

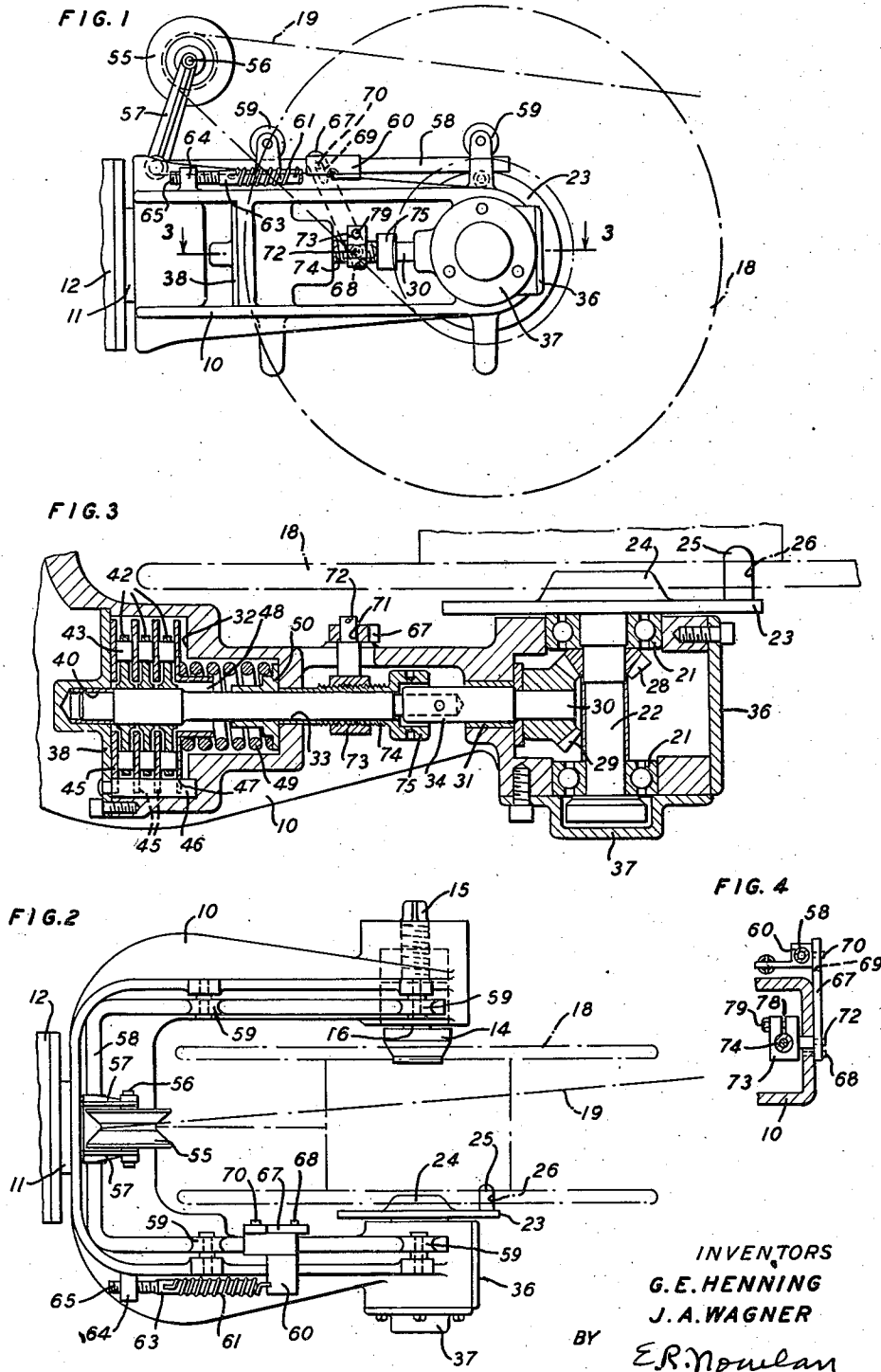
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TENSION CONTROL APPARATUS

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TENSION CONTROL APPARATUS

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This invention relates to tension control apparatus, and more particularly to apparatus for controlling the tension of a strand drawn from a supply reel in a strand twisting machine.

There are various types of strand twisting machines, the type of particular interest regarding this invention including rotary supports for supply reels to cause twisting of individual strands or groups of strands withdrawn from each reel prior to their being twisted together to form a cable. To produce a satisfactorily uniform cable it is important to apply a constant known tension to the strands, that they may be given like individual twists and may lie evenly in the cable they help to form. In the application of tension to a strand, withdrawn from a reel rotated by the withdrawal of the strand and simultaneously revolved about an axis normal to the axis of the reel, there exists the added problem of eliminating the effect of centrifugal force on the tensioning means.

An object of the invention is to provide a simple, efficient and highly practical tension control apparatus free of variations by centrifugal force.

With this and other objects in view, the invention comprises a tension control apparatus for a strand withdrawn from a supply reel rotatable about its axis by the withdrawal of the strand and revoluble about an axis normal to the axis of the reel, a brake on an axis at right angles to the reel axis under the control of the strand effecting rotation of the reel during any variation in the tension of the strand.

Other objects and advantages will be apparent from the following detailed description when taken in conjunction with the accompanying drawing, wherein

Fig. 1 is a side elevational view of a fragmentary portion of a strand twisting machine embodying the invention;

Fig. 2 is a top plan view of the structure shown in Fig. 1;

Fig. 3 is an enlarged horizontal sectional view taken along the line 3—3 of Fig. 1, and

Fig. 4 is a fragmentary detailed view of a portion of the apparatus.

Referring now to the drawing, attention is first directed to Figs. 1 and 2, which illustrate U-shaped supporting bracket 10 fixed near its center to an end of a shaft 11 for rotation about the axis of the shaft by suitable means (not shown) connected to the other end of the shaft. The shaft 11 is journaled in a bearing housing 12, the latter being a part of a strand twisting

machine. The strand twisting machine may include a plurality of units, such as shown in Figs. 1 and 2, depending upon the number of strands to be singly twisted and subsequently inter-twisted to form a cable. Further details of the machine are not believed essential to illustrate the invention, as the invention lies in the single unit illustrated in the drawing.

One end of the bracket 10 has a cone 14 adjustable axially by a screw 15 and otherwise rotatably mounted on a shaft portion 16 journaled in the end of the bracket and engaged by the screw. The cone 14 is formed to engage the hub of a supply reel 18, the latter being provided with a supply of strand material 19, the tension of which is to be controlled while being withdrawn from the reel.

The other end of the bracket 10 is formed as illustrated in Figs. 2 and 3, this end being hollow and providing apertures for bearings 21 to rotatably support a shaft 22 axially aligned with the reel 18. A disk-like member 23 is fixed to the shaft 22 and has a cone-shaped portion 24 whose function is similar to that of the cone 14 in entering the hub of the reel 18 to support the reel. A pin 25 fixed to the member 23 is positioned to enter an aperture 26 of the reel to provide a positive connection between the reel and the shaft 22.

A bevelled gear 28 is mounted upon the shaft 22 and fixed for rotation with the shaft. This gear is disposed in interengagement with a bevelled gear 29, the latter being fixed to the adjacent end of a brake shaft 30 which extends through a bearing 31 in a wall of the hollow end of the bracket 10 and into another hollow portion 32 of the bracket through an aperture 33. In actual construction the shaft 30 is in two parts, as illustrated in Fig. 3, these parts being joined by a telescoping connection indicated at 34. Suitable covers 36 and 37 are provided for the hollow end of the bracket 10 and a suitable cover 38 is provided for the hollow portion 32 of the bracket.

Cover 38 is formed to provide a bearing 40 for the adjacent end of the shaft 30. On this end of the shaft 30 a plurality of brake elements 42 is mounted for rotation with the shaft, these elements being disk-like in general contour and having a plurality of friction members 43 disposed in spaced apertures therein. The mounting of the brake elements on the shaft 30 is made through keys and keyways or spline connections (not shown) to permit axial movement of the switch elements relative to the shaft 30, yet will

maintain positive connection for rotation of the elements with the shaft. Brake members 45 are positioned alternately with the brake elements 42, as illustrated in Fig. 3, one brake member being disposed at each end of the group of brake elements, the other brake members being interposed between the brake elements. Suitably spaced cross pieces 46, only one of which is shown in the drawing, are fixedly mounted in the hollow portion 32 of the bracket 10, or, if desired, these portions may be made integral with the bracket, they being received in notches 47 of the brake members 45, to hold the brake members against rotation with the shaft 30, yet permit axial movement thereof relative to the shaft. The innermost brake member 45 has a tubular portion 48 integral therewith and disposed concentric with the shaft 30 to serve as a support for one end of a spring 49. The other end of the spring is supported by a tubular member 50 disposed in the hollow portion 32 adjacent the inner wall thereof and concentric with the shaft 30.

During rotation of the reel 18 through the withdrawal of the strand 19, the shaft 22 is rotated, causing rotation of the shaft 30 through the gears 28 and 29, thus rotating the brake elements 42 relative to the brake members 45. The force of the spring 49 on the adjacent member 45 causes axial movement of the brake members and the brake elements into closer engagement with each other to create a braking force transmitted back to the reel through the shafts 30 and 22 and their driving connections to apply a tension on the strand 19.

Means is provided to vary the force of the spring 49 by variations in the tension of the strand, to function in maintaining a substantially constant tension in the strand. This means includes a sheave 55 over which the strand travels while being withdrawn from the reel. The sheave 55 is rotatably mounted at 56 between arms 57 which are fixed at their lower ends to a U-shaped support 58. In the present structure the support 58 is circular in cross-sectional contour, the legs thereof lying substantially parallel to the legs of the bracket 10 and extending between sets of supporting rolls 59. The sets of supporting rolls are identical with each other and are supported by shafts journaled in brackets integral with the legs of the bracket 10 (Figs. 1 and 2). As illustrated in Fig. 1, the lower rolls of the sets of supporting rolls 59 are cylindrical in contour, while the upper rolls thereof, as shown in Fig. 2, are concave to conform to the contour of the legs of the support 58 to maintain accurate positioning of the support during movement thereof.

A bracket 60 is fixed to one leg of the support 58 at a position shown in Fig. 2, and by any suitable means (not shown). A spring 61, having one end fixed to the bracket 10, functions to normally urge the support to the left to normally urge the sheave 55 away from the reel 18 to a given position. The other end of the spring 61 is fixed to an adjusting pin 63 about which the spring is disposed, a threaded lug 64 integral with the bracket 10 receiving a threaded portion 65 of the pin for adjustment of the pin relative to the bracket 60 to vary the force of the spring 61.

A lever 67, pivotally mounted at 68 (Figs. 1 and 4), has an elongate aperture 69 in the upper end thereof to receive a pin 70, the latter being carried by the bracket 60. The pivot 68 is in the form of a pin carried by the adjacent arm of the bracket 10. Adjacent the pivot 68, but inter-

posed between the pivot and the pin 70, is an aperture 71 in the lever to receive a shaft-like portion 72 of a nut 73. The nut 73 is threadedly disposed upon an externally threaded tubular screw 74 disposed concentric with the shaft 30 but not rotatable therewith. One end of the screw 74 is of a sufficient contour to be slidably disposed in the aperture 33 and to engage the adjacent end of the tubular member 50 associated with the spring 49. The other end of the screw 74 has a head 75 through the aid of which, assisted by a suitable tool, adjustment may be made between the screw 74 and the nut 73 to vary the normal force of the spring 49 on the brake members and brake elements and to vary the effect of the brake controlling means resulting from variations in the tension of the strand and including the support 58 and its operative connection with the screw 74. As shown in Fig. 4, the nut 73 is split as at 78 so that it may be caused to grip the screw 74 and be locked thereon in any adjusted position through the aid of a screw 79. Adjustment of the nut 73 is another means in addition to the adjustment of the pin 63 to vary the setting of the braking force on the reel. The force in the spring 49 influencing the brake elements and members is initially controlled by the force in the spring 61 which is transmitted to the spring 49 through the connecting means of the two springs and influenced greatly by the lever 67. The relation of the spring connections 70 and 72 with the lever and the pivot 68 thereof renders the small spring 61 effective to control the force in the large spring 49.

During the operation of the machine the reel 18 will be rotated about its axis through the withdrawal of the strand 19 therefrom. During this action the reel is revolved about the axis of the shaft 11, which is normal to the reel axis. Rotation of the reel 18 through its connection 25-26 with the member 23 will cause rotation of the shaft 22 on its axis which is aligned with the axis of the reel. However, the shaft 30, through the gears 28 and 29, is driven on an axis at right angles to the axis of the reel. This causes relative rotation of the brake elements and brake members, affected by the force of the spring 49, to apply a braking force back through the shaft 30, the gears 29 and 28, the shaft 22, to the reel 18, effectively applying a predetermined tension to the strand 19.

If the tension in the strand should increase beyond the tension normally desired, the strand will pull the sheave 55 toward the reel 18, causing movement of the support 58 between the sets of supporting rolls 59 against the force of the spring 61, effecting a rocking movement of the lever 67 in a clockwise direction (Fig. 1). This movement of the lever 67 about its pivot 68 causes movement of the nut 73 to the right (Fig. 1) to decrease the force of the screw 74 on the spring 49, through the tubular member 50, and thus decrease the braking force of the brake elements 42 and members 45 on the reel. The decrease in the force of the spring 49 will decrease the frictional force between the brake members and brake elements to thus decrease the braking force on the reel, allowing the strand to more freely rotate the reel until the tension on the strand has been reduced to that normally desired. During normal operation of the apparatus the tension in the strand creates a pull on the spring 61 to maintain the normal selected force in the spring 49 and thus the normal braking force on the reel.

If, however, the tension in the strand should decrease from that normally desired the spring 81 will be free to apply additional force to the spring 49 through the connecting means of the two springs, resulting in added braking force to the reel, even to stopping the reel if, for example, the strand should break.

With the brake elements and members disposed on an axis normal to the axis of the reel, they may function, with their associated mechanism linking them with the reel and the strand, undisturbed by centrifugal force. If, for example, the brake members and elements should be mounted on the shaft 22 to function therewith instead of the shaft 30 during revolution of the reel about the axis of the shaft 11, this axis normal to the axis of the reel, centrifugal force would tend to move the brake members and elements closer together with variations in the speed of the revolution of the reel, thus rendering the braking means ineffective to maintain a constant tension on the strand. Such effects of centrifugal force are removed, however, by positioning the brake members and elements on an axis of a shaft normal to the axis of the reel, where of course it will not interfere with their functions. Furthermore, the brake elements and members lie in planes at right angles to the axis of revolution unaffected by centrifugal force created by the revolution of the reel.

Attention is also directed to the mechanism interposed between the strand and the brake mechanism, namely the support or carriage 58, the arms 57 and the lever 67 which are also unaffected by centrifugal force. If the conventional tension arm of the pivotal type should be employed it is apparent that the result of centrifugal force thereon during the rotation of the apparatus about the shaft 11 would make it impossible to maintain a uniform tension on the strand. However, in the present structure the centrifugal force affecting the support 58 is consumed by the rolls 59, the latter permitting free movement of the carriage with light strand tension despite the high relative speeds.

The embodiment of the invention herein disclosed is merely illustrative and may be widely modified and departed from in many ways without departing from the spirit and scope of the invention as pointed out in and limited solely by the appended claims.

What is claimed is:

1. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a brake element operatively connected to the reel for rotation thereby about an axis disposed at right angles to the reel axis, a brake member held against rotation with the brake element and cooperating therewith to apply a braking force to the reel to create a given tension in the strand, and means controlled by the strand to affect the brake element and member to vary the braking force with variations in the tension of the strand.

2. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a brake element operatively connected to the reel for rotation thereby about an axis disposed at right angles to the reel axis, a brake member held against rotation with the brake element, force applying means to cause relative movement of the element and member to apply a predeter-

mined braking force to the reel and establish a predetermined tension in the strand, and means controlled by the strand to affect the force applying means to vary the said braking force with variations in the tension of the strand.

3. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a brake element and a cooperating brake member lying in planes at right angles to the axis about which the reel revolves, force applying means to cause relative movement of the element and member to apply a predetermined braking force to the reel and establish a predetermined tension in the strand, and means controlled by the strand to affect the force applying means to vary the said braking force with variations in the tension of the strand.

4. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a brake element operatively connected to the reel for rotation thereby about an axis disposed at right angles to the reel axis, a brake member held against rotation with the brake element, force applying means to cause relative movement of the element and member to apply a predetermined braking force to the reel and establish a predetermined tension in the strand, means to vary the force applying means to cause variation of the said given tension in the strand, and means controlled by the strand to affect the force applying means to vary the said braking force with variations in the tension of the strand.

5. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a sheave about which the strand travels on leaving the reel, a support for the sheave movable by the strand during variations in the tension thereof, a brake element operatively connected to the reel for rotation thereby about an axis disposed at right angles to the reel axis, a brake member held against rotation with the brake element and cooperating therewith to apply a braking force to the reel to create a given tension in the strand, means controlled by the strand to affect the brake element and member to vary the braking force with variations in the tension of the strand, and means actuated by movement of the support to affect the brake element and member to vary the braking force with variations in the tension of the strand.

6. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a sheave about which the strand travels on leaving the reel, a support for the sheave movable by the strand during variations in the tension thereof, a brake element operatively connected to the reel for rotation thereby about an axis disposed at right angles to the reel axis, a brake member held against rotation with the brake element, a spring to apply a given force to the brake element and member to cause relative movement thereof to apply a predetermined braking force to the reel and establish a predetermined tension in the strand, and means controlled by the support to vary the force of the spring.

7. A tension control apparatus for a strand being withdrawn from a supply reel rotated about

its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a sheave about which the strand travels on leaving the reel, a support for the sheave movable by the strand during variations in the tension thereof, a brake element operatively connected to the reel for rotation thereby about an axis disposed at right angles to the reel axis, a brake member held against rotation with the brake element, a spring to apply a given force to the brake element and member to cause relative movement thereof to apply a predetermined braking force to the reel and establish a predetermined tension in the strand, means controlled by the support to vary the force of the spring, and means to alter the variations in the force of the spring by the support.

8. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a shaft driven by the reel and disposed at right angles to the axis of the reel, a brake element driven with the shaft, a brake member held against rotation with the shaft, and means to cause relative axial movement of the brake element and member to cause application of a braking force through the shaft to the reel.

9. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a shaft driven by the reel and disposed at right angles to the axis of the reel, a brake element driven with the shaft, a brake member held against rotation with the shaft, and a spring to apply a force to the brake element and member to cause relative axial movement thereof to cause application of a braking force through the shaft to the reel.

10. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a

shaft driven by the reel and disposed at right angles to the axis of the reel, a brake element driven with the shaft, a brake member held against rotation with the shaft, a spring to apply a force to the brake element and member to cause relative axial movement thereof to cause application of a braking force through the shaft to the reel, and means disposed concentric with the shaft to cause variations in the force of the spring.

11. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a sheave about which the strand travels on leaving the reel, a support for the sheave movable by the strand during variations in the tension thereof, a shaft driven by the reel and disposed at right angles to the axis of the reel, a brake element driven with the shaft, a brake member held against rotation with the shaft, and means actuated by the support to cause the brake element and member to apply a braking force to the reel variable with variations in the tension of the strand.

12. A tension control apparatus for a strand being withdrawn from a supply reel rotated about its axis by the withdrawal of the strand and revolved about an axis normal to the reel axis, a sheave about which the strand travels on leaving the reel, a support for the sheave movable by the strand during variations in the tension thereof, a shaft driven by the reel and disposed at right angles to the axis of the reel, a brake element driven with the shaft, a brake member held against rotation with the shaft, a spring to apply a force to the brake element and member to cause relative axial movement thereof to cause application of a braking force through the shaft to the reel, and means controlled by the support to vary the said spring and braking forces.

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