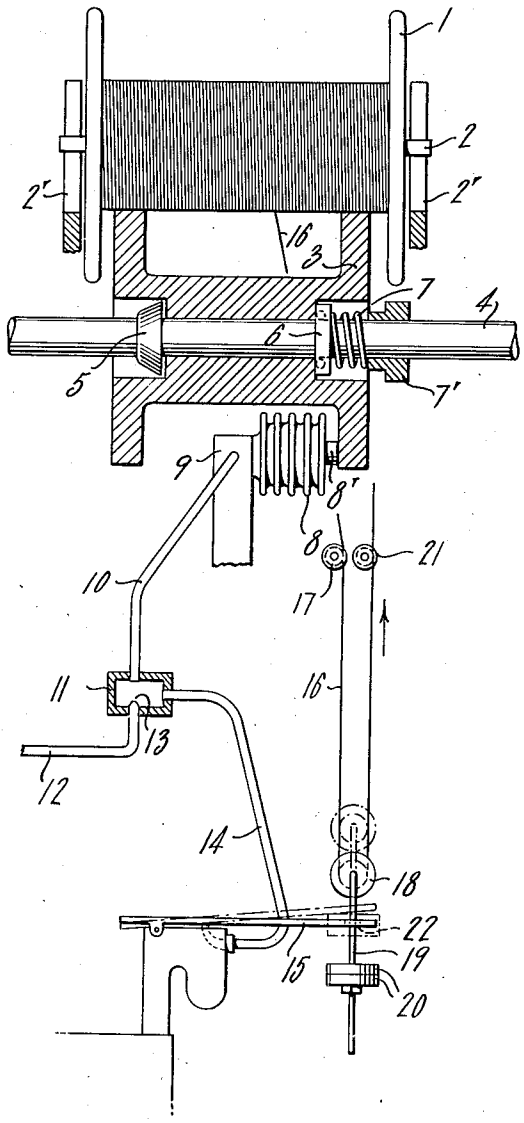
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CONSTANT TENSION CONTROL FOR ELASTIC FILAMENTS

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## CONSTANT TENSION CONTROL FOR ELASTIC FILAMENTS

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This invention relates to a constant tension control for elastic filaments, and more particularly to a tension control for rubber thread as supplied to a covering machine.

Covered elastic yarns in common use in the textile industry for weaving and knitting purposes are not made by covering the rubber core with textile yarns while the core is relaxed, because for most purposes this would produce a finished elastic yarn having very little extensibility and insufficient contractive force or "kick". Instead the elastic core is covered while held under tension at a constant elongation, the elongation and the covering construction being chosen so as to produce a finished elastic yarn having as nearly as possible the desired extensibility and kick. However, due to small variations in cross sectional area of the elastic core, particularly in the smaller sizes, and also due to slight variations in vulcanization and variations in the tension under which the completed rubber core is wound or spooled, there has been an unavoidable and relatively wide variation in the extensibility of the finished elastic yarn after it comes from the covering machine.

An object of the present invention is to provide an apparatus for imparting a constant tension to a traveling elastic filament.

Another object is to provide an apparatus for imparting a constant tension to an elastic filament as it is unreeled and simultaneously therewith controlling its rate of unreeling to correspond.

Other objects will appear from the detailed description and drawing, in which latter:

The figure is a more or less diagrammatic view illustrating one form of the invention.

In the drawing there is shown an apparatus more particularly designed for imparting a constant tension to a rubber core as it is unreeled from a spool and fed to a machine for applying coverings to the core. However, it will be obvious that the invention is not limited to such use and may be applied generally for use in winding rubber cores or other elastic filaments under a constant tension.

In the drawing, the numeral 1 designates a spool of rubber thread, the spindle 2 of which is mounted in slotted guides 2' so that the spool may rest by gravity on the flanged drum 3 rotatably and slidably mounted on the drive shaft 4. The shaft 4 may be clutched in driving relation to the drum 3 by means of the ball thrust bearing 6 which is slidable on the shaft 4 and is urged against one end of the hub of drum 3 by spring 7, and by clutch collar 5 which is fixed on the shaft and frictionally engages the other end of the hub, thus transmitting the full driving torque of the shaft to the drum and causing the latter to rotate at the speed of the shaft. Spring 7 is retained on the shaft by collar 7' fixed to the shaft.

In order to controllably retard the speed of the drum relative to the shaft, or to stop the rotation of the drum altogether, there is provided a brake operated by a fluid pressure controlled bellows. The bellows 8 carries a friction member 8' at its free end adapted to engage the flange of drum 3, the other end of the bellows being fixedly mounted on a support 9. In the inoperative position of the brake, the bellows is deflated and the friction member 8' is disengaged from the drum. In operative position, the bellows is at least partially inflated and urges friction member 8' against the flange of drum 3 in such a direction as to oppose the thrust of bearing 6 against the drum, thus partially or completely releasing the drum from engagement with collar 5. It is seen that, by controlling the fluid pressure in the bellows, the braking action of the friction member 8' on the flange of the drum and the degree of slippage between the drum hub and collar 5 may be controlled so that the drum will rotate at any required intermediate speed.

By reason of the gravity support of the spool 1 on the drum 3, the rubber thread will be unreeled from the spool at the peripheral speed of the drum 3, irrespective of the size of the package of rubber thread on the spool.

Communicating with the bellows 8 through a pipe 10 is a pressure control chamber 11, to which air or other fluid is supplied under constant pressure by supply pipe 12 and reduced nozzle 13. Also leading from the chamber 11 is an air-leak pipe 14, the reduced end of which may be partially or completely closed by the pivoted valve lever 15, thus providing control of the pressure in chamber 11 and hence of the pressure in bellows 8. In the drawing there is shown in full lines for illustration purposes one position which the parts may assume, with the valve lever 15 completely closing the end of the air leak pipe 14, the brake 8' fully engaging the flange of drum 3, and the drum entirely withdrawn from contact with clutch collar 5.

The rubber thread 16, upon delivery from the spool 1, is led around a fixed guide pulley 17 and then around the floating pulley 18, which latter by means of the rod 19 carries the variably fixed weights 20. The rubber thread 16 after leaving

the floating pulley 18 then passes around the fixed guide pulley 21 and thence to the covering apparatus or a windup reel or spool. The rod 19 of the pulley 18 passes through an opening 22 in the pivoted valve lever 15.

In operation it will be seen that by varying the number of weights 20 the desired amount of tension may be placed upon the rubber thread 16 and by reason of the floating character of the pulley 18, this tension will be constant, regardless of the length of the suspended loop of thread. If, by reason of any variation in cross section of the rubber thread, or in its degree of vulcanization or its winding tension, there is any change in the elongation of the thread 16 as it is delivered from the spool 1, there will be a corresponding change in the length of the suspended loop of thread. This will cause the pulley 18 to rise or fall depending upon whether the thread 16 decreases or increases in its elongation. Upon any decrease in elongation sufficient to lift the weights 20 into contact with the pivoted valve lever 15, the air-leak valve at the end of pipe 14 will at least be partially opened and the air pressure in the bellows 8 will accordingly be reduced, permitting the bellows to deflate and thus reducing the braking action of the brake 8' on the drum 3. When this occurs the spring 7 and thrust bearing 6 operate to increase the thrust of the drum hub against collar 5, whereby a greater driving torque is transmitted to the drum, and the speed of rotation of the drum and accordingly that of the spool 1 is increased. The resulting increase in the rate of delivery of thread from the spool thus compensates for the decrease in its elongation. Upon an increase in the length of the suspended loop of thread, the weights 20 drop, the valve lever 15 closes the air-leak valve, the fluid pressure in the bellows 8 is increased and the bellows expands, thereby causing the brake 8' to engage the flange of the drum 3, thus retarding its rotation and also at least partially releasing the driving engagement between the collar 5 and the drum. The resulting decrease in the rate of delivery of thread from the spool thus compensates for the increase in its elongation.

In normal operation of the mechanism the air-leak valve remains in a partly closed position which varies slightly according to variations in the elongation of the thread, thus effecting a continuous throttling control on the brake and clutch. The mechanism is instantly responsive to slight variations in the elongation of the thread, and accordingly the rate at which thread is unwound from the spool is so accurately controlled that the length of the suspended loop of thread remains substantially constant. Obviously, the smoothness with which the throttling action operates may be increased by increasing the leverage ratio of lever 15.

In the following table there are shown the results obtained with two different constructions of covered elastic yarn, a portion of each construction having been covered by the prior art procedure and another portion having been covered with the use of the tension control of the present invention. In construction "A" there was used as the elastic core a round thread of rubber deposited directly from latex and of size 125's. By "125's" is meant that 125 of the threads laid side by side will measure one inch across. In this construction the inner and outer coverings were oppositely helically wrapped on the tensioned core and each covering was of two ends of 140/1 cotton yarn.

In construction "B" the elastic core was of rubber deposited directly from latex and of size 100's; the inner cover was of one end of 50/1 cotton yarn while the outer cover was of 2 ends of 100/1 cotton yarn.

In order to secure as great uniformity as possible, rubber thread from four different spools was used in the covering of each construction. The covering was done on two adjacent spindles of the same machine, one equipped with the regular let-off and the other equipped with the core tension control of the present invention. The finished yarns were tested at regular intervals along their lengths by hanging a 6½ oz. weight on a 5'' loop (10 inch length) of the yarn and measuring the elongation. The frequency of occurrence of various elongations is shown in the following table, but as the elongations of the series shown in the table differ by 5% and the actual elongations measured sometimes differed by less than this amount, the tests at each elongation in the table include those differing by plus or minus 2½% from the specified one.

*Construction "A"*

| Elongation % | 120 | 125 | 130 | 135 | 140 | 145 | 150 | Total tests |
|---|---|---|---|---|---|---|---|---|
| No. tests regular | 1 | 2 | 3 | 19 | 16 | 12 | 2 | 55 |
| No. tests new | ----- | ----- | 3 | 11 | 33 | 8 | ----- | 55 |

*Construction "B"*

| Elongation % | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | Total tests |
|---|---|---|---|---|---|---|---|---|---|---|
| No. tests regular | ---- | 1 | 3 | 4 | 29 | 20 | 29 | 12 | 2 | 100 |
| No. tests new | 5 | 23 | 48 | 14 | 10 | 1 | ---- | ---- | ---- | 101 |

It will be seen from the table that, in the case of yarn of construction "A", the yarn made in the usual manner varied in elongation values over a range of 30% while the yarn made by the use of the present invention varied in elongation values over a range of only 15%. If 135% elongation be taken as the norm in the usual construction, then in only 19 tests or 34.5% of the total was the elongation within 2½% of the norm, while taking 140% elongation as the norm for yarn made by the invention, then in 33 tests or 60% of the total the elongation was within 2½% of the norm.

In the case of yarn of construction "B", the yarn made in the usual manner varied in elongation values over a range of 35%, while the yarn made by the use of the invention varied in elongation values over a range of only 25%. If 110 or 120% elongation be taken as the norm in the usual construction, then in only 29 tests or 29% of the total was the elongation within 2½% of the norm, while taking 100% elongation as the norm for yarn made by the invention, then in 48 tests or 47.5% of the total the elongation was within 2½% of the norm.

It will be seen from the above that by the use of the invention the uniformity in elongation of the covered thread has been greatly increased, and thereby variation in fabrics employing the covered elastic thread is greatly reduced.

While the invention has been specifically described in connection with the covering of a rubber core to make elastic yarns, it is obvious, as before pointed out, that it is also capable of use

in winding rubber thread, or elastic filaments in general, under a uniform tension.

Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. A constant tension control for elastic filaments comprising supply means for delivering the filament, a weighted element adapted to be movably supported by the delivered filament, a bellows for controlling delivery from said supply means, means for supplying a gaseous medium under pressure to said bellows, a relief valve for the bellows, and means actuated by said weighted element for operating said valve.

2. A constant tension control for filaments, comprising a spool for the filament, rotary drive means for unwinding the filament from said spool, a drive shaft, a clutch for driving said drive means from said shaft, a brake operable to engage and shift said drive means along said shaft away from the clutch to release said clutch, and means for controlling the brake from said filament, said brake and clutch being constructed and arranged whereby as the pressure of the brake against said drive means is increased the latter will be forced away from said clutch.

3. A constant tension control for filaments, comprising a spool for the filament, a drive shaft, a spool driving drum rotatably and slidably mounted upon said shaft, a clutch for driving the drum from said shaft, a brake adapted to engage said drum and move it away from said clutch, and means for controlling the brake from said filament whereby as the brake action is increased the clutch action will be decreased.

4. A constant tension control for filaments, comprising a spool for the filament, a drive shaft, a spool driving drum rotatably and slidably mounted upon said shaft, a clutch for driving the drum from said shaft, a brake adapted to engage said drum and move it away from said clutch, and fluid pressure mechanism for operating said brake and controlled by the delivered filament whereby as the brake action is increased the clutch action will be decreased.

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