Dec. 16, 1958 N. E. KLEIN 2,864,566

TENSION DAMPER

Filed June 14, 1954 2 Sheets-Sheet 1

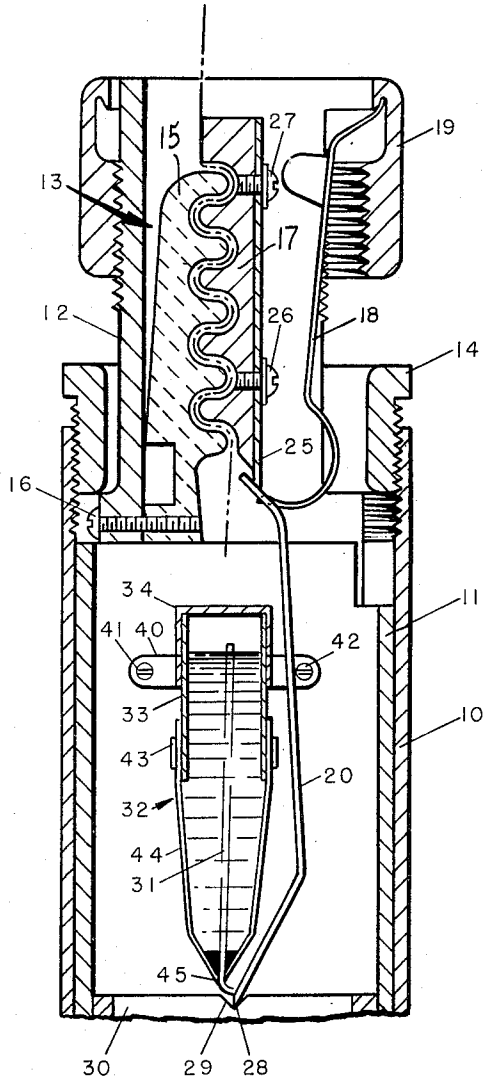

FIG.-1-

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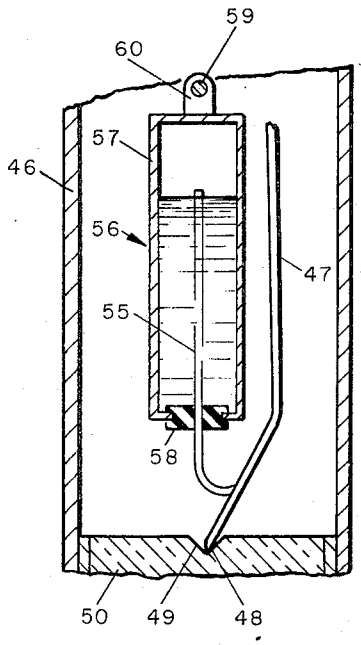

FIG.-2-

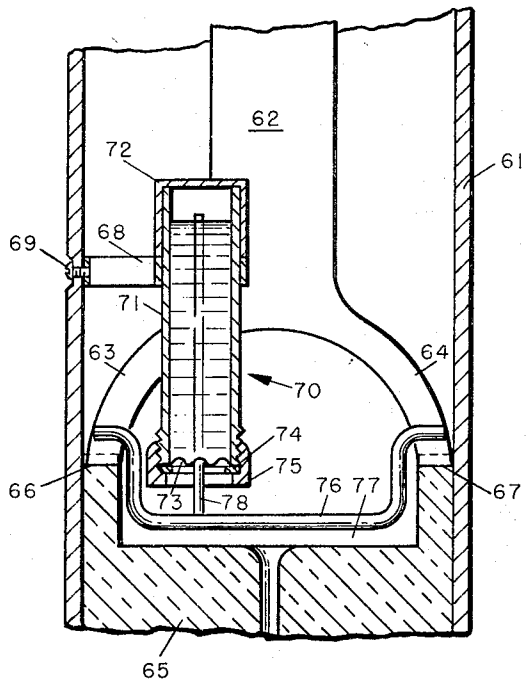

FIG.-3-

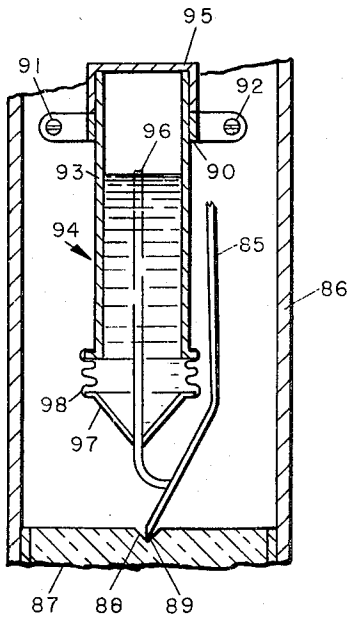

FIG.-4-

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2,864,566

TENSION DAMPER

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Application June 14, 1954, Serial No. 436,466

5 Claims. (Cl. 242—153)

This invention relates to motion dampers and more particularly to mechanical damping means suitable for use with yarn tension regulators and the like.

Yarn tension regulators are employed in the textile industry in conjunction with twisting apparatus, plying apparatus, and in many other instances. A most satisfactory form of tension regulator comprises a stationary yarn engaging member and a movable yarn engaging member cooperating therewith so that the tension in the yarn is regulated by movement of the movable member with respect to the stationary member, and while there are other types of tension regulators, substantially all have at least one movable member.

It is known that any tension regulator with a movable member tends to overcontrol if it is constructed to have a reasonable degree of sensitivity and it has been previously suggested that such regulators might advantageously be equipped with damping means. Little progress in this direction has been made, however, since there has not been available a simple damping means suitable for use with tension regulators and because of the difficulties encountered in providing a device of suitable dimensions and with satisfactory operating characteristics for use with such mechanisms.

It is a primary object of this invention to provide improved damping means suitable for use with yarn tension regulators and the like.

It is a further object of the invention to provide damping means which can be inverted without the loss of damping fluid and in which the damping fluid does not become contaminated by dirt, lint and fly.

A further object of the invention is to provide a damping chamber with a flexible arrangement for receiving an agitator such that negligible restraining force arises from resilient counteractions when the agitator is moved with respect to the chamber.

These as well as other objects of the invention are accomplished by a novel damping means comprising in combination an agitator or the like adapted to move in correlation to the movement of a member the motion of which is to be damped, a closed chamber adapted to receive at least a portion of the agitator means, and substantially non-resilient means adapted to permit movement of the agitator means with respect to at least a portion of the chamber.

It has been found that if the force required to move the agitator with respect to the damping chamber is due in large part to the resiliency of the seal between the agitator and the chamber, effective damping is not obtained, and that for best results the resiliency of the agitator mounting should account for no more than about 10% of the force required to move the agitator at velocities encountered in normal operation. If not more than about 10% of the force required to move the agitator, at average agitator velocities, is due to the resiliency of the agitator mounting, the mounting is considered in this specification and claims to be "substantially non-resilient."

Several preferred embodiments of the invention will

now be described with reference to the accompanying drawings in which:

Figure 1 is a sectional view of a preferred embodiment of the invention;

Figure 2 is a sectional view of a second embodiment of the invention;

Figure 3 is a sectional view of another embodiment of the invention; and

Figure 4 is a sectional view of still another embodiment of the invention.

With reference to the drawings in greater detail there is illustrated in Figure 1 the upper part of a pedestal such as may be employed in a textile twisting machine of, for example, the type disclosed in my copending U. S. application Serial Number 244,812, filed September 1, 1951, now Patent No. 2,811,013. The reference numeral 10 indicates the outer housing of the pedestal which is supported by the platform of the twister, not illustrated. Located partially within the sleeve or outer housing 10 is a cylindrical member 11 with an exposed extension 12 of smaller diameter. The member 11 constitutes the pedestal proper and serves as a housing for the yarn tension regulating device generally indicated by the reference numeral 13. A collar 14 threaded into the upper end of housing 10 serves to properly secure the member 11 in operating position.

The tension regulator 13 comprises a stationary member 15 which is rigidly secured by any suitable means such as screw 16 to the cylindrical member 11. Cooperating with the stationary yarn engaging member 15 is a movable yarn engaging member 17 which is urged toward the stationary member by any suitable means such as spring 18. When a strand of yarn is threaded between the two members 15 and 17, the output tension in the yarn tends to remain constant with large variations in input tension since the spring 18 is so disposed that the force with which movable member 17 is urged toward stationary member 15 decreases as the distance between the two members is increased. The tension in spring 18 may be varied by movement of a collar 19 threaded onto the upper end of extension 12.

Movable member 17 is supported by a pivot arm 20 the upper end of which is rigidly affixed to a plate 25 secured to the back of member 17 by any suitable means such as by screws 26 and 27. The lower end of pivot arm 20 is provided with a pair of knife edges 28 (only one of which is illustrated) resting in a pair of notches 29 on opposite sides of the upper end of a cylindrical platform 30. This arrangement permits limited pivotal movement of member 17 about knife edges 28.

Attached to pivot arm 20 in close proximity to knife edges 28 is an agitator rod 31 which extends upwardly in a plane substantially parallel to that in which the pivot arm 20 is movable. Enclosing the free end of agitator 31 is a fluid chamber, generally indicated by the reference numeral 32, which comprises a tubular member 33 provided with a close fitting cap 34. The tubular member 33 is rigidly secured in position by any suitable means such as for example a bracket 40 attached to member 11 by screws 41 and 42. Secured to the lower end of tubular member 33 by any suitable means such as by clamp 43 is an elongated flexible member 44 made from any suitable material such as neoprene. The flexible member 44 is provided with an orifice at 45 of such size as to permit entry of the agitator 31 into the chamber 32 but to prevent the loss of damping fluid from the chamber.

In operation, the yarn tension regulator 13 is threaded with a strand of yarn and chamber 32 is filled with any viscous liquid such as for example a silicone fluid sold under the trade name "Dow Corning 200 Fluid." When movable member 17 is pivoted about the axis of knife edge 28 because of the variations of tension in the strand

of yarn, it will be apparent that agitator means **31** will move in correlation to the movement of pivot arm **20**. It will also be seen that the agitator means **31** not only is pivoted with respect to the longitudinal axis of chamber **32** by the movement of pivot arm **20** but that agitator means **31** is also moved laterally with respect to the longitudinal axis of the chamber. The flexible member **44** accommodates both the lateral and pivotal movement of agitator means **31** while the rigid member **33** insures that when the agitator means is moved there will actually be a circulation of the fluid in the chamber rather than mere deformation of the chamber wall.

Since it is desirable that the resiliency of the system be as low as possible and since this necessitates as little lateral movement as possible of the portion of the chamber adjacent the point of entry thereinto of the agitator means **31**, it will be seen that it is advantageous that the point of entry of the agitator means into chamber **32** be as near the axis of rotation of pivot arm **20** as possible. It has been found that for best results, the distance of the point of entry of the agitator into the chamber from the axis of rotation of the pivot arm should be not more than about 1/5 the effective length of the agitator when the limits of movement are not more than about 20° and in this specification and claims when the point of entry of the agitator means into the fluid chamber is within this distance it is referred to as being within "close proximity" of the axis of rotation of the pivot arm. Under these conditions, the resiliency of the flexible member **44** is very low so that almost the entire force necessary to move the agitator means **31** is due to the damping action of the fluid in the container. The arrangement is thus capable of exerting near maximum efficiency in damping the movement of the member **17**.

Figure 2 illustrates another embodiment of the invention wherein a damping means is employed with a yarn tension regulator. Only a section of the pivot arm of the tension regulator means is illustrated but the remainder of the tension regulator means can be the same as illustrated in Figure 1. The reference numeral **46** indicates a cylindrical member within which the damping means is positioned. The pivot arm **47** extending from the movable regulator element (not illustrated) is provided with a pair of knife edges **48** (only one of which is illustrated) resting in notches **49** in the upper edge of a platform member **50**.

An elongated agitator **55** is attached to pivot arm **47** in close proximity to the knife edge **48** and extends upwardly in a plane substantially parallel to that in which pivot arm **47** is adapted for movement. Enclosing the free end of agitator **55** is a fluid chamber, generally indicated by the reference numeral **56**, comprising a rigid tubular member **57** having an orifice in its lower end. The orifice is provided with a resilient grommet **58** made of any suitable material such as neoprene and is adapted to receive the agitator means **55**. The chamber **56** is pivotally attached at its upper end to member **46** by means of a pivot pin **59** and a tab **60** so that it is free to pivot in substantially the same plane as that in which the agitator rod **55** is adapted for movement.

In operation the chamber **56** is filled with a viscous fluid to at least substantially cover the agitator **55**. When pivot arm **47** is moved about the axis formed by knife edge **48**, the chamber is pivoted about the axis of pin **59** because of the lateral movement of the agitator **55** at its point of entry into chamber **56**. As will be seen, the rubber grommet serves only as a means to permit the agitator **55** to move pivotally with respect to the longitudinal axis of chamber **56** while pivot pin **59** permits lateral movement of the agitator at its point of entry into chamber **56**.

Figure 3 of the drawings illustrates an embodiment of the invention suitable for use with a yarn tension regulator and again only the pivot arm of the regulator is illustrated. The embodiment of Figure 3 differs from those previously described in that in place of providing means to permit lateral movement of the agitator at the point of its entry into the chamber, lateral movement of the agitator at point of entry is substantially eliminated by a construction which places this point on the axis of rotation of the movable yarn engaging member.

In Figure 3 there is indicated by the reference numeral **61** a tubular member constituting a part of the pedestal of a textile twisting device, and within the member **61** is partially illustrated a pivot arm **62** of a yarn tension regulator such as described above. The pivot arm **62** has a bifurcated lower extremity with the legs **63** and **64** resting on opposite sides of a cylindrical support member **65**. The supporting ends of legs **63** and **64** are sharpened into knife edges at **66** and **67** and rest in a pair of suitable notches in the upper edge of the member **65**.

Supported by a bracket **68** secured to the inner wall of the tubular member **61** by any suitable means such as by screw **69**, is a fluid chamber generally indicated by the reference numeral **70**. The chamber **70** comprises a tubular body portion **71**, a close fitting cover **72**, and a flexible diaphragm **73** adapted to close the lower end of the chamber. The diaphragm **73** is secured in place by a washer **74** and a shoulder nut **75** threaded onto the end of tubular member **71**. The chamber **70** should be so positioned that the center of diaphragm **73** lies on a line running between the knife edges on legs **63** and **64** for reasons that will be made more apparent by subsequent paragraphs.

Attached at either end to the legs **63** and **64** by any suitable means such as by brazing is a cross member **76** which extends downwardly into a recess **77** in member **65** so that it passes below the lower end of chamber **70**. An agitator **78** is carried by the cross member **76** and extends upwardly into chamber **70** through a centrally positioned orifice in diaphragm **73**.

In operation, the chamber **70** is filled with a damping fluid to at least cover the agitator **78**. When the arm **62** is pivoted on the knife edges **66** and **67**, the agitator **78** is moved through the damping fluid but since the point of entry of the agitator into the damping chamber exactly coincides with the axis of rotation of arm **62** and therefore with the axis of rotation of agitator **78**, there is substantially no lateral movement of the agitator at its point of entry into the damping chamber and the diaphragm **73** need only accommodate the pivotal movement of the agitator. This it is capable of doing with only a negligible restraining force resulting from resilient counteractions.

Figure 4 of the drawings illustrates still another embodiment of the invention suitable for use with a yarn tension regulator, and again only the pivot arm of the regulator has been illustrated. The pivot arm, indicated by the reference numeral **85** is positioned within a cylindrical member **86** which constitutes a part of the pedestal of a textile twisting machine. Mounted within the member **86** is a platform member **87**, the upper peripheral rim of which provides a pair of grooves **88** (only one of which is shown) positioned on opposite sides of the rim for the seating of corresponding knife edges **89** on pivot arm **85**.

Rigidly positioned with respect to cylindrical member **86** by any suitable means such as bracket **90** and screws **91** and **92** is a rigid tubular member **93** which forms the body of a fluid chamber generally indicated by the reference numeral **94**. The tubular member **93** is provided with a close fitting cap **95** for its upper end thereby forming an inverted well which encloses the free end of an agitator rod **96** attached by its lower end to the pivot arm **85**. Near the point of its attachment to pivot arm **85**, the agitator **96** is provided with a flange **97** of substantially the same diameter as tubular member **93**. The flange **97** is connected to tubular member **93** by a flexible bellows **98** which completes the chamber **94**. The cylin-

drical bellows **98** can be attached to cylindrical member **93** and flange **97** by any suitable means such as for example by cementing.

In operation, the chamber **94** is filled, to a level sufficient to substantially cover the upper end of agitator rod **96**, with a viscous liquid such as a silicone fluid. When the pivot arm is moved about the axis of knife edge **89**, agitator rod **96** is moved accordingly through the viscous liquid in chamber **94** thus providing the desired damping action. It will be seen that the tubular bellows **98** provides for both the lateral movement and pivotal movement of agitator rod **96** with respect to tubular member **93**.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a yarn tensioning device having a first yarn engaging member, a second yarn engaging member, and a pivot arm attached to said second member whereby said second member is capable of limited movement about an axis remote therefrom, improved damping means comprising in combination elongated agitator means rigidly attached by one end to said pivot arm in close proximity to said axis and extending substantially parallel to the plane in which said pivot arm is movable, a fluid chamber enclosing a major portion of said agitator means and having a flexible fluid-tight seal at the point of entry of said agitator means into said chamber, said fluid-tight seal being disposed in close proximity to the pivot axis of said pivot arm, and said agitator means being fixed against substantial longitudinal movement along its length and being movable angularly about said axis in substantially angular synchronization with said pivot arm.

2. In a yarn tensioning device having a first yarn engaging member, a second yarn engaging member, and a pivot arm attached to said second member whereby said second member is capable of limited movement about an axis remote therefrom, improved damping means comprising in combination an elongated agitator means attached by one end to said pivot arm in close proximity to said axis and extending substantially parallel to the plane in which said pivot arm is movable, a rigid, elongated fluid container adapted to enclose the free end of said agitator means, said chamber being pivotally secured at one end and said chamber having an orifice in the unsecured end, and a flexible grommet in said orifice adapted to receive said agitator means and to permit pivotal movement of said agitator means with respect to said chamber, said grommet engaging said agitator at a point in close proximity to the pivot axis of said pivot arm to thereby provide substantially non-resilient means for permitting relative movement of said agitator with respect to said chamber.

3. In a yarn tensioning device having a first yarn engaging member, a second yarn engaging member, and a pivot arm attached to said second member whereby said second member is capable of limited movement about an axis remote therefrom, improved damping means comprising in combination elongated agitator means attached by one end to said pivot arm and extending through said

axis substantially parallel to the plane in which said pivot arm is movable, a rigid tubular container open at one end and adapted to enclose the free end of said agitator means and a flexible diaphragm covering the open end of said container, said diaphragm having an orifice to receive said agitator means positioned substantially on said axis, whereby when said pivot arm is moved with respect to said container there is substantially no lateral movement of said agitator at the point of contact with said diaphragm and substantially non-resilient means is provided for permitting relative movement of said agitator means with respect to said chamber.

4. In a yarn tensioning device having a first yarn engaging member, a second yarn engaging member, and a pivot arm attached to said second member whereby said second member is capable of limited movement about an axis remote therefrom, improved damping means comprising in combination elongated agitator means attached by one end to said pivot arm in close proximity to said axis and extending substantially parallel to the plane in which said pivot arm is movable, a rigid tubular container open at one end and positioned to enclose the free end of said agitator means, a flange on said agitator means, said flange being carried by said agitator means at a point in close proximity to the pivot axis of said pivot arm, and a flexible tubular corrugated sleeve forming a fluid-tight connection between said flange and the open end of said container to thereby provide non-resilient means to permit relative movement of said agitator with respect to said chamber.

5. In a yarn tensioning device having a first yarn engaging member, a second yarn engaging member, and a pivot arm attached to said second member, whereby said second member is capable of limited movement about an axis remote therefrom, improved damping means comprising an upstanding rod rigidly secured at its lower end to said pivot arm in close proximity to the pivot axis thereof, an elongated fluid container enclosing a major portion of said rod, said container including a rigid upper portion and an elongated, tapered, readily flexible lower portion, said lower portion forming, at its lower extremity, a fluid-tight seal with a portion of said rod which is in close proximity to the pivot axis of said pivot arm, said lower portion of said chamber thereby providing substantially non-resilient means for permitting movement of said rod with respect to the upper portion of said chamber, and securing means associated with said upper rigid portion to insure relative movement between said rigid portion and the free end of said rod upon movement of said pivot arm.

References Cited in the file of this patent

UNITED STATES PATENTS

2,222,847	Kent	Nov. 26, 1940
2,776,805	Klein	Jan. 8, 1957

FOREIGN PATENTS

200,630	Switzerland	Jan. 2, 1939