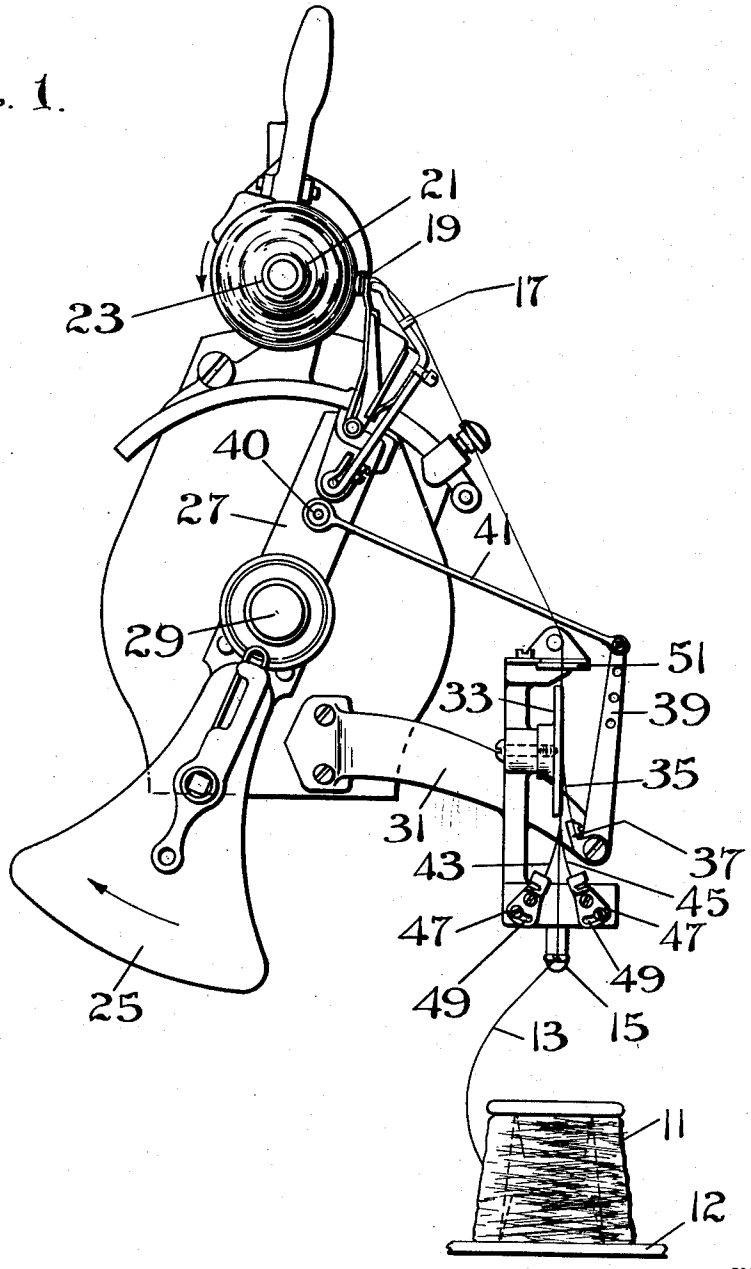
Dec. 3, 1940. A. E. GUENTHER 2,223,912

THREAD PRODUCTION

Filed May 24, 1938 2 Sheets-Sheet 1

Fig. 1.



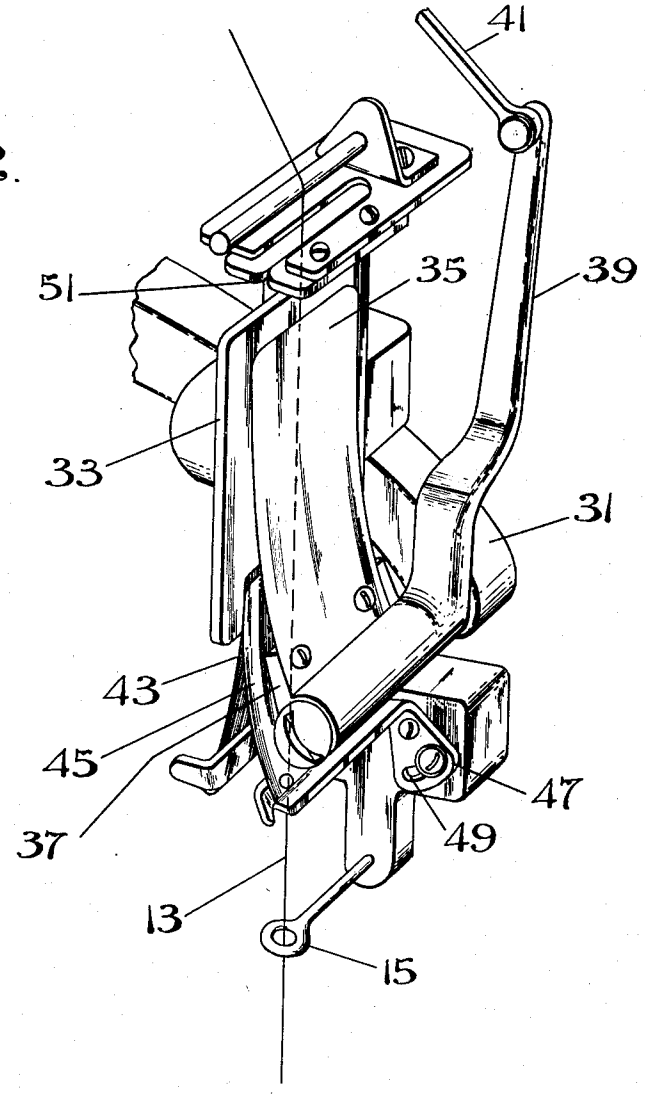
INVENTOR.
Arthur E. Guenther
BY
Louis Auiebe
ATTORNEYS.

Dec. 3, 1940. A. E. GUENTHER 2,223,912

THREAD PRODUCTION

Filed May 24, 1938 2 Sheets-Sheet 2

Fig. 2.



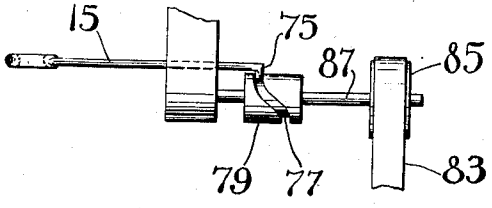


Fig. 3

INVENTOR.
Arthur E. Guenther
BY Louis Allis
ATTORNEYS.

Patented Dec. 3, 1940

2,223,912

UNITED STATES PATENT OFFICE

2,223,912

THREAD PRODUCTION

Arthur E. Guenther, Buffalo, N. Y., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware

Application May 24, 1938, Serial No. 209,653

8 Claims. (Cl. 242—45)

This invention relates to thread production, and more particularly, it relates to an improved thread tensioning device for imparting a uniform tension on a thread during the winding thereof. The tensioning device of this invention has particular utility in the tensioning of a thread which is being precision-wound onto a core while it is being unwound from a package, the unwind necessitating a pull of varying tension on the thread.

In the precision-winding of thread on a core, it is necessary to have, at all times, a substantial minimum tension on the thread, usually from 10 to 30 grams, so that an evenly wound, uniformly dense package may be obtained.

It has long been desired to produce precision-wound packages of thread directly from bucket cakes of thread which have been subjected to liquid treatment and drying. To unwind thread from bucket cakes, particularly cakes which have been liquid treated and dried in an unsupported state, it must be subjected to pulls of greatly varying tension due to deformation arising from the liquid processing and drying procedures to which the thread cakes have been exposed.

The two cone winding devices now on the open market are provided with either a conventional washboard type or finger type tensioning device. Both these devices were found to be entirely unsuitable under the above-mentioned conditions, in view of their large angular contact with the thread. As an example, when winding cones from bucket cakes on one of these standard devices, the angular contact of the thread on the washboard device is approximately 260°, and the angular contact of the thread with other guides, over which it must pass in its travel from the cake to the wind-up package, is 240°, making a total of approximately 500°. The tension imparted to the thread by such a washboard tensioning device or finger tensioning device is due to angular snubbing; that is, the tension is developed by causing the thread to deviate from a straight line by interposing surfaces over which it must slide.

When a cake of thread is unwound on such a machine, the tension required to removed the thread from the cake is multiplied by a factor which varies exponentially with the angularity of the snubbing in accordance with the following formula: $T_1=T_2(e^{Kr})$ in which T_1 is the tension on the thread after it leaves the last element of the tensioning or guiding devices; T_2 is the tension on the thread after it is drawn from the cake and as it approaches the first element of the tensioning or guiding devices; e is the base of natural logarithms; the constant K is the coefficient of kinetic friction of the thread on the surfaces over which the thread is being drawn as determined by the method described by Sellars, Textile World, December 1934, p. 78, (approximately 0.35 for viscose rayon on porcelain or steel for a range of speeds generally use); and r is the total snubbing angularity of the thread in radians as determined by adding together all the arcs of contact of the thread with the snubbing surfaces.

Since the tension necessary to draw the thread from bucket cakes of rayon, or the like, varies from about 2 grams to 10 or 15 grams, and at times very much higher, it will be readily apparent that the use of a washboard tensioning device which, in combination with the necessary directional guides, offers a total snubbing angularity in the neighborhood of 500°, will at times produce an extremely high tension on the thread at the point where it is being wound. For example, applying these data in the formula given above, we find a change in tension from 2 grams to 10 grams at the cake will cause a change in tension, at the point where the thread is being wound, from 42 grams to about 210 grams. Since the application of this high tension is of extremely short duration (about 0.02 of a second), the thread is not broken but is stretched beyond its elastic limit over a short length and a "shiner" is produced in the thread. Obviously, if the pull were still greater, or were of a longer duration, the thread would be broken. Threads which have been stretched beyond their elastic limits and contain shiners are unsatisfactory for use as the weft or filler thread in the production of certain types of fabrics, since shiners will be clearly visible in the finished product. A shiner in a thread is evidenced by a higher luster than is present in the adjacent sections of the thread.

It is, therefore, an object of the present invention to provide a thread tensioning device for winding machines which device will impart a substantially uniform tension to the thread.

It is a further object of the present invention to provide a thread tensioning device for winding machines which device will impart an additive tension to the thread.

It is a still further object of the present invention to provide a thread tensioning device for winding machines which device will not impart to a thread an excessive tension caused by multiplication of tension imparted to it in withdrawing the same from a cake.

Still another object is to provide a thread tensioning device for winding machines which will avoid the excessive tensions causing shiners and will not be subject to excessive wear.

A still further object of this invention is to provide a tensioning device which will impart a gradually decreasing tension to the thread as the wind-up core increases in diameter.

Other objects of the invention will appear hereinafter.

The objects of the invention may be accomplished, in general, by positioning, between the thread package being unwound and the thread package being wound, a pinching tensioning device of the type hereinafter to be described. The details of the invention and the objects thereof will be clearly apparent from the following description taken in connection with the accompanying illustration, in which,

Figure 1 is a side elevational view showing the essential winding elements of a winding machine and the relative positioning of the pinching tensioning device of the present invention.

Figure 2 is a perspective view of the pinching tensioning device of the present invention.

Figure 3 is a detail view showing a mechanism for continuously reciprocating a thread guide.

Referring to Figure 1 of the drawings, reference numeral 11 designates a bucket cake mounted on a support 12 of a coning machine. The thread 13 is drawn from the bucket cake, passes through the guide 15, through the tensioning device, over a guiding bail 17, through the button guide 19 of a traversing mechanism, and is wound on a conical core 21 mounted on the spindle 23 of a winding machine. The spindle 23 is driven at a constant rate of speed. The button guide 19 is held against the package being wound by means of the weight 25 on the pivoted arm 27, in a conventional manner. The arm 27 is pivoted at 29 to the winding machine.

The tensioning device is attached to the winding machine by means of arm 31. A smooth, rigid, steel plate 33 is rigidly attached to the framework of the tensioning device. A spring steel plate 35 is fastened to a pivoted bracket 37. The pivoted bracket 37 is secured to a lever arm 39 by means of which the spring steel plate is pressed against the rigid steel plate 33 so that they will have a substantial area of contact with each other. The spring steel plate 35 is positioned, relative to the rigid steel member 33 in such a manner that when the spring steel member is pressed against the plate 33, the said two members are in converging relationship with each other in the direction of the movement of the thread.

As the thread builds up on the core 21, it is necessary that the thread tension be decreased to prevent bulging of the thread at the ends of the package. This is accomplished by fastening the arm 39 through linkage 41 to the pin 40 of the swing arm 27. It will now be readily seen that as the weighted arm 27 rotates in the direction of the arrow, the arm 39 will be forced to the right, thereby decreasing the pressure between the spring plate 35 and the rigid steel plate 33. Instead of a rigid plate, a flexible plate, backed by a rigid member, may be used. This type of construction is advantageously used because when wear occurs, it is a simple matter to insert another thin flexible plate instead of changing the rigid member.

It is preferred to provide the tensioning device with a pair of spring plate members 43 and 45 which are permanently adjusted, by means of screws 47 and slots 49, to exert a definite small tension on the thread to eliminate certain variations due to uneven crinkle in the yarn. If desired, the tensioning device may be provided with a thread cleaner 51 which is comprised of two narrow plates spaced from each other slightly more than the thickness of the thread.

It is also preferred that the thread be passed, as nearly as possible, in a straight line from the thread cake 11 to the cone 21. It is, therefore, desired that the cone spindle be driven in the direction of the arrow to eliminate the abrupt change in direction of the thread as it passes from the traverse guide to the cone. While counter-clockwise rotation, as indicated by the arrow, is preferred, it should be understood that the cone spindle can be driven in the conventional clockwise direction of rotation, when using the present invention, if due consideration is given to the angular snubbing caused by the abrupt change in direction of the thread as it passes from the traverse guide to the cone.

The thread, as it passes through the tensioning device of the present invention, is maintained in a substantially straight line and, therefore, since all snubbing action on the thread is avoided as it passes through the device, the tension imparted to the thread by the pinching tensioning device is purely additive to the tension already imparted to the thread.

The spring plate member 35 is preferably constructed of very thin, spring steel of the order of 0.005" in thickness.

The tension on the thread imparted by the spring steel plate 35 is entirely due to the spring in the member rather than to frictional resistances between sliding members such as are present in spring-pressed disc tensioning members such as are well known in the art. Spring-pressed disc tensioning members are also objectionable in that they have considerable inertia and, therefore, are not quickly responsive to variations in crinkle and twist of the thread.

Preferably, the thread is traversed back and forth between the plates 33 and 35 to prevent wearing of the plates along a single line. This may be accomplished by reciprocating thread guide 15 as shown in Figure 3. The thread guide 15, in Figure 3, is provided with a pin 75 which is positioned in groove 77 of cam 79. The cam 79 is fixed on a shaft 81, the latter being rotated in any desired manner, such as, for example, by a belt 83 and pulley 85.

It is to be noted that there are very few metal-to-metal moving parts in the mechanism of the present invention and, therefore, the maintenance and upkeep will be proportionately small. The only metal-to-metal moving parts in the device are the pivot bracket 37, and the pivoted rod 41. It is also of distinct advantage that the cooperating tensioning members of the tensioning device; that is, plates 33 and 35, are arranged, relative to each other, in converging relationship in the direction of the movement of the thread. This particular arrangement eliminates vibration due to variations in tension on the thread, and provides a sensitivity greater than that of previously known tensioning devices.

Since it is obvious that many changes and modifications can be made in the apparatus above described without departing from the na-

ture and spirit of the invention, it is to be understood that the invention is not to be limited except as set forth in the appended claims.

I claim:

1. In a thread tensioning device for winding machines, thread tensioning members coacting to pinch the thread therebetween, and means for traversing said thread back and forth between said members simultaneously with the pinching action of said members upon the thread during the winding operation.

2. In a thread tensioning device for winding machines, thread tensioning members adapted to have a substantial area of contact with each other and coacting to pinch the thread therebetween, and means for traversing said thread back and forth between said members simultaneously with the pinching action of said members upon the thread during the winding operation.

3. In a thread tensioning device for winding machines, thread tensioning members pressed against each other in converging relationship, said members adapted to have a substantial area of contact with each other and coacting to pinch the thread therebetween, and means for traversing said thread back and forth between said members simultaneously with the pinching action of said members upon the thread during the winding operation.

4. In a thread tensioning device for winding machines, thread tensioning members including a resilient member coacting to pinch the thread therebetween, and means for traversing said thread back and forth between said members simultaneously with the pinching action of said members upon the thread during the winding operation.

5. In a thread tensioning device for winding machines, thread tensioning members coacting to pinch the thread therebetween, and continuously operating means for traversing said thread back and forth between said members simultaneously with the pinching action of said members upon the thread during the winding operation.

6. In a thread tensioning device for winding machines, thread tensioning members coacting to pinch the thread therebetween, and a reciprocating thread guide for traversing said thread back and forth between said members simultaneously with the pinching action of said members upon the thread during the winding operation.

7. In a thread tensioning device for precision winding of thread onto a wind-up core directly from bucket cakes necessitating a pull of varying tension for the removal of the thread therefrom, a pair of thread tensioning members coacting to pinch the thread therebetween for imparting a predetermined minimum fixed additive tension to said thread and a separate pair of thread tensioning members coacting to also pinch the thread therebetween and being continuously adjustable throughout the winding operation for imparting a gradually decreasing variable additive tension to said thread as it builds up on said wind-up core, and means automatically operated by said wind-up core for continuously reducing the tension imposed on said thread by said separate pair of thread tensioning members as the diameter of thread increases on said wind-up core whereby a substantially uniform and continuously smooth tension is imparted to the thread throughout the winding operation.

8. In a thread tensioning device for precision winding of thread onto a wind-up core directly from bucket cakes necessitating a pull of varying tension for the removal of the thread therefrom, a pair of thread tensioning members coacting to pinch the thread therebetween for imparting a predetermined minimum fixed additive tension to said thread and a separate pair of thread tensioning members including a converging resilient member adapted to have a substantial area of contact with the other of said members, said separate pair of thread tensioning members coacting to also pinch the thread therebetween and being continuously adjustable throughout the winding operation for imparting a gradually decreasing variable additive tension to said thread as it builds up on said wind-up core, and means automatically operated by said wind-up core for continuously reducing the tension imposed on said thread by said separate pair of thread tensioning members as the diameter of thread increases on said wind-up core whereby a substantially uniform and continuously smooth tension is imparted to the thread throughout the winding operation.

ARTHUR E. GUENTHER.