the thread guide 26 which carries the press roll 27 bearing on the spool 28 there is fastened at 29 a link 30. To this link there is attached by a pin and slot connection 30^a a further link 31, the slot of the connection providing a means of adjustment. The yarn guide 26, and the two links 30 and 31 cannot turn relatively and form a rigid construction. With the link 31 there is engaged a further link 32 which is pivotally connected to another link 33. Slots 34 and 35 in the links 32 and 33 respectively serve for adjustment of the ratio of transmission. The link 33 is rigidly attached to the frame 1 so that they form one unit. In the linkage 26, 30, 31, 32 and 33 the pins 37 and 38 form pivotal connections. As the yarn guide 26 swings outward in the direction of the arrow the linkage turns the frame 1 about the pivot 36. The adjustments provided permit of a given swing of frame 1 being made to result from a given swing of the guide 26. By such adjustment the effect of the angle of contact of yarn and yarn bending elements during the growth of the spool can be diminished to a determined extent according to the kind of yarn being wound, and so the increasing effect of the yarn speed can be compensated.

As the diameter of the spool 28 increases the position of the frame 1 is gradually adjusted by the guide 26 and linkage 30 and 33 by a determined and adjustable amount. Thus at every moment the frame 1 is brought to and held fast in a determined position. It is not affected by the tension in the yarn 11. The movable frame 2 on the

other hand can swing freely under the pull of the yarn. The weights 14 and 14^a upon the movable frame 2 can be of such amount and so adjusted that, the frame 1 being held at the beginning of winding in a substantially vertical position, the freely swinging frame 2 can also be brought by the yarn tension into the vertical position. As the frame 1 is positively moved by the linkage, the frame 2 can at first follow it, and only slowly begins to lag behind it as the angle between the two frames widens. Thus the effect of the angle of contact of the yarn 11 with the elements 3 and 4 during winding can be adjusted and controlled as desired. By means of the scheme described the yarn tension can be kept constant notwithstanding that the speed of revolution of the spool is constant and the speed of the yarn increases with the spool diameter, even though there is a wide difference between the initial and final diameters of the spool and therefore between the initial and final yarn speeds.

With respect to the spring clamping ring 16, it is to be noted that this element is merely a spring clip or disk as shown at 16^a on FIG. 8 and is inserted between the head of the screw 12 and the bracket 7 into which the screw 12 is threaded, and this type of device is for the purpose of removing loose play between the thread and its counter thread. Also the mounting of the screw 12 in this manner prevents loosening thereof in the presence of vibrations and the foregoing is the entire function of the spring clamping ring 16 which is designated at 16^a on FIG. 8 of the drawings. It may also be noted that in lieu of this spring clip 16^a the element 16 on the drawings as filed may be designated a nut and the same objects will be accomplished.

In reference to the showing of the invention in FIG. 7, the frame 1 and also the frame 2 are pivotally mounted. The supporting point of frame 1 is the pivot 36 shown in FIG. 7 and also in FIG. 9 of the drawings. With the frame 1 there is fixedly connected the lug 8 to which is fixed the vessel 19, the same as in the disclosure of the invention in FIGS. 1 to 4, while the other frame 2 pivots on the shaft 6 as shown in FIGS. 1, 2 and 7 as well as in FIG. 9 of the drawings, it being noted that FIG. 9 is a side elevation of the invention as shown in FIG. 7 and from which may be seen the pivotal mounting 36. The pivot shaft 36 is mounted in a stationary frame 5^a and the rod 33 is fixedly connected with the pivot shaft 36. The frame 1 is also connected with the pivot shaft 36 as indicated by the support 1^a fixed to the frame 1 on FIG. 9. Frame 1 and support 1^a then form one part which is, for example, fixedly connected with pivot 36 by means of the pin 1^b passing through the pivot 36. The frame 1 together with the linkage 33, 32, 31, 30 and the lug 8 with the vessel 19 may be turned about the pivot 36, while the frame 2 together with the rod 17 and the paddle 18 dipping into the vessel 19 is pivotally mounted relative to the frame 1.

It may be further noted that the entire device is held by the stationary frame 5^a on FIG. 9 with the pivot 6 mounted in the lug 8 and in the frame 1. The pivot 6 is therefore supported by the frame 1 which is held by the pivot 36 on the stationary frame 5^a.

It is even possible to diminish the yarn tension as the diameter of the spool increases. This makes it possible to wind spools of greater weight (up to 800 to 1500 grams) with constant or decreasing tension, and so to wind soft spools uniform right up to the spool ends and throughout all layers, without complex and expensive

mechanical or electrical means for diminishing the speed of revolution as the spool grows so as to keep the yarn speed constant.

While there are herein shown and described the preferred embodiments of the invention, it is nevertheless to be understood that minor changes may be made therein without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A thread tensioning device comprising a first frame and a second frame lying in a plane parallel to the plane of said first frame, a plurality of thread tensioning pins extending from each of said frames, said pins being disposed in opposed staggered relation, said second frame having an opening therein adjacent one end thereof, and a pivot pin extending through said opening and projecting from opposite sides of said second frame and having pointed ends, a U-shaped yoke carried by the upper part of said first frame, opposed conical bearings carried by said yoke and receiving the ends of said pivot pin, said first frame having an upper arm with a generally horizontal slot therein, adjustable clamp means passing through said slot and clamping said yoke to said first frame in an adjusted position whereby the relative position of said pivot pin with respect to said first frame may be varied to vary thread tension, a rod extending from the upper end of said second arm generally normal to the axis of said pivot pin, a weight adjustably carried by said arm to effect the pivoting of said second frame relative to said first frame to vary thread tension, and means for dampening the pivoting of said second frame.

2. The thread tensioner of claim 1 wherein said dampening includes a spring clip adjustably urging said bearings into engagement with said pivot pin ends to vary the frictional engagement therebetween.

3. The thread tensioner of claim 1 wherein said dampening means is in the form of a fluid receptacle secured to said yoke, and a dampening plate is carried by said rod within said fluid receptacle wherein fluid resists the movement of said dampening plate, said rod having a generally vertical dampening plate supporting portion and said dampening plate being generally horizontally disposed.

4. The thread tensioner of claim 3 wherein said first frame has a fixed connection with said arm, a pivotally mounted spool follower, and linkage connecting said spool follower to said first frame.

5. The thread tensioner of claim 4 wherein said linkage includes a lever arm secured to said first frame, a first link pivotally connected to said lever arm, a second link pivotally connected to said spool follower, and an intermediate third link adjustably and rigidly secured to said first and second links.

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