

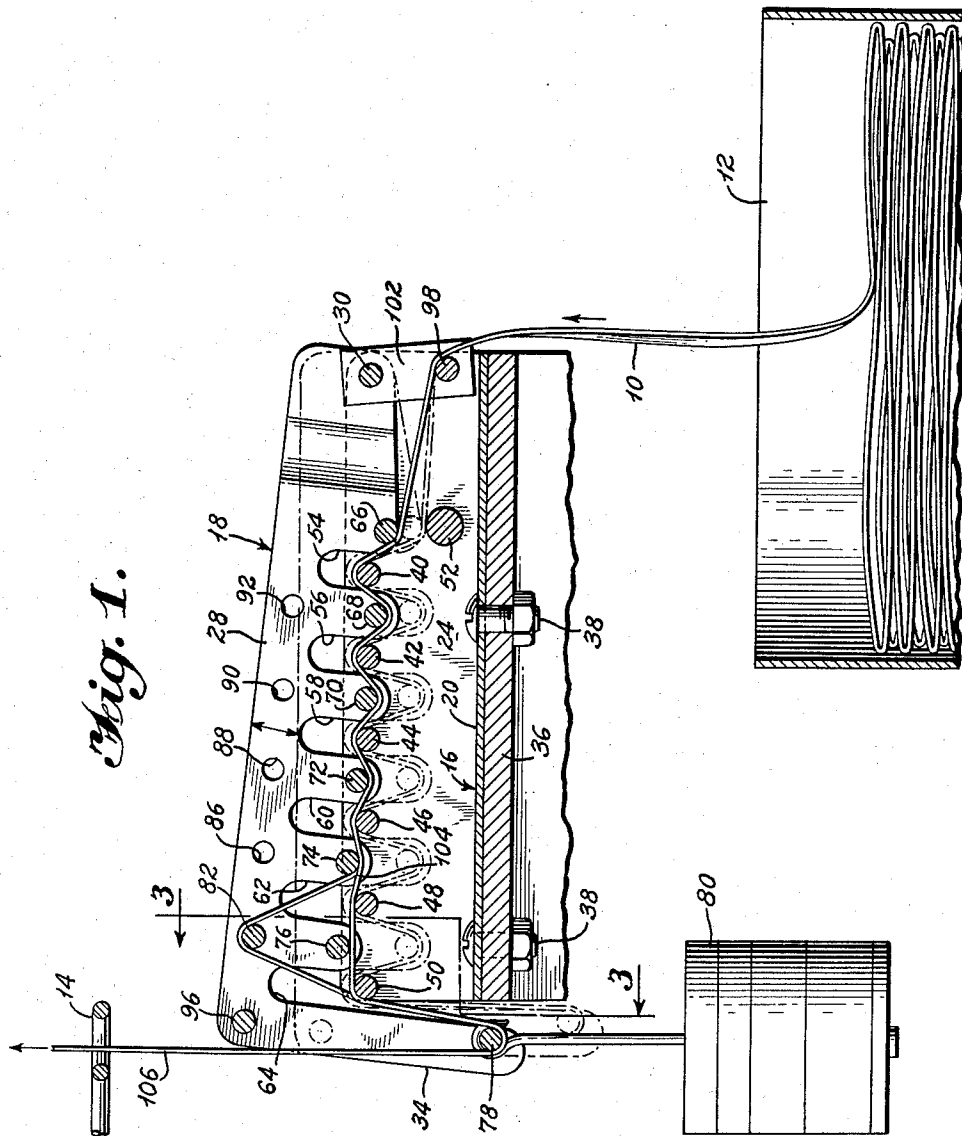
Jan. 12, 1960

K. WILHELM ET AL
APPARATUS FOR SPLITTING RUBBER RIBBONS INTO THREADS
AND FOR APPLYING TENSION TO THE THREADS

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3 Sheets-Sheet 1



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Fig. 2.

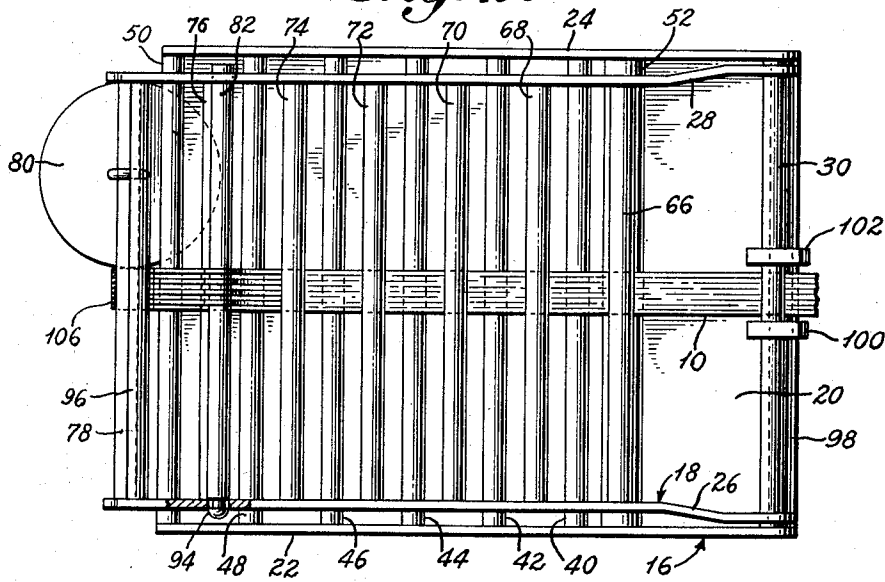
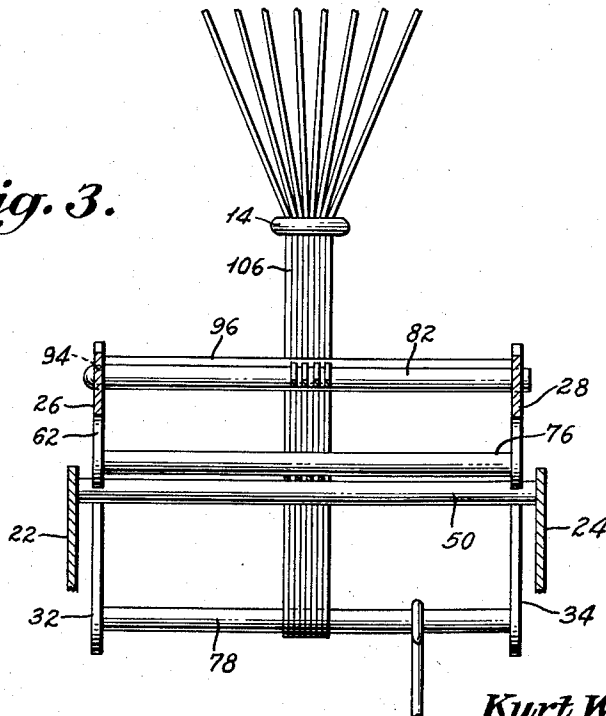


Fig. 3.



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APPARATUS FOR SPLITTING RUBBER RIBBONS INTO THREADS AND FOR APPLYING TENSION TO THE THREADS

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2 Claims. (Cl. 214—1)

The present invention relates to apparatus for splitting rubber ribbons into individual threads and for applying substantially constant and uniform tension to the threads as they are advanced to a textile machine or other point of use.

It is common practice to manufacture and to market rubber threads in the form of ribbons of parallel, loosely united rubber threads. The most common practice is to slit ribbons of rubber longitudinally along parallel lines. The adhesive character of the freshly cut edges causes the threads to adhere to retain the ribbon form. Such slit ribbons can be manipulated and stored as ribbons and upon reaching the point of use the ribbons can be split into their individual threads. A somewhat less common practice is to arrange a plurality of individual threads in parallel, side by side relationship and to slightly bond the threads together in the form of a ribbon. Such ribbons can also be split into their individual threads at the point of use. The rubber ribbons are conventionally packaged and shipped in containers in which the ribbons are under no tension. This manner of producing and packaging the rubber results in certain economies and enables the rubber to be sold at lower cost. The use of a ribbon of this kind also insures equal tension in all threads fed from the ribbon toward the point of use. However, this manner of producing and packaging the rubber requires that the user split the ribbons into the individual threads. It is also necessary for the user to apply the requisite tension to the threads as they are fed from the container to the textile machine or other point of use.

A single user of rubber thread many have hundreds of separate machines utilizing the threads and it may be necessary to feed threads from as many as fifty ribbons to some such machines. It is therefore important that there be available simple and inexpensive devices for splitting the ribbons into individual threads and for applying the desired tension to the threads. Devices for accomplishing these purposes have heretofore been available but to the best of our knowledge such prior devices have invariably been both complex and expensive. It is one of the primary objects of the present invention to provide simple and inexpensive devices for splitting rubber ribbons into individual threads and applying tension of the desired magnitude to the threads.

Rubber threads are made from a variety of compositions. Some threads are made from compositions containing substantial amounts of filler. Our experience has shown that ribbons produced from such compositions can best be split while the ribbons are under substantial tension. Some rubber threads are produced from substantially pure gum rubber and ribbons of such composition are best split at low tension. For purposes of economy and standardization, it is advisable for rubber thread splitting and tensioning devices to be capable of use with rubber threads of all compositions. The accomplishment of this objective is another important purpose of the present invention.

The elastic nature of rubber presents certain prob-

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lems in proper tensioning of rubber threads, which problems are not present in more inelastic textile threads or yarns. Most machines utilizing rubber threads require that the threads be fed to the machines under uniform and substantially constant tension in order that the machines be capable of producing satisfactory products. Another important object of the present invention is to provide rubber thread splitting and tensioning devices which are capable of producing substantially uniform and constant tension in the rubber threads as they are advanced to the textile machines or other points of use.

The term "rubber" as used herein is intended to be generic to all elastic rubber-like materials, either natural or synthetic, from which rubber threads are produced.

The invention can best be understood from the following description which has reference to the accompanying drawings wherein:

Figure 1 is a longitudinal sectional view through a device embodying the invention, illustrating a rubber ribbon passing therethrough and being split into individual threads while tension is applied to the ribbon and to the threads;

Figure 2 is a top plan view of the apparatus illustrated in Figure 1;

Figure 3 is a sectional view taken in the direction of the arrows along the line 3—3 of Figure 1;

Figure 4 is a longitudinal sectional view of the apparatus but illustrating a different manner of use of the apparatus;

Figure 5 is a view similar to Figure 4 but illustrating still another manner of use of the apparatus;

Figure 6 is a diagrammatic view illustrating an ideal condition for relative positions of certain portions of the apparatus which result in applying substantially constant and uniform tension to the threads;

Figure 7 is a view similar to Figure 6 but is illustrative of the disadvantages which would be present if certain relative relationships of portions of the apparatus were not adhered to; and

Figure 8 is a view similar to Figure 6 but illustrating the threads being drawn from the apparatus in a direction other than vertically.

Figure 1 illustrates a rubber ribbon 10 which is composed of a plurality of parallel loosely united rubber threads, as described above. The ribbon 10 is shown as packaged in a shipping container 12, there being no tension in the ribbon within the container. The rubber ribbon is to be split and its individual threads tensioned and advanced through a thread guide 14 to a textile machine or other point of use, not shown. The device for splitting the threads and applying tension thereto consists of a base member designated generally by the reference numeral 16 and a movable member designated generally by the reference numeral 18. The base member 16 is provided with a base plate 20 and side walls 22 and 24. The movable member 18 is provided with side members 26 and 28 which are pivotally mounted to the side walls 22 and 24 by means of a horizontally extending pivot pin 30. The side members 26 and 28 of the movable member 18 have depending legs 32 and 34 at the free ends thereof. The base plate 20 of the base member 16 is preferably horizontally positioned and supported on any suitable support 36 by means of bolts and nuts 38.

Extending between the side walls 22 and 24 of the base member 16 are a plurality of pins 40, 42, 44, 46, 48 and 50. The pins 40 to 50 are parallel to each other and to the pivot pin 30. The pivot pin 30 and the pins 40 to 50 preferably all lie in the same horizontal plane. A pin 52 also extends between the side walls 22 and 24. The pin 52 lies below the plane of the pins 40 to 50 and its purpose is hereinafter described.

The side members 26 and 28 of the movable member

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18 have recesses 54, 56, 58, 60, 62 and 64 in their lower edges in positions to receive the pins 40 to 50 respectively when the movable member 18 is pivoted downwardly relative to the base member 16. Extending between the side members 26 and 28 are pins 66, 68, 70, 72, 74 and 76. The pins 66 to 76 are parallel to each other and to the pivot pin 30. The pins 66 to 76 lie in a common plane which passes slightly below the pivot pin 30 in the manner shown in the drawings so that the pins 66 to 76 intermesh with the pins 40 to 50 respectively by gradually decreasing extents.

A deflecting bar 78 extends between the depending legs 32 and 34 at the lower end thereof. The deflecting bar 78 is parallel to the pivot pin 30 and is positioned substantially vertically below the pin 50. A weight 80 of adjustable magnitude is suspended from the deflecting bar 78.

A separating bar 82 is arranged to be positioned in any pair of pairs of holes 84, 86, 88, 90 or 92 in the side members 26 and 28 of the movable member 18. As best shown in Figure 2, the separator bar 82 may have a circumferential groove 94 near one end thereof to prevent longitudinal displacement of the separator bar while still permitting easy removal of the bar for repositioning. Extending between the free ends of the side members 26 and 28 and fixed relative thereto is a second separator bar 96 which may be used in the manner hereinafter described.

A ribbon guide bar 98 extends between the side walls 22 and 24 of the base member at the entrance end thereof. The ribbon guide bar 98 is parallel to and spaced below the pivot pin 30. A pair of lateral ribbon guides 100 and 102 extend between the pivot pin 30 and the ribbon guide bar 98. The lateral ribbon guides 100 and 102 are frictionally movable longitudinally along the pivot pin 30 and the bar 98 to permit the apparatus to accommodate ribbons of different widths.

The operation of the apparatus will be described first in connection with the manner of use illustrated in Figure 1. The end of the ribbon 10 is withdrawn from the container 12 and is threaded between the lateral ribbon guides 100 and 102 and between the ribbon guide bar 98 and the pivot pin 30. The ribbon is positioned above the pins 40 to 50. Alternating threads of the ribbon are threaded over the separator bar 82 and rejoin the remaining ribbons at the pin 50. Separation of the ribbon into individual threads thus occurs at the point 104. All of the separated ribbons pass downwardly from the pin 50 beneath the deflector bar 78 and upwardly through the thread guide 14 to the point of use. The drawing of the ribbon and threads through the apparatus is accomplished entirely by the machine utilizing the threads.

The tension in the ribbon and threads is caused by frictional resistance to movement past the pins 40 to 50 and 66 to 76, the separator bar 82 and the deflector bar 78. The magnitude of the tension is determined by the amplitude of the undulations in the path of the ribbon and threads and the magnitude of those undulations is in turn controlled by the magnitude of the weight 80. The positioning of the separator bar 82 in the manner shown in Figure 1 results in substantial tension being applied to the ribbon 10 before the ribbon reaches the thread separating point 104.

The importance of positioning the deflector bar 78 substantially vertically below the final pin 50 on the base member 16 can best be understood by reference to Figures 6 and 7. Referring first to Figure 6, which represents one ideal condition, it will be seen that the total tension "T" in all of the threads 106 being drawn upwardly from the deflector bar 78 will be equal to one half the magnitude of the weight 80, if the friction resistance to movement of the threads about the deflector bar 78 is ignored, or if the bar 78 is freely rotatable in the legs 32 and 34. In other words, in the arrangement

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illustrated in Figure 6 the total tension in all of the threads 106 will be substantially constant and approximately equal to one half the magnitude "W" of the weight 80. This situation will prevail so long as the deflector bar 78 occupies a position substantially vertically below the final pin 50 on the base member 16 and so long as the threads passing downwardly from the pin 50 to the deflector bar 78 are approximately parallel to the threads 106 being drawn upwardly therefrom.

The situation which would prevail if the deflector bar 78 were not positioned approximately below the final pin 50 on the base member 16 can be understood by reference to Figure 7. If it be assumed that "T" equals the total tension in all the threads 106 passing upwardly from the deflector bar 78, that "t" represents the total tension in all the threads between the final pin 50 and the deflector bar 78 and that "a" is the angle between the vertical and the threads approaching the deflector bar 78, it can be seen that:

$$T + t \cos a = W$$

If there is assumed to be no friction to oppose movement of the threads about the bar 78, then T equals t and:

$$T + T \cos a = W$$

It will be seen that as the movable member 18 oscillates, the angle "a" changes and hence the value of "T" will change over a wide range even though the value of "W" is kept constant. It will also be seen that as angle "a" approaches zero (as in Figure 6) "cos a" approaches unity or one, and if angle "a" is zero (as in Figure 6) then

$$T + T = W$$

or

$$T = \frac{W}{2}$$

It can be seen from the foregoing explanation that with the apparatus illustrated in Figure 6 the total tension in the threads 106 will remain substantially constant so long as the magnitude of the weight 80 is constant. This substantial constancy of the tension in the threads 106 will prevail irrespective of the fact that the movable member 18 may oscillate through a small arc about the pivot pin 30. Experience has shown that the movable member 18 will find a position of substantial equilibrium while the ribbon and threads are being drawn through the apparatus and that oscillation of that member will be very slight.

It is not necessary that the threads 106 be drawn vertically from the deflector bar 78. Figure 8 illustrates the threads being drawn from the deflector bar at an angle "b" to the vertical. The threads between the final pin 50 and the deflector bar 78 are assumed to be vertical and again there is assumed to be no friction to oppose movement of the threads about the bar 78. Under these conditions:

$$W = T + T \cos b$$

The threads 106 may be drawn horizontally from the deflector bar 78 in which event the angle "b" is 90° and "cos b" is zero. Under these conditions:

$$T = W$$

While the apparatus has been described as utilizing a weight 80 as suspended vertically from the deflector bar 78 and the threads as extending vertically from the final pin 50 to the deflector bar 78, it will be apparent that this arrangement can be varied so long as the direction of the threads extending between the final pin 50 and the deflector bar 78 is the same or parallel to the direction of the force imposed by the weight 80 or its equivalent.

The frictional resistance to movement of the threads

past the bar 78 has been ignored in the above computations and illustrations. The deflector bar 78 can be made freely rotatable to eliminate such resistance. However, a non-rotating bar 78 makes a simpler and more economical construction and in practice does not introduce a sufficient factor to materially effect operation under most conditions.

The purpose of the pin 52 on base member 16 is to cooperate with the initial pin 66 on the movable member 18 to clamp the ribbon 10 in the event the textile machine is stopped and ceases to draw thread through the apparatus. As soon as the textile machine stops, the movable member 18 pivots in a counterclockwise direction about the pivot pin 30 to the position shown in dot-dash lines in Figure 1 in which position the pin 66 clamps the ribbon 10 against the pin 52. Tension is thus retained in the threads 106 until the textile machine resumes operation. If it were not for this clamping action the threads and ribbon would tend to creep through the apparatus to an extent which would relieve the tension in threads 106. Because of this clamping action it is unnecessary for the operator to make any adjustment of the apparatus before resuming operation of the textile machine.

The position of the separator pin 82 shown in Figure 4 is preferred when operating on ribbons of certain compositions of rubber. As indicated above, ribbons of certain compositions of rubber are best split at low tension. The separator bar 82 is shown in Figure 4 as positioned in the pair of holes 92 in the side members 26 and 28 of the movable member 18. In this arrangement the splitting of the ribbon 10 into individual threads occurs at approximately the point 108 adjacent the initial pin 66 on the movable member. It will be apparent from an inspection of Figure 4 that the splitting occurs before substantial tension has been applied to the ribbon 10. It should be pointed out that the separator bar 82 can be positioned intermediate the positions shown in Figures 1 and 4 and that the tension in the ribbon at the point of splitting can thus be controlled.

In the manner of use illustrated in Figure 5 the separator bar 82 is not used. According to this manner of use the splitting occurs at the separator bar 96 at the free end of the movable member 18. This arrangement is preferred if the tension applied to the threads 106 is small or when operating with compositions of rubber which split better at the highest available tension.

The lateral ribbon guides 100 and 102 are adjustable as to the distance between them so that the apparatus can accommodate ribbons having a width approximately equal to the horizontal spacing between the side members 26 and 28 of the movable member 18.

Experience has shown that with apparatus as illustrated in the drawings the magnitude of the weight 80 should be approximately 2.5 pounds when splitting an 8-thread ribbon and tensioning the threads for use in a braiding machine. The magnitude of the weight 80 can be increased or decreased as circumstances require. Normally the magnitude of the weight 80 will be increased when additional threads are being drawn through the device and will be decreased when the number of threads is less. The proper magnitude for the weight 80 can be roughly determined by multiplying the desired tension in each thread by the number of threads and multiplying the product by two.

It will be seen that the apparatus is simple and requires no power except that supplied by the textile machine or other machine utilizing the threads. The simplicity of the device renders it inexpensive and the fact that there are no wearing parts gives the device a long life and makes it troublefree in operation.

We have illustrated and described what we now consider to be the preferred embodiment of the invention. It will be understood that various modifications may be

resorted to without departing from the broader scope of the invention as defined by the following claims.

Having thus described our invention we claim:

1. Apparatus for splitting rubber threads from a ribbon of loosely united rubber threads and for applying substantially constant and uniform tension to such threads as the threads are drawn to a point of use, comprising a stationary, horizontal base member, a movable member pivotally mounted at one end to said base member on a horizontal pivotal axis, pins fixed on said base member and on said movable member, said pins being parallel to said pivotal axis and positioned at different distances therefrom to intermesh upon pivotal movement of said movable member toward said base member, said pins on said base member lying in a horizontal plane, said intermeshing pins being arranged to engage a ribbon of loosely united threads drawn past said pivotal axis and along a generally horizontal path above said pins on said base member to provide frictional resistance to the drawing of such threads of a magnitude dependent on the extent of such intermeshing, a separator bar on one of said members arranged for alternate threads of the ribbon to pass on opposite sides thereof to split the ribbon into individual threads, legs fixed to the free end of said movable member and extending downwardly therefrom, a deflecting bar carried by said legs, said deflecting bar being parallel to said pivotal axis and spaced generally vertically beneath the final pin on said base member to deflect threads substantially downwardly from said final pin along a generally vertical path as the threads are drawn around said deflecting bar to the point of use, and a weight secured to the free end of said movable member tending to increase the extent of said intermeshing of said pins, whereby said weight is directly opposed by the tension in the generally vertically disposed threads between said final pin and said deflecting bar and the total tension in all threads drawn from said deflecting bar is substantially proportional to the magnitude of said weight.

2. Apparatus for splitting rubber threads from a ribbon of loosely united rubber threads and for applying substantially constant and uniform tension to such threads as the threads are drawn to a point of use, comprising a stationary base member, a movable member pivotally mounted at one end to said base member on a pivotal axis, pins fixed on said base member and on said movable member, said pins being parallel to said pivotal axis and positioned at different distances therefrom to intermesh upon pivotal movement of said movable member toward said base member, said pins on said base member lying in a common plane, said intermeshing pins being arranged to engage a ribbon of loosely united threads drawn past said pivotal axis and along a first path between said pins and to provide frictional resistance to the drawing of such threads of a magnitude dependent on the extent of such intermeshing, a separator bar on one of said members arranged for alternate threads of the ribbon to pass on opposite sides thereof to split the ribbon into individual threads, legs fixed to the free end of said movable member and extending in the direction of movement of said free end toward said base member, a deflecting bar carried by said legs, said deflecting bar being parallel to said pivotal axis and spaced from the final pin on said base member in a direction substantially normal to said common plane of said pins on said base member to deflect threads from said final pin along a second path substantially normal to said first path as the threads are drawn around said deflecting bar to the point of use, and means for applying a substantially constant force to the free end of said movable member in substantially the direction in which the threads extend from said final pin to said deflecting bar to tend to increase the extent of said intermeshing of said pins, whereby the tension in the threads between said final pin and said deflecting bar acts in substantially the opposite di-

rection to said constant force and the total tension in all threads drawn from said deflecting bar is substantially proportional to the magnitude of said constant force.

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