Jan. 30, 1968 S. J. KETTERER ETAL 3,366,083

THREAD TENSIONING DEVICE FOR SEWING MACHINES

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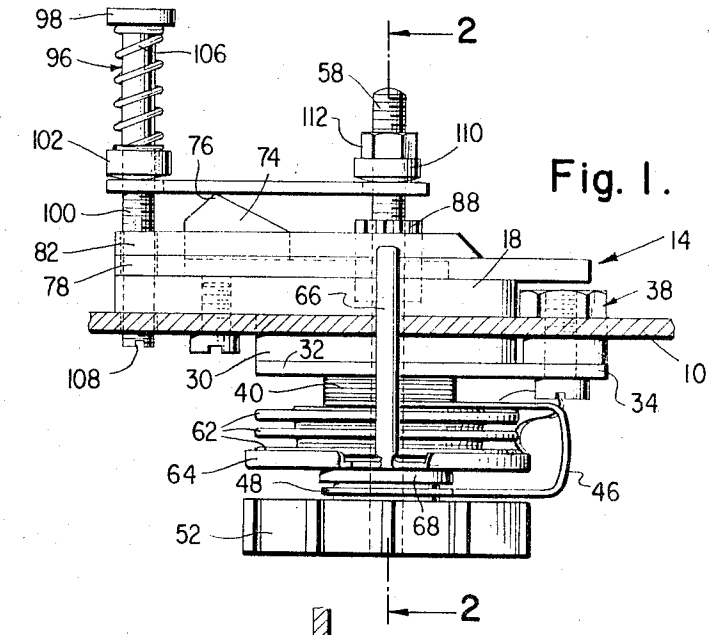


Fig. 1.

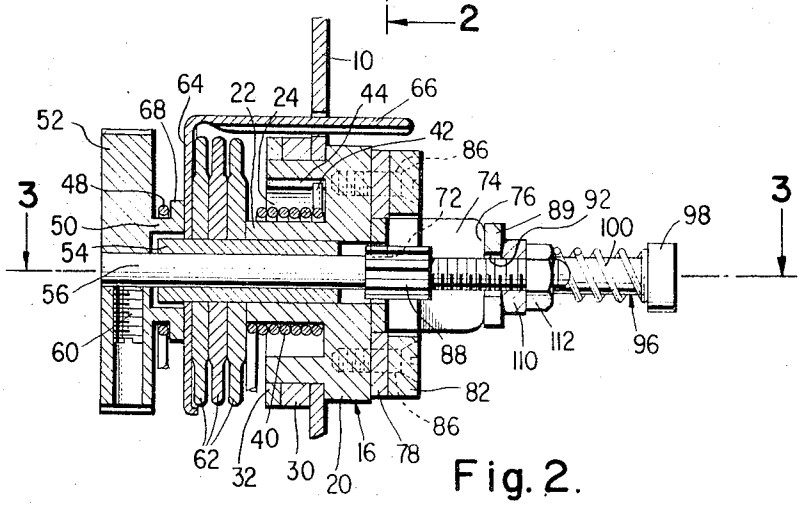


Fig. 2.

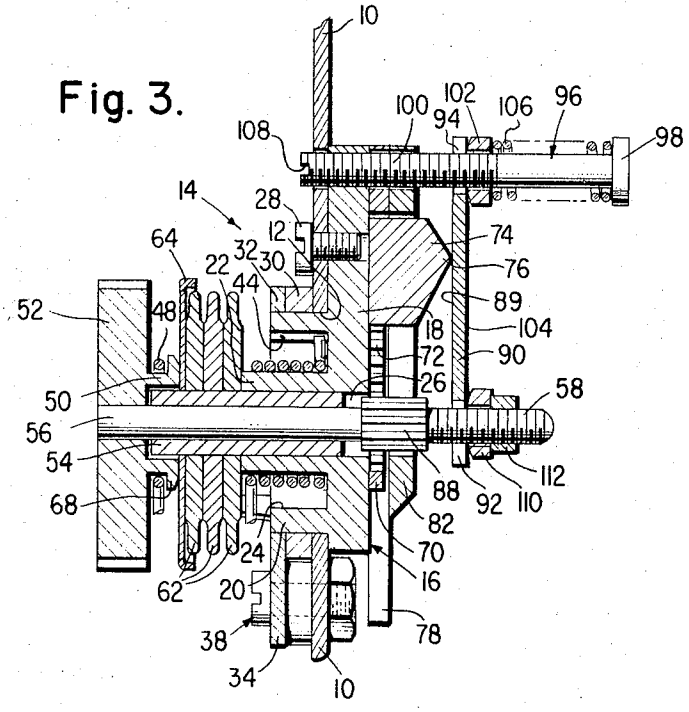
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Fig. 3.



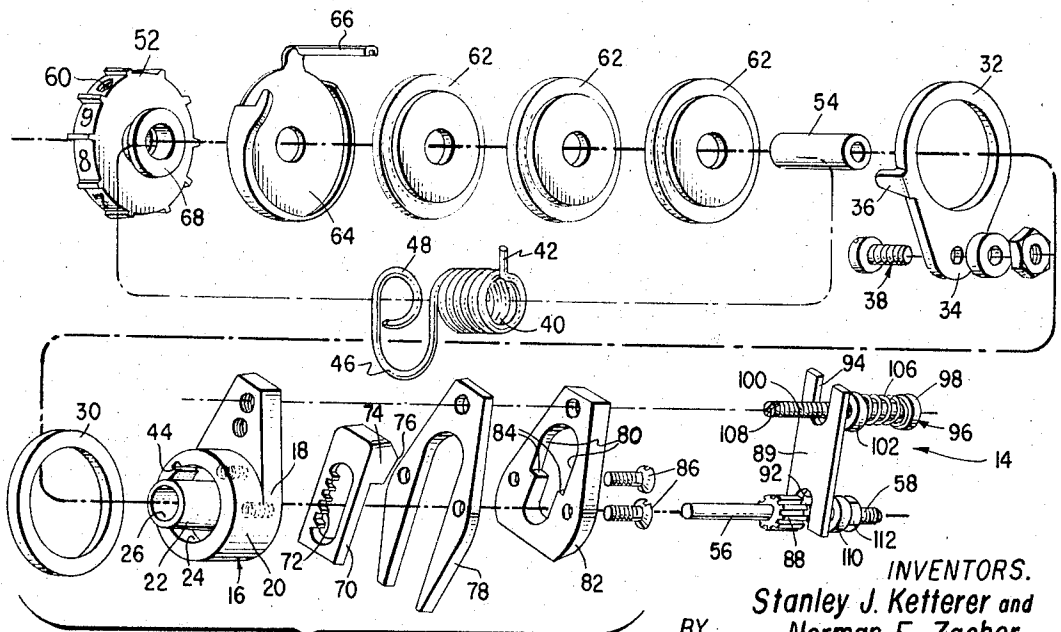


Fig. 4.

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THREAD TENSIONING DEVICE FOR SEWING MACHINES

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ABSTRACT OF THE DISCLOSURE

A sewing machine thread tension device equipped with a plurality of opposed thread tensioning discs and an adjustable leverage system for pressing the discs together.

The present invention relates to thread tension devices for sewing machines, and in particular to thread tension devices that utilize tension discs which are yieldingly urged together.

In conventional thread tension devices, opposed thread tension discs are mounted loosely on an arbor and are urged resiliently against each other by a compression spring coiled about the arbor. The discs, in turn, tension thread adapted to slide between the discs. The thread tension is varied by utilizing an adjusting nut, threadedly engaging the arbor, for adjustably compressing the spring. A set of indicia is used in cooperation with the adjusting elements to provide the operator with a means for gauging the relative degree of thread tension.

When using such conventional thread tension devices, the indicia cannot as a practical matter be calibrated, and therefore, each time that the operator prepares for sewing she must empirically adjust the thread tension device to provide the degree of tension required by the specific character of the thread and material being used.

The reason that prior art thread tensioning devices could not be calibrated, requiring annoying empirical adjustment, is that the manufacturer of such conventional thread tension devices finds prohibitive the cost of the very high quality compression springs which would be necessary in order to provide for uniform calibration of each individual tensioning device. Thus, while it may be economically feasible to manufacture compression springs for thread tension devices that supply a particular maximum force within an acceptable tolerance range, it is not economically feasible to manufacture springs with uniform spring rates, i.e., each one providing an identical amount of force for a given compression of the spring. It has not been economically practical therefore, to manufacture conventional thread tension devices with indicia having any uniformity of correlation with the actual thread tension being developed.

It is an object of this invention to provide in a sewing machine thread tension device new and improved means for biasing the tension discs.

It is another object of this invention to provide a novel construction for thread tension devices which provides for the application of spring pressure to the discs in such a manner that indicia associated with the means for regulating the spring pressure on the discs will be correlated accurately with the actual pressure regardless of the spring rate of the particular spring being used.

It is still another object of this invention to improve the sewing machine operator's view of the point of stitch formation by reducing the size of the parts of the tension device that extend outside of the machine frame.

The aforegoing objects are attained in the present invention by a novel organization and arrangement of parts of a thread tensioning device in which the spring that provides the biasing force urging the tension discs together is not applied directly to the discs but instead is applied indirectly to a leverage system. By providing for regulation of the mechanical advantage of the leverage system the spring force applied to the tension discs may be varied with substantially no change in the spring elongation. Since the spring rate has no influence upon the pressure applied to the discs, the tension device of this inventon may be calibrated when it is first assembled and thereafter indicia associated with the device will indicate the actual pressure developed between the discs and no further calibration on the part of a machine operator need ever be made.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

FIG. 1 is a side view of the tension device of the present invention shown mounted on a fragment of a sewing machine frame,

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1,

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2, and

FIG. 4 is an exploded perspective view of the elements of the tension device shown in FIGS. 1–3.

With reference to the drawings there is illustrated at 10 a fragment of the wall of a sewing machine frame having a bore 12 (FIGS. 1 and 3). A thread tension device indicated generally by the numeral 14 is shown mounted on the fragment 10 of the sewing machine frame.

An apertured support block 16 is formed with an apertured base, 18 from which rises a cylindrical body portion 20 and a cylindrical neck 22, which neck is disposed within and concentric with the cylindrical body portion 20 but extends a short distance beyond the body portion. The neck and body portion form an annular recess 24 between them, and a bore 26 concentric with the recess 24 extends through the neck 22 and the base 18. The block 16 is secured to the inner face of the wall 10 by a screw 28 with the cylindrical body portion 20 extending through the bore 12 in the wall. Mounted on the body portion 20 are rings 30 and 32, the ring 32 being formed with an ear 34 from which extends a finger 36, the rings being secured in place on the body portion 20 by a nut, bolt and spacer arrangement 38. The recess 24 receives a conventional check spring 40 which is coiled about the cylindrical neck 22. One end 42 of the spring 40 is captured by a groove 44 cut into and lengthwise of the inner wall of the boly portion 20. The spring 40 at its other end is formed into a laterally extending thread engaging U-shaped portion 46 and terminates in a loop 48 that is coiled about the neck 50 of a knob 52.

The bore 26 in the cylindrical neck 22 of the block 16 receives a fixed cylindrical bushing 54 which in turn slidingly receives an arbor 56. One end segment 58 of the arbor is threaded and the other end segment is secured to the knob 52 by a set screw 60. The disclosed device is designed to accommodate two needle threads and is therefore provided with three tension discs 62 having centrally positioned apertures for mounting them in opposed relationship on the bushing 54. A guard plate 64 is mounted on the bushing 54 outwardly of the discs 62 and has an arm 66 that seats in an aperture in the wall 10. The discs 62 and the plate 64 are sandwiched between the end face of the cylindrical neck 22 of the block 16 and a shoulder 68 formed at the free end of the neck 50 of the knob 52.

The function of the tension discs 62, as understood in the sewing machine art, is to establish the required degree of tension in the needle thread as it is pulled between the discs and it is preferable that such tension be adjustable. The thread is tensioned by the amount of friction between the thread and the discs 62, which friction may be adjusted by varying the amount of pressure by which the discs are pressed together. In the present invention this is accomplished by endwise movement of the arbor 56. When the arbor is moved to the right, as viewed in FIG. 3, the discs 62 are pressed together, thereby increasing the degree of tension in the thread. Movement of the arbor in the other direction relieves the pressure on the discs and decreases the degree of tension in the thread. The pressure on the discs is applied via the arbor, knob 52, neck 50, shoulder 68 and guard plate 64.

Turning now to the elements of the device which function to apply an endwise force on the arbor 56, there is shown in the drawings an elongated rack 70 having teeth 72 and formed with a fulcrum 74 that rises from the rack 70, at the end of which block there is formed a fulcrum point 76. The rack 70 is slidable along the exposed face of the base 18 within the confines of a flat, generally U-shaped tracking member 78 which serves to guide the rack 70 along a predetermined path. The fulcrum block 74 protrudes through a limiting aperture 80 in a flat, substantially triangular member 82. The aperture 80 is partially defined by abutments 84, as seen more clearly in FIG. 4, which limit the movement of the fulcrum block 74 in one direction, while the wall of the aperture and the closed end of the member 78 limit its movement in the other direction. The U-shaped member 78 is sandwiched between the triangular member 82 and the base 18 to which both members 78 and 82 are secured by screws 86. The arbor 56 has formed thereon intermediate the threaded end segment 58 and its knob end a pinion 88 having teeth adapted to mesh with the teeth 72 of the rack 70. By turning the knob 52 the arbor and the pinion 88 are rotated, thereby driving the rack 70 and the fulcrum block 74 along the path determined by the members 78 and 82.

The fulcrum point 76 slidingly engages a surface 89 of a flat elongated lever 90 which has formed in its end segments U-shaped open-ended slots 92 and 94. The slot 92 receives the arbor 56 while the slot 94 receives the shank of a bolt 96. The bolt 96 includes a head 98 and a threaded segment 100 which passes through apertures in the members 78 and 82 and engages a threaded opening in the base 18 of the block 16. A collar 102 is slidably mounted on the shank of the bolt 96 and is biased into engagement with a surface 104 of the lever 90 by a coil spring 106 mounted on the shank of the bolt between the collar 102 and the head 98 of the bolt. A slot 108 in the threaded end of the bolt 96 allows an operator manually to adjust the bias applied by the coil spring 106 to the lever 90. A pair of nuts 110 and 112 are threaded on the end segment 58 of the arbor 56 with the nut 110 in contact with the surface 104 of the lever 90. The lever 90 therefore is captured between the bolt 96 and the arbor 56, and between the fulcrum point 76 and the collar 102 and the nut 110.

The force exerted by the coil spring 106 is applied to the bolt-end of the lever 90 thereby pivoting the lever about the fulcrum point 76 so that a force is applied by the other end of the lever to the nuts 110 and 112 which tends to move the arbor 56 to the right, as viewed in FIG. 3, and bias the tension discs 62 as discussed above. By turning the knob 52 the fulcrum point 76 is moved along its predetermined path in one direction or the other depending upon the direction of knob rotation, thereby changing the lever arm (i.e. the distance between the fulcrum point and the point at which the spring 106 exerts its force). By changing the lever arm the lever is pivoted about the fulcrum point thereby varying the force applied by the spring 106 through the lever 90, nut 110, arbor 56, knob 52, knob neck 50, shoulder 68, guard plate 64 to the discs 62. It is noted that the spring rate for coil spring 106 does not change in any significant amount as the lever arm is adjusted because of the parallel relation between the fulcrum support i.e., the surface along which the fulcrum block 74 slides, and the lever 90.

Since the spring rate of coil spring 106 does not vary in any significant amount as the fulcrum point is moved along the lever only one critical pressure producing point is required for the spring, and that is the fixed amount of pressure required to be applied at the spring end of the lever 90. The pressure required can be set during assembly at the manufacturing plant simply by adjusting the collar 102. Since the spring rate is not important and all that is required of the spring is one particular pressure output, conventional inexpensive coil springs may be utilized.

In addition to the preferred embodiment disclosed herein, it is noted that other methods and means may be utilized to maintain the spring rate substantially constant while adjusting the leverage to vary the mechanical advantage. Thus, the spring 106 could be slid along the lever 90 while the fulcrum point 76 remained fixed relatively to the lever, or the spring 106 and the fulcrum point 76 could be slid together along the lever 90. In addition, of course, other means and methods could be utilized to drive the fulcrum block 74 so that the fulcrum point 76 could be moved relatively to the lever 90 as in the presently disclosed embodiment.

It is also pointed out that the arrangement provided by this invention is ideally suited for use with a means other than a spring for applying the force biasing the tension discs together, and particularly a means such as a weight or an air cylinder operated at constant pressure which inherently provides for the application of a constant force to the leverage system. With such an arrangement pivotal movement of the leverage system during shifting of the fulcrum can be tolerated since no variation in spring rate or other objectionable change in the applied force will occur.

While the invention has been described in its preferred embodiment, it is to be understood that the words which have been used are words of description rather than of limitation and that changes within the purview of the appended claims may be made without departing from the true scope and spirit of the invention.

Having thus set forth the nature of this invention, what is claimed herein is:

1. A sewing machine thread tension device comprising a plurality of opposed thread tensioning discs, means for pressing said discs together, a leverage system including an inflexible member operatively connected to said pressing means, means for applying substantially constant force of predetermined amount to a point on said inflexible member spaced from said operative connection, and means for varying the mechanical advantage of said leverage system.

2. A sewing machine thread tension device as set forth in claim 1, in which said means for varying the mechanical advantage comprises a fulcrum engaging said leverage system, and means for shifting the location of engagement of said fulcrum with said leverage system relatively to said operative connection.

3. A sewing machine thread tensioning device as set forth in claim 2 in which said means for shifting the location of engagement of said fulcrum includes means defining a predetermined path of shifting movement for said fulcrum, and a fulcrum engaging surface on said leverage system substantially coincident with the path of shifting movement of said fulcrum.

4. A sewing machine thread tensioning device as set forth in claim 1 in which said means for applying a force to said leverage system includes a spring means, and means for constraining said spring means relatively to said leverage system.

5. A sewing machine thread tensioning device as set forth in claim 1 in which said inflexible member is a single lever, means defining a fulcrum for said lever, and manually operative means for selectively varying the ratio of lever arm distances of said operative connection and of the point of application of said force relatively to said fulcrum.

6. A sewing machine thread tensioning device comprising a bracket adapted to be supported on a sewing machine frame, an arbor carried for turning and endwise movement in said bracket, a plurality of opposed thread tensioning discs each formed with an aperture accommodated on said arbor at one side of said bracket, disc abutment means on said arbor at the opposite side of said discs from said bracket, means for biasing said discs together including a lever operatively engaging said arbor at the opposite side of said bracket from said tensioning discs, a fulcrum block carried by said bracket in engagement with said lever, means for sliding said fulcrum block along said lever relatively to the operative connection of said lever with said arbor, and spring means anchored on said bracket and biasing said lever toward said bracket, said spring means engaging said lever at a point spaced from the operative connection of said lever with said arbor.

7. A sewing machine tensioning device as set forth in claim 6 in which said lever is formed with a planar fulcrum block engaging surface and in which said fulcrum block is slidably supported for movement in a plane substantially parallel to said lever surface.

8. A sewing machine thread tensioning device as set forth in claim 6 in which means are provided for sliding said fulcrum block along said lever to a point substantially directly opposite said point on said lever engaged by said spring means.

9. A thread tension device according to claim 6 wherein said means for sliding said fulcrum includes a rack connected to said fulcrum and a pinion mounted on said arbor, the teeth of the rack and pinion being meshed, and means for turning said arbor thereby to rotate said pinion and move said rack and connected fulcrum.

10. A thread tension device according to claim 8 wherein said means for turning said arbor includes an operator influenced knob formed outwardly of said tensioning disc abutment means on said arbor.

11. A sewing machine thread tension device comprising

a plurality of opposed thread tensioning discs, means for pressing said discs together, a leverage system operatively connected to said pressing means, means for applying substantially constant force of predetermined amount to a point on said leverage system spaced from said operative connection, means for varying the mechanical advantage of said leverage system, said means for varying the mechanical advantage comprising a fulcrum engaging said leverage system, and means for shifting the location of engagement of said fulcrum with said leverage system relatively to said operative connection.

12. A sewing machine thread tension device comprising a plurality of opposed thread tensioning discs, means for pressing said discs together, a leverage system operatively connected to said pressing means, means for applying substantially constant force of predetermined amount to a point on said leverage system spaced from said operative connection, means for varying the mechanical advantage of said leverage system, said means for shifting the location of engagement of said fulcrum including means defining a predetermined path of shifting movement for said fulcrum, and a fulcrum engaging surface on said leverage system substantially coincident with the path of shifting movement of said fulcrum.

13. A sewing machine thread tension device comprising a plurality of opposed thread tensioning discs, means for pressing said discs together, a leverage system operatively connected to said pressing means, means for applying substantially constant force of predetermined amount to a point on said leverage system spaced from said operative connection, means for varying the mechanical advantage of said leverage system, said leverage system including a single lever, means defining a fulcrum for said lever, and manually operative means for selectively varying the ratio of lever arm distances of said operative connection and of the point of application of said force relatively to said fulcrum.

References Cited

UNITED STATES PATENTS

2,609,772	9/1952	Casas-Robert	112—254
2,760,458	8/1956	Ayres	112—254

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