March 7, 1950 F. TAYLOR 2,499,888

APPARATUS FOR TENSIONING STRANDS

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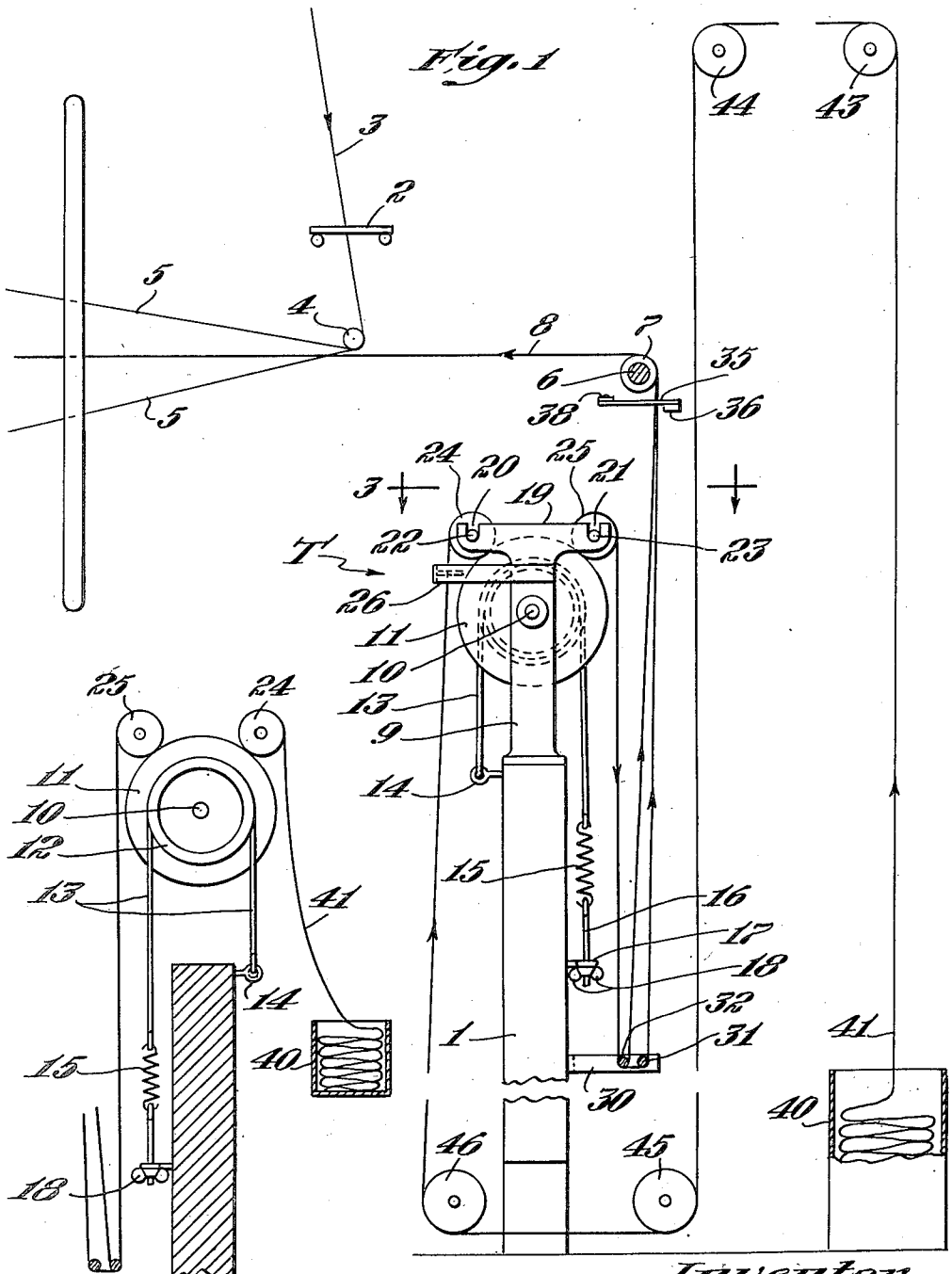


Fig. 2

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March 7, 1950 F. TAYLOR 2,499,888

APPARATUS FOR TENSIONING STRANDS

Filed Oct. 30, 1945 3 Sheets-Sheet 2

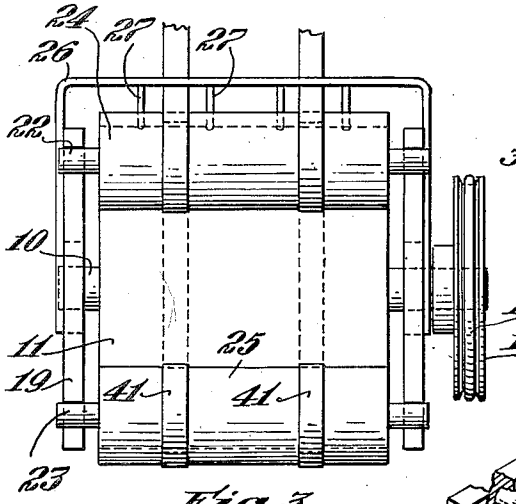


Fig. 3

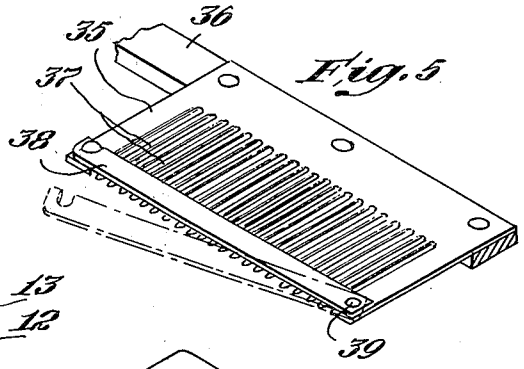


Fig. 5

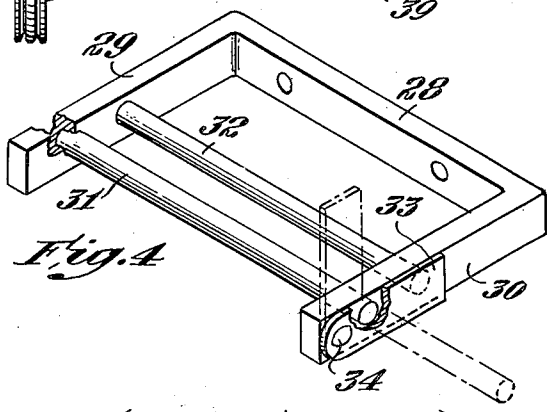
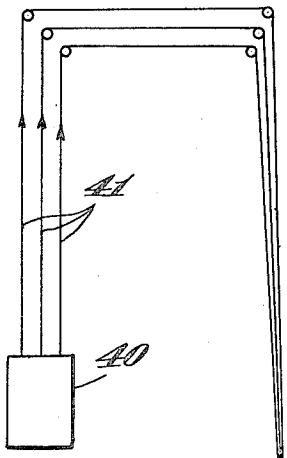
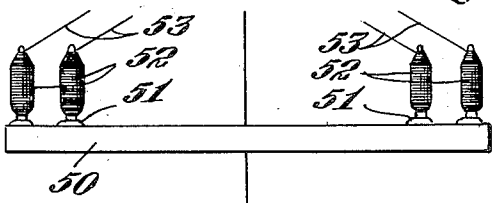


Fig. 4





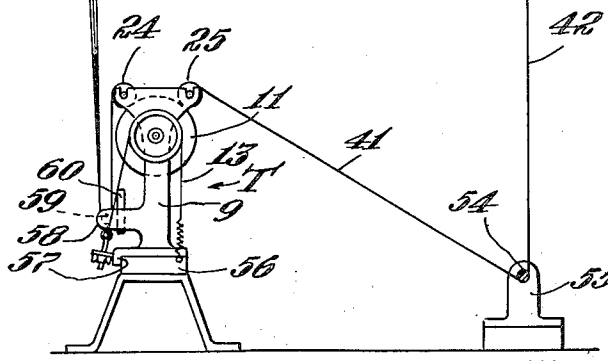


Fig. 6

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March 7, 1950 F. TAYLOR 2,499,888

APPARATUS FOR TENSIONING STRANDS

Filed Oct. 30, 1945 3 Sheets-Sheet 3

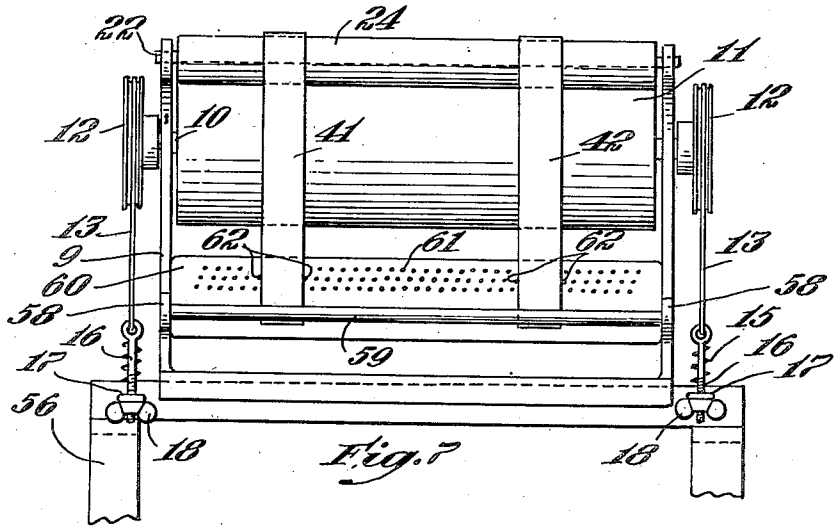


Fig. 7

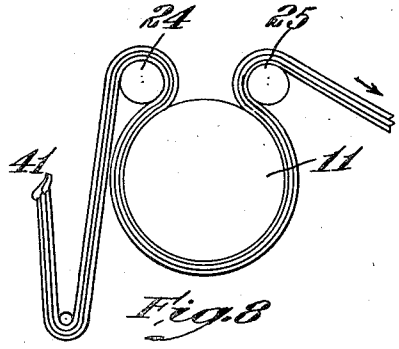
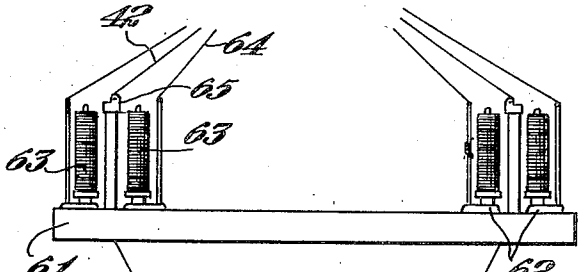


Fig. 8



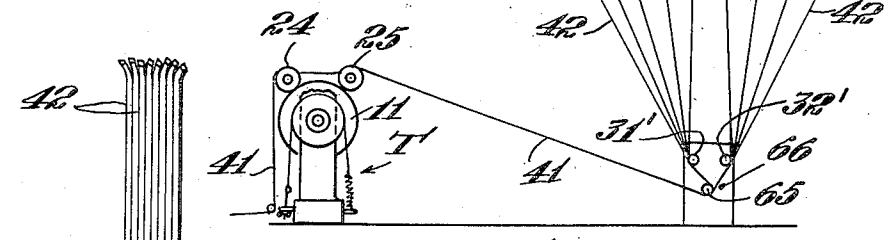


Fig. 9

Fig. 10

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UNITED STATES PATENT OFFICE

2,499,888

APPARATUS FOR TENSIONING STRANDS

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Application October 30, 1945, Serial No. 625,593

2 Claims. (Cl. 139—104)

1

This invention pertains to textile manufacture, and relates more particularly to a novel means for and method of tensioning elastic elements, for instance rubber-elastic threads or strands. While the invention is of especial importance for the tensioning of rubber-elastic threads preparatory to incorporating them in a fabric, it is also applicable to the tensioning of strands which are not elastic like rubber, as well as for tensioning sheet material. When hereinafter reference is made to "strands" without other limitation, this term is understood to be inclusive of any elongate flexible element regardless of its width, that is to say, whether it is in the nature of a filament or a sheet, and regardless of whether or not it is elastic like rubber. Further, when "rubber-elastic" is referred to, this term is intended to denote the stretch characteristics of the material as rubber-like and not necessarily that the material is or contains rubber.

Among specific uses of this improved tension, and to which reference will hereinafter be made, are the delivery of rubber-elastic warps or single rubber strands for incorporation in a woven fabric; to the delivery of rubber-elastic threads for incorporation either as core elements or as a part of the braided structure itself, in the manufacture of braided fabrics; to the delivery of elastic threads to rubber covering machines; or in fact to the delivery of rubber elastic strands to machines or other equipment to which such strands should be fed under a constant predetermined tension.

Many difficulties are inherent in the handling of rubber-elastic strands in weaving, braiding, knitting or the like, which are not encountered when using ordinary textile strands, and complicated and troublesome preparatory steps and/or the use of complex tensioning devices have heretofore been necessary for the manipulation of such rubber-elastic strands during fabric manufacture. When rubber-elastic strands are drawn off from a wound mass of the strand material, for instance a warp beam, the gradual decrease in diameter of the wound mass as the operation progresses, requires a corresponding adjustment of the tension mechanism in order to insure uniform unwinding tension. Rubber-elastic threads elongate much more than ordinary textile yarns in response to tension, and most prior tensioning devices are to some extent at least responsive to such factors as variation in atmospheric moisture or temperature. Thus it has been very difficult to make an elastic fabric which is uniform in texture, appearance and resistance to elongation. Since the rubber-elastic threads are so different in characteristics from the textile yarns with which they are usually combined, it has heretofore been thought necessary to wind the rubber-elastic strands upon

2

a special warp beam preparatory to weaving, but even this procedure of itself is difficult and demands great care and skill in so winding the rubber-elastic threads upon the warp beam as to insure uniform unwinding tension. Moreover, this special warp beam with its accessories occupies substantial space in the loom structure. Likewise, in braiding, the rubber-elastic threads are often wound upon separate spools, and great difficulty is experienced in letting off each of the several rubber-elastic threads so that they all approach the braiding mechanism under equal tension, the result being that the edges of flat elastic braid are usually uneven and the braid itself is wavy and lacks the desired uniformity and finish.

The basic conception upon which the present invention is predicated is the discovery that the elastic recovery force of a stretched elastic element may be employed in maintaining uniformity of tension of said element. This concept embodied in a simple mechanical construction as hereinafter more fully described, makes it possible to apply a substantially constant predetermined tension to substantially any number of elastic strands or threads without recourse to the complicated tension means customarily employed in the effort (heretofore unsuccessful) to attaining this desirable result.

One object of the present invention is to provide a novel method of and means for delivering rubber-elastic strands of as great individual length and in as great a number as may be desired, at substantially constant and uniform tension, to the point of use. A further object is to provide a novel method of tensioning rubber-elastic warps whereby the use of a warp beam for the rubber strands is dispensed with. A further object is to provide tensioning means applicable to weaving, braiding, rubber covering, knitting or the like, and capable of handling substantially as many rubber threads as may be desired but in a very small space. A further object is to provide tensioning means capable of use with so-called "ribbon rubber," that is to say, rubber threads disposed in the same plane and cohering at their adjacent edges so as to form a ribbon-like strand which is easily separated into its constituent threads. A further object is to provide tensioning means of simple, reliable, durable and inexpensive type applicable to looms, braiders, rubber covering machines and the like, without substantial modification (except as respects size) and which is operative to deliver each of a large number of threads with the same and uniform tension. Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings, wherein

Fig. 1 is a fragmentary diagrammatic side view, partly in vertical section, showing portions of the frame and certain other elements of a weaving loom designed to interweave rubber elastic threads with textile yarns, and showing details of the tensioning means of the present invention;

Fig. 2 is a fragmentary vertical section showing the tension means of Fig. 1, but viewed from the opposite side of the loom;

Fig. 3 is a plan view, to larger scale, of the tensioning means of Fig. 1;

Fig. 4 is a perspective view, to larger scale than Fig. 1, and with parts broken away, illustrating a desirable dividing means for separating alternate threads of ribbon rubber;

Fig. 5 is a fragmentary perspective view showing a desirable form of comb for guiding the separated rubber threads;

Fig. 6 is a diagrammatic side elevation showing the improved tension applied to a braiding machine of conventional type in which rubber threads are incorporated as a core in a tubular braid;

Fig. 7 is a fragmentary rear elevation, to larger scale, of the tensioning means of Fig. 6;

Fig. 8 is a diagrammatic end view showing how several strands of ribbon rubber may simultaneously be fed through the tensioning means of the present invention;

Fig. 9 is a diagrammatic side elevation showing the tensioning means of the present invention applied to a conventional braiding machine in which rubber elastic threads are incorporated in the braided fabric; and

Fig. 10 is a plan view illustrating the construction of ribbon rubber.

Referring to the drawings and in particular to Figs. 1 to 5 inclusive, the numeral 1 designates a horizontal rail which may form a part of the rear structure of a conventional weaving loom, for instance a narrow ware loom employed in weaving elastic webbing. As illustrated, the loom comprises a horizontal comb or reed 2 for guiding textile yarns 3 from a suitable source of supply, for example a warp beam (not shown), to a horizontal guide roller 4 from which these yarns pass to the heddles by means of which they are formed into a shed, as indicated at 5—5. The numeral 8 indicates the path of rubber-elastic threads which are delivered substantially in the horizontal plane of the forming cloth web by passing over an elongate anti-friction roller 7, carried by a horizontal fixed shaft 6.

The improved tensioning means T of the present invention is herein illustrated as comprising a supporting bracket 9 mounted upon the upper edge of the rail 1 and having spaced aligned bearings for a horizontal shaft 10 on which is mounted the tensioning roll 11. This roll is of substantial diameter, for example five inches, and is of rigid material. If desired, this roll may have a friction surface, for instance a tight and firm covering of textile fabric, rubber or the like, but preferably it is of metal and smooth and polished. The roll 11 is fixed to the shaft 10 and a brake drum or pulley 12 (Fig. 2) is also fixed to the shaft 10 and is embraced by a brake band 13. Preferably this brake band is in the form of a cord and it may make one or more turns about the brake drum or pulley 12, as desired. One end of this brake band 13 is fixed to a suitable anchorage, here shown as a screw eye 14 set into the rail 1, while its other end is connected to a tension spring 15 which in turn is secured to an eye bolt 16, passing through a screw eye 17 fixed

in the rail 1. The bolt has a wing nut 18 at its lower end, by means of which the effective length of the bolt 16 may be varied, thereby varying the tension of the spring 15 and thus varying the retarding force applied by the brake band to the brake drum.

At its upper part the bracket 9 is provided with parallel horizontal arms 19 having downwardly directed open slots 20 and 21 for the reception of the ends of shafts 22 and 23, respectively, carrying presser rolls 24 and 25. The shafts are free to turn in the slots 20 and 21 and also to rise and fall so that the rolls 24 and 25 may move bodily toward and from the periphery of the tensioning roll 11. Preferably the rolls 24 and 25 are of substantially less diameter than the tension roll 11.

The bracket 9 preferably carries a yoke member 26 (Figs. 1 and 3) having a series of spacer pins 27 directed toward the periphery of the tension roll 11 and defining a series of stalls for the reception of the ribbon rubber strands.

A divider device (Fig. 4), comprising a frame 28 having horizontal parallel rearwardly directed arms 29 and 30, is secured to the rear side of the rail 1 at the lower part of the latter. This frame 28 supports a pair of parallel, freely rotatable divider rolls 31 and 32. Preferably, the arm 29 has socket bearings for the reception of one end of each of the rolls 31 and 32, respectively, while the arm 30 has openings extending all of the way through it and forming bearings for the opposite ends of the rolls 31 and 32. The rolls may be inserted by pushing them endwise through the openings in the arm 30, and the latter is provided with a cover plate 33, pivoted at 34 and which may be swung down so as to be parallel to the arm 30 and thus to form a closure for the bearing openings in the arm 30 after the rolls have been inserted.

Above this divider device there is preferably arranged a comb 35 (Fig. 5) mounted on a fixed transverse bar or rail 36 of the loom structure, this comb having spaced parallel teeth 37 providing slots for the reception of individual rubber threads. These slots are normally open at their rear ends to facilitate insertion of the rubber threads, but may be closed by a closure plate 38 pivoted at 39 to one end of the comb device and which in normal position overlies the ends of the teeth 37 and thus closes the spaces between them.

As illustrated, the tension device T is designed for handling ribbon rubber and for this purpose there is provided a receptacle 40 (Figs. 1 and 2) at the rear of the loom in which a supply of ribbon rubber may be placed. Ribbon rubber 41, as illustrated in Fig. 10, comprises a series of rubber threads 42 arranged parallel to each other and in the same plane, and with their adjacent edges cohering. However, while the threads cohere to the extent that the assembly may be handled as a unit in the form of a ribbon or tape, the constituent threads which are very uniform and all in substantially the same state of initial relaxation, are readily separated merely by pulling them apart. In accordance with the present invention, the ribbon rubber 41 may be piled into the receptacle 40 without especial care and under no initial tension. The ribbon rubber is led from this supply 40 up and over guide rollers 43 and 44, then down beneath a guide roller 45, forwardly beneath the rail 1, and beneath a guide roller 46, then up through one of the stalls defined by the guide pins 27, and thence over the presser roll 24. It is contemplated that several

strands of ribbon rubber will be delivered at the same time through the tension means, and when several ribbons are thus to be delivered simultaneously it is preferable to arrange them symmetrically so that the same number of ribbons will lie at each side of the center of length of the tension roll 11 and preferably at the same distances from the center of the roll 11. The separating pins 27 facilitate such arrangement.

The ribbon rubber passes over the roll 24, thence down between the roll 24 and the tension roll 11, then down and around the lower part of the roll 11, then between the roll 11 and the presser roll 25, over the roll 25 and then down to the dividing means, the latter being located substantially directly below the point of tangency of the ribbon rubber where it leaves the roll 25. At the dividing means the alternate threads 42 forming the ribbon rubber are caused to pass about the guide roll 32 and then upwardly to the comb 35, while the intervening constituent rubber threads pass about the roll 31 and thence upwardly to the comb 35.

It may be noted that in the arrangement shown, the ribbon rubber approaches the tensioning means T under substantially no tension, the only tension imposed being that sufficient to lift it out from the loosely piled mass in the receptacle, and lead it to the presser roll 24. On the other hand, the guide rolls 31 and 32 of the dividing means are so located that the tension force imposed on the rubber threads by the weaving operation tends to pull the presser roll 25 bodily downwardly and toward the tension roll 11, and the greater the tension applied to the rubber elastic threads between the presser roll 25 and the fell of the cloth, the more the ribbon rubber is compressed by the roll 25 where the ribbon rubber passes between the tension roll 11 and the presser roll 25. The compression to which the ribbon rubber is thus subjected is substantially proportionate to the effective tensioning force which stretches the rubber elastic yarn as it approaches the fell of the cloth. As the tension increases the ribbon rubber is squeezed more and more firmly against the surface of the roll 11 and eventually the frictional drag of the rubber against the roll 11 will turn the latter in opposition to the action of the brake band 13, thus letting off sufficient length of the ribbon rubber to restore the tension to the normal operating tension. Since the resistance imposed by the brake band 13 may be adjusted as desired, it is thus possible to determine the tension at which the rubber threads will be delivered into the cloth with great nicety, it being noted that there is always a substantially uniform length of rubber thread undergoing tension so that the imposed load is always distributed throughout the same length of material.

By the employment of this tensioning device it becomes unnecessary to wind the rubber elastic threads on a warp beam, whether or not ribbon rubber or initially independent rubber threads or covered rubber threads be employed, thus avoiding all of the difficulties incident to the winding and preparation of a beam of rubber warps; the provision of the complicated let-off mechanisms essential to the use of a beam of rubber warps is avoided; and the space requisite for the installation of a warp beam and the let-off mechanism is thus saved, since the tension device of the present invention occupies but very little space and may be installed at a point in the loom

structure which is normally free and available for the purpose.

While the tension device of the present invention is very useful, in combination, in a weaving loom structure, it is also useful in other textile machines in which rubber elastic threads must be fed under a definite tension. Thus, for example, it is highly useful in a braiding machine, as illustrated for example in Figs. 6 and 7. In Fig. 6 the numeral 50 designates a conventional braiding machine having carriers 51 each designed to support a yarn mass 52 from which the yarn 53 is led to the braiding die, not shown. In the arrangement shown in Figs. 6 and 7, rubber elastic threads 42 are delivered to the braiding die so as to form a core within a tubular braid formed of the textile yarns 53. For this purpose there is provided a guide roll 54 carried by a suitable supporting bracket 55 and so located as to deliver the yarns 42 directly to the braiding die. These strands 42 may be the constituent threads of ribbon rubber 41 derived from a suitable source of supply such as a box or other receptacle 40. The tensioning device T is substantially identical with that above described in its essential characteristics comprising a bracket 9 which supports the tension roll 11 and the presser rolls 24 and 25. However, in this instance, as illustrated in Fig. 7, the shaft of the tensioning roll 11 is provided at each end with a brake drum or pulley 12 embraced by a brake band 13 provided with means 15, 16, 18, for varying its tension.

The tensioning mechansim T is mounted upon a suitable base or support 56 and the base of the bracket 9 is preferably provided with a downwardly directed lip or flange 57 (Fig. 6) which engages the vertical rear surface of the support 56 and thus opposes tipping of the bracket 9 in response to the tension of the ribbon rubber 41 on its way to the guide 54.

In this instance the bracket 9 is shown as provided with rearwardly directed arms 58 which support a guide roller 59 beneath which the ribbon rubber passes on its way to the presser roll 24. The arms 58 also support a vertical panel 60 having series of staggered openings 61 designed to receive spacer pins 62. With this arrangement the spacer pins may be plugged into the openings 61 at desired points to form guideways for various widths of ribbon rubber 41 and also to locate several strands of the ribbon rubber symmetrically with respect to the center of length of the roller 11.

While ordinarily a single strand of ribbon rubber is arranged to pass between the presser rolls and the tension roll 11, at any given point, it is possible to obtain good results and at the same time to deliver a greater number of rubber elastic threads by superposing one or more ribbon rubber strands 41 as they are delivered to the tensioning means. Such an arrangement is illustrated in Figs. 6 and 8, where three strands of ribbon rubber are shown in superposed relation said three strands being treated in the same way as the single strand above described and being delivered as a unit to the tensioning means as many such units being used as necessary to obtain the desired number of threads.

As illustrated in Fig. 6, the guide roll 54 is so located relatively to the presser roll 25, that tension imposed upon the ribbon rubber between the roll 25 and the braiding point, tends to pull the roll 25 downwardly toward the tension roll 11, thus pressing the ribbon rubber more and

more firmly against the roll 11 as the tension increases, and thus insuring firm frictional engagement of the rubber with the roll 11, such as to cause the roll 11 to turn whenever the tension reaches a certain predetermined amount.

In Fig. 9 a further utility of the tensioning means is illustrated wherein it is shown as employed for feeding rubber-elastic threads to a braiding machine for incorporation in the braided fabric. In Fig. 9 a conventional braiding machine 61 is shown having movable carriers 62, each supporting a yarn mass 63 from which the yarn 64 extends to the braiding point. The machine also comprises guides 65 for the rubber-elastic threads 42. The tensioning means T is similar in all respects, if desired, to that shown in Fig. 6, or that shown in Fig. 1, and is designed to receive ribbon rubber 41 which passes over the presser roll 24 under the tension roll 11 and over the presser roll 25, and then to dividing means comprising a guide roll 65 mounted in a bracket 66 which also has bearings for the dividing rolls 31' and 32'. The ribbon rubber passes beneath the roll 65 and then alternate constituent rubber threads pass beneath the roll 31' while the intervening threads pass beneath the roll 32', the separated rubber threads 42 then extending up to the several guides 65 and thence to the braiding point where they are interbraided with the textile yarns 64.

The use of the tensioned rubber strands to supply the force for compressing the rubber threads between the tensioning rolls, makes unnecessary the usual complexity of adjustable weights, levers, etc., heretofore usually employed.

While as above noted the application of the present invention is especially valuable in connection with the use of ribbon rubber, it functions equally well in dealing with ordinary individual rubber elastic threads or covered rubber threads, whether delivered from spools, tubes, cones or even from a loose mass in a box or other receptacle. Desirably, although not necessarily, in handling individual threads so supplied, a separator device or comb is employed to insure proper distribution of the threads leading to or to and from the tension rolls. The lengths of the tensioning rolls may be varied according to the number of threads to be handled, the number varying from one to one thousand or more, according to the type of apparatus being served by this tensioning means. The device is far simpler than ordinary tensioning means; the winding of the rubber-elastic threads upon warp beams is made unnecessary; and a far more uniform tension is obtained than in any previous construction employed for the purpose.

While certain desirable embodiments of the invention have been illustrated by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the terms of the appended claims.

I claim:

1. Apparatus for delivering rubber elastic threads under tension to a point of use comprising, a container for ribbon-rubber, means for separating the ribbon-rubber into its constituent threads and for guiding said threads to a point of use, and tensioning means interposed between the container and the dividing means, said tensioning means comprising a rigid, smooth-surfaced, rotatable tension roll which is partially embraced by the ribbon-rubber as the latter advances, brake means imposing a substantially constant retarding force opposing rotation of the tension roll, a first presser roll which is bodily movable toward and from the periphery of the tensioning roll and which is so constructed and arranged as to press the ribbon-rubber against the periphery of the tensioning roll at its first point of contact with the latter, a second presser roll also bodily movable toward and from the periphery of the tensioning roll and spaced from the first presser roll about the periphery of the tensioning roll approximately 90°, the ribbon-rubber passing between the presser rolls and the tension roll and partially embracing each presser roll, the second presser roll being arranged to contact the ribbon rubber at the point of tangency at which the latter leaves the surface of the tensioning roll, the parts being so constructed and arranged that the ribbon-rubber urges the second presser roll toward the tensioning roll with a force proportionate to that which advances the ribbon-rubber.

2. Apparatus for delivering rubber elastic threads under tension to a point of use comprising, a container for ribbon-rubber, means for separating the ribbon-rubber into its constituent threads and for guiding said threads to the point of use, and tensioning means interposed between the container and the dividing means, said tensioning means comprising a rotatable tension roll which is partially embraced by the ribbon-rubber, a brake band for retarding rotation of the tension roll, one end of the brake band being attached to a tension spring and its opposite end being attached to the frame of the machine, a pair of presser rolls whose axes are parallel to that of the tension roll, and which are spaced apart from each other, each of said presser rolls being bodily movable toward and from the tension roll, the ribbon-rubber passing over one of said presser rolls between said latter presser roll and the tension roll, partially about the tension roll and then between the latter and the second presser roll, and then to the dividing means, the parts being so designed and arranged that in passing about the first presser roll, the tension of the ribbon-rubber urges the first presser roll toward the peripheral surface of the tensioning roll, the second presser roll urging the ribbon-rubber toward the tension roll with a force which is proportionate to the force which advances the ribbon-rubber.

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