Jan. 23, 1951 P. J. CAMPBELL 2,538,932

TENSIOMETER

Filed April 3, 1947

Fig. 1

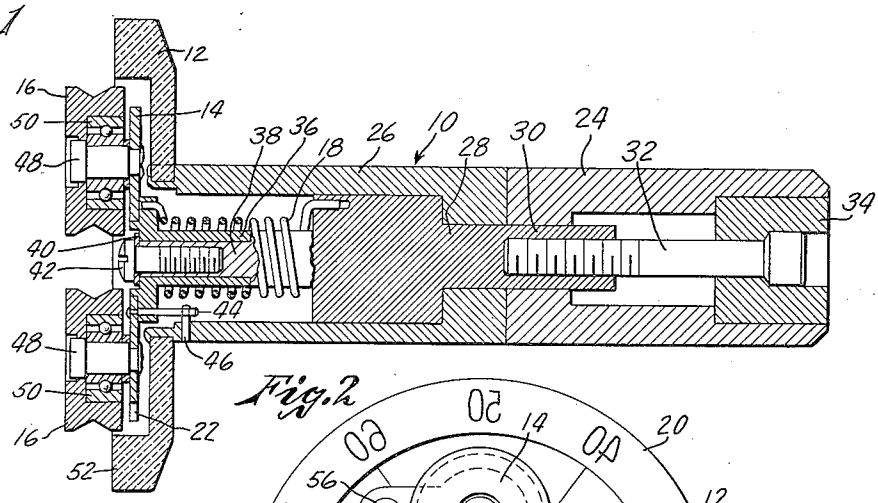


Fig. 2

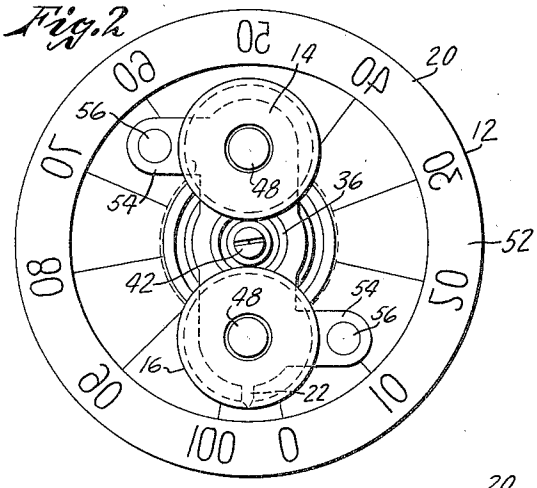


Fig. 3

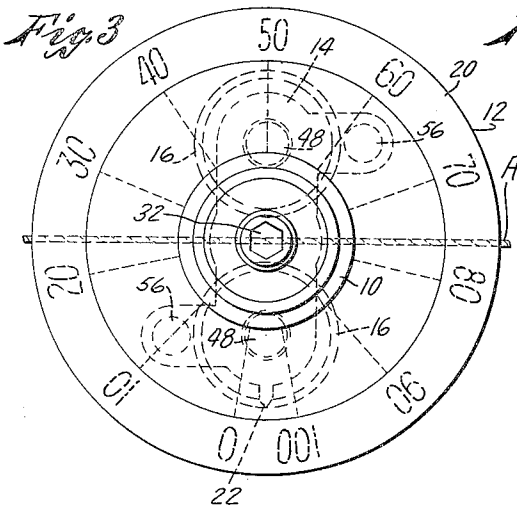
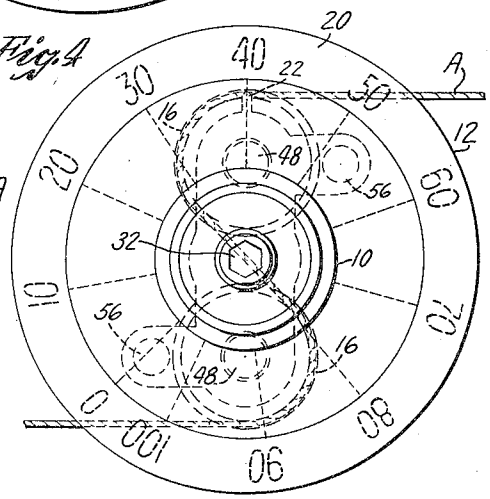


Fig. 4



INVENTOR
PAUL J. CAMPBELL

BY S. Jay Teller
ATTORNEY

Patented Jan. 23, 1951

2,538,932

UNITED STATES PATENT OFFICE

2,538,932

TENSIOMETER

Paul J. Campbell, Middletown, Conn., assignor to Raymond Engineering Laboratory, Inc., Middletown, Conn., a corporation of Connecticut

Application April 3, 1947, Serial No. 739,144

9 Claims. (Cl. 73—144)

1

The object of the invention is to provide a simple and reliable tensiometer adapted for indicating the tension in a strand of yarn, more particularly in a moving strand of yarn. The term "yarn" is used in a generic sense and is intended to include not only material of the types commonly designated as yarn, but also any other readily flexible elongated material as to which it may be necessary or desirable to determine tension.

In accordance with the invention two yarn guides are provided around which two reverse loops of the strand of yarn are formed, the main portions of the strand extending in opposite directions from the loops. A rotatable frame is provided for supporting a pivoted carrier on which at least one of the guides is mounted, and a spring is provided for resisting relative rotation between the frame and the carrier. The extent of relative rotation in opposition to the spring is determined by the yarn tension, and means including a scale and a pointer is provided for indicating the extent of relative rotation and for thus indicating the tension.

In the drawing I have shown in detail a preferred embodiment of the invention, but it will be understood that various changes may be made from the construction shown, and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing,

Fig. 1 is a longitudinal central sectional view through a tensiometer embodying the invention.

Fig. 2 is a rear view.

Fig. 3 is a front view with the parts in the same relative positions as in Figs. 1 and 2.

Fig. 4 is a view similar to Fig. 3 but showing the parts in different relative positions.

Referring to the drawing, a frame is provided which may be varied widely as to details. The frame may be variously supported, but it is preferably adapted to be supported or held manually. When adapted to be held manually it comprises a handle, generally indicated at 10, which is preferably cylindrical and of suitable size to be conveniently gripped by the hand of the user. A flange 12 is connected with the handle portion 10 at one end thereof, preferably the rear end. A carrier 14 is provided immediately adjacent the flange 12 and this carrier is pivotally connected with the frame, preferably with the handle portion 10 thereof, for rotation about a central longitudinal axis. Two yarn guides 16, 16 are provided which project outward or rearward from the flange 12 and at least one of these guides is supported on the carrier 14 at a substantial distance from the axis of relative rotation thereof. Preferably, both guides 16, 16 are mounted on the carrier 14 and are equally spaced from the axis of relative rotation, being positioned at opposite sides of the said axis. A spring 18 is provided which serves to resist any relative rotation in one direction between the frame and the carrier. Means including a scale and a pointer is provided for indicating the extent of relative rotation between the frame and the carrier. As shown, this means comprises a circular scale 20 on the outer portion of the flange 12 and a pointer 22 on the carrier 14 and associated with the scale 20. The pointer 22 is preferably on a line through the center of the guides.

2

While the invention is not necessarily limited as to details, the construction shown has been found to be highly desirable and this will be described in detail.

The handle 10 of the frame comprises two sections 24 and 26. The handle section 26 is hollow and a core 28 is located therein, the said core being relatively rotatable for purposes of adjustment. A forward extension 30 on the core extends through apertures in the adjacent ends of the handle sections 24 and 26 and has a central threaded aperture. A screw 32 extends through a bushing 34 seated in a recess in the front end of the front handle section 24. This screw enters the threaded aperture in the core extension 30 and when the screw is tightened the two handle sections 24 and 26 and the core 28 are held in fixed relationship with each other.

A sleeve 36 is rotatably mounted on a rearward extension 38 of the core 28 and is held in place by means of a washer 40 and a screw 42. The before-mentioned carrier 14 is rigidly connected with a flange on the sleeve 36 by brazing or otherwise. Thus the carrier 14 is connected with the handle portion of the frame for relative rotation. The before-mentioned spring 18 surrounds the rearward extension 38 of the core, one end of the spring being entered in an aperture in the core proper and the other end of the spring being entered in an aperture in the flange on the sleeve 36. The spring is so wound and positioned that it resists rotation of the frame relatively to the carrier and the guides in the clockwise direction, as viewed in Fig. 2, or in the counterclockwise direction as viewed in Fig. 4. Relative rotation of the frame in the direction stated tends to wind the spring.

Preferably, a pin 44 extends forward from the flange on the sleeve 36 and is adapted to engage a pin 46 projecting inward from the wall of the handle section 26. The engagement of the pin 44 with the pin 46 serves to limit relative movement in the spring unwinding direction.

The yarn guides 16, 16 are preferably in the form of rotatable grooved wheels, so as to reduce friction to a minimum when the tensiometer is used with a moving strand of yarn. As shown, the carrier 14 is provided with two outward or rearward projecting bearing studs 48, 48 on which the grooved wheels 16, 16 are mounted. Preferably, ball bearings 50, 50 are interposed between the studs 48, 48 and the wheels 16, 16.

The flange 12 has an outward or rearward extending rim 52 and the before-mentioned scale 20 is engraved or otherwise formed on or attached to the rim 52. As indicated, the markings of the scale extend in steps of 10 from 0 to 100. The pointer 22 on the carrier 14 is located within the rim 52 and is adapted to register with the various markings on the scale. The markings are so spaced that the pointer directly indicates the tension in the strand of yarn, which tension may be measured in grams. Preferably, for a reason which will presently appear, the flange 12 is formed of a suitable transparent material such as a plastic material, so that the scale 20 and the pointer 22 can be observed from the front. Inasmuch as the scale 20 is to be observed from the front through the transparent flange 12, the figure markings thereof are reversed when viewed from the rear as in Fig. 2.

As shown, the carrier 14 is provided with laterally extending ears 54, 54 which carry rearward extending pins 56, 56. Each of the said ears projects in the counterclockwise direction, that is, in the direction opposite to the direction of relative rotation of the frame which is resisted by the spring 18.

When the tensiometer is in use, as shown in Fig. 4, the strand of yarn A, in which the tension is to be measured, extends partly around the two guides 16, 16 to form two relatively reverse loops with the main portions of the strand extending in opposite directions from the loops. The drawing shows a relatively thick strand A, but it will be understood that the tensiometer is particularly adapted for very small strands. The frame has been rotated in the counterclockwise direction with respect to the carrier 14 and the guides 16, such rotation having been effected in opposition to the spring 18. The line through the centers of the guides and through the axis of relative rotation is at a predetermined angle to the main portions of the strand and is preferably perpendicular thereto. The pointer 22 indicates on the scale 20 the extent of rotation of the frame additional to that of the carrier and guides and thus indicates the amount of tension in the strand of yarn. In the specific instance shown in Fig. 4, the tension is 40 grams. Inasmuch as the guides 16, 16 are freely rotatable wheels, little or no resistance is offered to movement of the strand of yarn and the tensiometer can be used to measure the tension in a rapidly moving strand.

In order that the loops shown in Fig. 4 may be conveniently formed, the tensiometer is initially positioned manually at the front of the strand of yarn, as shown in Fig. 3, the tensiometer being so positioned that the pointer 22 and the zero marking on the scale 20 are at the bottom. The strand of yarn A extends between the two guides 16, 16. Inasmuch as the flange 12 is transparent, the scale 20 and the pointer 22 can be readily seen from the front. Furthermore, the transparent flange enables the user to see the strand of yarn and the guides 16, 16 so that the device can be easily positioned with the strand between the guides.

It will be observed from Fig. 1 that the rear face of the flange 12 is adjacent the guides 16, 16 and is therefore adapted to engage the straight strand of yarn A shown in Fig. 3. This flange limits rearward movement of the tensiometer with respect to the strand so that the strand can be properly engaged by the guides to form loops as shown in Fig. 4. When the guides are grooved wheels, the rear face of the flange 12 is approximately in register with the front edges of the grooves in the wheels so that the strand is relatively positioned for entering the grooves.

With the tensiometer located as shown in Fig. 3, the user turns the handle 10 to rotate the entire device in the counterclockwise direction from the position shown in Fig. 3 to the position shown in Fig. 4. The handle 10 serves primarily to rotate the frame about an axis approximately coincident with the axis of relative rotation between the frame and the carrier. When the frame is so rotated, the spring 18 causes the carrier 14 to also rotate carrying the guides 16, 16 with it. Movement of the guides forms the described loops in the strand. As stated, the carrier and the guides are moved by the spring 18, and if there were no tension in the strand of yarn the spring would not be wound and all of the parts would rotate in unison, the pointer 22 remaining at or near the zero marking on the scale 20. However, when there is tension in the strand of yarn, such tension must be overcome and the spring 18 must be wound to an extent sufficient to overcome it. As the spring is wound, the frame with the scale 20 thereon moves to a greater extent than the carrier and the guides. The extent of additional rotation of the frame is indicated on the scale 20 by the pointer 22, thus indicating the tension in the strand of yarn. It will be understood that the rotation of the frame is continued until the line through the centers of the guides is substantially perpendicular to the main portions of the strand. Minor variations from the exact perpendicular relationship are immaterial, but any major variation would result in an incorrect reading.

The pins 56, 56 do not ordinarily function and may be entirely omitted if preferred. However, they are desirable to prevent any tangling or breaking of the strand in the event that the device is inadvertently turned in the counterclockwise direction far beyond the position shown in Fig. 4, as for instance 90° or more beyond such position. In the event of such excessive turning, the pins 56, 56 would prevent the main portions of the strand from engaging with the opposite yarn guides.

For purposes of calibration relative adjustment may be effected between the scale 20 and the pointer 22. In the construction as shown, the scale 20 is angularly adjustable with respect to the core 28 with which the spring 18 is connected and on which the carrier 14 with its pointer 22 is mounted. To effect such angular adjustment the screw 32 is loosened and the rear handle section 26, together with the flange 12, may be adjusted in one direction or the other with respect to the core 28 so as to obtain a correct indication of tension. After the adjustment has been made

the screw 32 is tightened to again lock the several parts in relatively fixed positions.

The invention claimed is:

1. In a tensiometer for a strand of yarn, the combination of two yarn guides adapted to engage two associated relatively reverse loops of a strand of yarn with the main portions of the strand extending in opposite directions from the loops, a carrier having an axis of relative rotation and supporting both of the guides at substantial equal distances from the axis and at diametrically opposite sides thereof, a frame connected with the carrier to permit relative rotation of the carrier about the said axis of relative rotation which frame is independently rotatable about the same axis, a spring connected with the carrier and with the frame for resisting rotative movement of the frame relatively to the carrier and guides which are prevented from rotation in unison with the frame by reason of the tension in the strand of yarn, and means including a scale and an associated pointer for indicating the extent of rotative movement of the frame in opposition to the spring and relatively to the carrier and guides and for thus indicating the tension in the strand of yarn when the frame has been rotated so that a line through the centers of the two guides is substantially perpendicular to the main portions of the strand.

2. In a tensiometer for a strand of yarn, the combination of two yarn guides adapted to engage two associated relatively reverse loops of a strand of yarn with the main portions of the strand extending in opposite directions from the loops, a carrier having an axis of relative rotation and supporting both of the guides at substantial equal distances from the axis and at diametrically opposite sides thereof, a frame connected with the carrier to permit relative rotation of the carrier about the said axis of relative rotation which frame is independently rotatable about the same axis, a spring connected with the carrier and with the frame for resisting rotative movement of the frame relatively to the carrier and guides which are prevented from rotation in unison with the frame by reason of the tension in the strand of yarn, a circular scale on the frame, and a pointer on the carrier associated with the scale and positioned on the line connecting the centers of the two guides, the said pointer indicating the extent of rotative movement of the frame relatively to the carrier and guides and thus indicating the tension in the strand of yarn when the frame has been rotated so that the said line through the centers of the two guides is substantially perpendicular to the main portions of the strand.

3. In a tensiometer for a strand of yarn, the combination of a carrier having an axis of relative rotation, two yarn guides supported on the carrier at substantial equal distances from the axis and at diametrically opposite sides thereof, a space being provided between the two guides for receiving an initially straight strand of yarn extending transversely of the aforesaid axis and the said guides upon rotative movement of the carrier and guides through approximately 180° serving to form two associated reverse loops in the strand with the main portions of the strand extending in opposite directions from the loops, a frame connected with the carrier to permit relative rotation of the carrier about the said axis of relative rotation which frame is similarly rotatable independently, a spring connecting the frame with the carrier for rotating the carrier and guides to form reverse loops as aforesaid when the frame is rotated, the said spring permitting the frame to rotate additionally to the carrier and guides to an extent dependent upon the resistance to carrier and guide rotation resulting from yarn tension at the loops, and means including a scale and an associated pointer for indicating the extent of the said additional rotation of the frame and for thus indicating yarn tension when the line through the carrier axis and through the centers of the two guides is substantially perpendicular to the main portions of the strand.

4. In a tensiometer for a strand of yarn, the combination of a carrier having an axis of relative rotation, two spaced yarn guides supported on the carrier at substantial equal distances from the axis and at diametrically opposite sides thereof, a space being provided between the two guides for receiving an initially straight strand of yarn extending transversely of the aforesaid axis and the said guides upon rotative movement of the carrier and guides through approximately 180° serving to form two associated reverse loops in the strand with the main portions of the strand extending in opposite directions from the loops, a manually supported frame connected with the carrier to support it and to permit relative rotation of the carrier about the said axis of relative rotation which frame is similarly rotatable manually and independently, a spring connecting the frame with the carrier for rotating the carrier and guides to form reverse loops as aforesaid when the frame is rotated, the said spring permitting the frame to rotate additionally to the carrier and guides to an extent dependent upon the resistance to carrier and guide rotation resulting from yarn tension at the loops, and means including a scale and an associated pointer for indicating the extent of the said additional rotation of the frame and for thus indicating yarn tension.

5. In a tensiometer for a strand of yarn, the combination of a frame comprising a handle, a carrier connected with the frame adjacent the flange and relatively rotatable about a longitudinal axis, two yarn guides on the carrier projecting outward therefrom at equal distances from the axis and at diametrically opposite sides thereof, the said guides being positioned to initially receive between them a straight strand of yarn extending transversely of the aforesaid axis and the said guides serving upon rotation of the carrier and guides from their initial positions to form two associated reverse loops in the strand with the main portions of the strand extending in opposite directions from the loops, a flange secured to the handle of the frame adjacent the guides for engagement with the said straight strand of yarn so that the said strand is relatively positioned for engagement by the guides upon rotative movement of the carrier and guides, a spring connecting the frame with the carrier for rotating the carrier and guides to form loops as aforesaid when the frame is rotated about its longitudinal axis, the said spring permitting the frame with its flange to rotate additionally to the carrier and guides to an extent dependent upon the resistance to carrier and guide rotation resulting from yarn tension at the loops, a circular scale on the flange of the frame, and a pointer on the carrier for indicating on the scale the extent of the said additional rotation of the frame and for thus indicating yarn tension.

6. In a tensiometer for a strand of yarn, the

combination of a frame comprising a handle, a carrier connected with the frame adjacent the flange and relatively rotatable about a longitudinal axis, two bearing studs on the carrier projecting outward therefrom at equal distances from the axis and at diametrically opposite sides thereof, rotatable circumferentially grooved wheels on the bearing studs constituting yarn guides, the said guides being positioned to initially receive between them a straight strand of yarn extending transversely of the aforesaid axis and the said guides serving upon rotation of the carrier and guides from their initial positions to form two associated reverse loops in the strand with the main portions of the strand extending in opposite directions from the loops, a flange secured to the handle of the frame adjacent the grooved wheels for engagement with the said straight strand of yarn so that the said strand is relatively positioned for entry into the circumferential grooves in the said wheels, a spring connecting the frame with the carrier for rotating the carrier and guides to form loops as aforesaid when the frame is rotated about its longitudinal axis, the said spring permitting the frame with its flange to rotate additionally to the carrier and guides to an extent dependent upon the resistance to carrier and guide rotation resulting from yarn tension at the loops, a circular scale on the flange of the frame, and a pointer on the carrier for indicating on the scale the extent of the said additional rotation of the frame and for thus indicating yarn tension.

7. In a tensiometer for a strand of yarn, the combination of a frame comprising a handle, a carrier connected with the frame adjacent the flange and relatively rotatable about a longitudinal axis, two yarn guides on the carrier projecting outward therefrom at equal distances from the axis and at diametrically opposite sides thereof, the said guides being positioned to initially receive between them a straight strand of yarn extending transversely of the aforesaid axis and the said guides serving upon rotation of the carrier and guides from their initial positions to form two associated reverse loops in the strand with the main portions of the strand extending in opposite directions from the loops, a flange secured to the handle of the frame adjacent the guides for engagement with the said straight strand of yarn so that the said strand is relatively positioned for engagement by the guides upon rotative movement of the carrier and guides, a spring connecting the handle portion of the frame with the carrier for rotating the carrier and guides to form loops as aforesaid when the frame is rotated about its longitudinal axis, the said spring permitting the frame with its flange to rotate additionally to the carrier and guides to an extent dependent upon the resistance to carrier and guide rotation resulting from yarn tension at the loops, a circular scale on the flange of the frame, a pointer on the carrier for indicating on the scale the extent of the said additional rotation of the frame and for thus indicating yarn tension, and means enabling the flange to be adjusted angularly with respect to the handle portion of the frame to vary the relationship between the scale and the pointer.

8. In a tensiometer for a strand of yarn, the combination of a frame comprising a handle and a transparent flange at one end thereof, a carrier connected with the frame adjacent the flange and relatively rotatable about a longitudinal axis, two spaced yarn guides on the carrier projecting rearward therefrom at equal distances from the axis, the said guides being adapted to initially receive a straight strand of yarn between them with the handle and flange at the front of the said strand and being adapted upon rotation of the carrier and guides from their initial positions to form two associated reverse loops in the strand with the main portions of the strand extending in opposite directions from the loops, a spring connecting the frame with the carrier for rotating the carrier and guides to form loops as aforesaid when the frame is rotated about its longitudinal axis, the said spring permitting the frame with its flange to rotate additionally to the carrier and guides to an extent dependent upon the resistance to carrier and guide rotation resulting from yarn tension at the loops, a circular scale on the flange of the frame which may be observed from the front, and a pointer on the carrier for indicating on the scale the extent of the said additional rotation of the frame and for thus indicating yarn tension, the said pointer being visible from the front through the said transparent flange.

9. In a tensiometer for a strand of yarn, the combination of a frame comprising a handle and a flange at one end thereof, a carrier connected with the frame adjacent the flange and relatively rotatable about a longitudinal axis, two spaced yarn guides on the carrier projecting outward therefrom at equal distances from the axis, the said guides being adapted to initially receive a straight strand of yarn between them and being adapted upon rotation of the carrier and guides from their initial positions to form two associated reverse loops in the strand with the main portions of the strand extending in opposite directions from the loops, a spring connecting the frame with the carrier for rotating the carrier and guides to form loops as aforesaid when the frame is rotated about its longitudinal axis, the said spring permitting the frame with its flange to rotate additionally to the carrier and guides to an extent dependent upon the resistance to carrier and guide rotation resulting from yarn tension at the loops, a circular scale on the flange of the frame, a pointer on the carrier for indicating on the scale the extent of the said additional rotation of the frame and for thus indicating yarn tension when the line through the centers of the guides is substantially perpendicular to the main portions of the strand, and two pins on the carrier adjacent the respective guides and spaced therefrom in directions opposite to the directions of movement of the guides to form the said loops, the said pins being adapted to engage and guide the yarn in the event that the guides move substantially beyond the positions in which the line through their centers is perpendicular to the main portions of the strand.

PAUL J. CAMPBELL.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,133,763	Williams	Oct. 18, 1938
2,312,419	King	Mar. 2, 1943
2,428,379	Naumann	Oct. 7, 1947