United States Patent

Jones

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[45] **Jan. 25, 1972**

[54] TENSION-RELAXING DEVICE FOR FEEDING FILLING THREADS TO A WARP KNITTING MACHINE

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[52] **U.S. Cl.** .....**66/84**, 28/1 CL, 156/439

[51] **Int. Cl.** **D04b 23/12**

[58] **Field of Search** .....66/84; 28/1 CL; 156/439, 440

[56] **References Cited**

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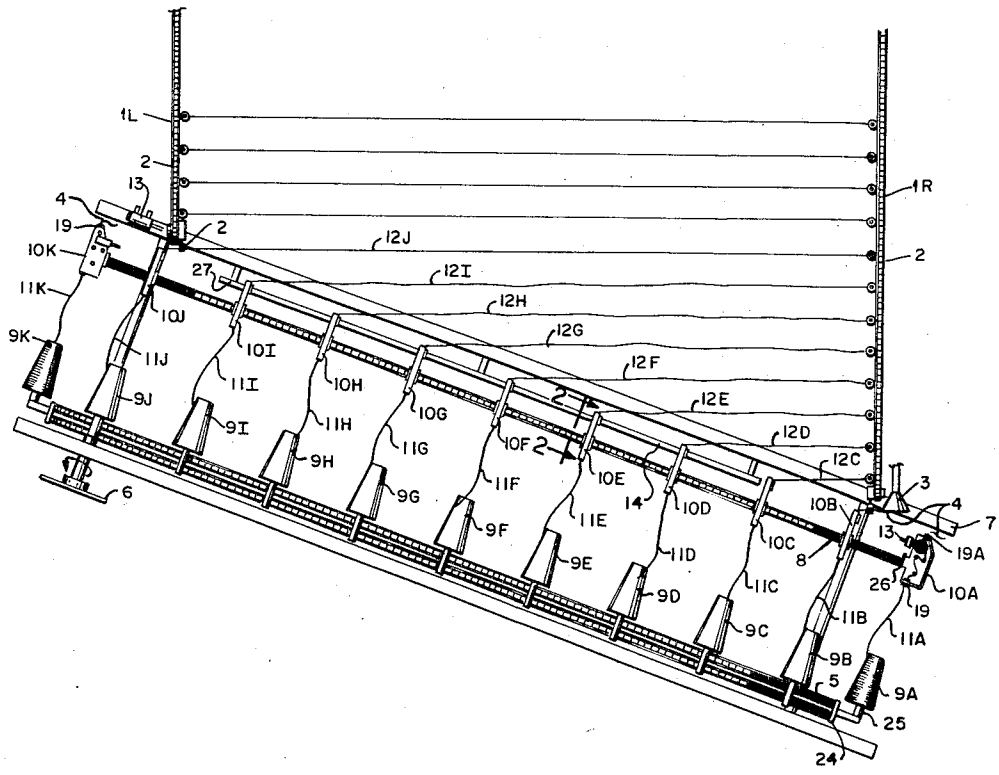
Primary Examiner—Robert R. Mackey

Attorney—Robert Ames Norton, Michael T. Frimer and Saul Leitner

[57] **ABSTRACT**

In a multiple-package filling-thread-feeding device for warp knitting machines of the so-called "carousel" type in which thread from a plurality of packages which are moved around by an endless chain is fed to transfer chains provided with pins which carry the filling or weft threads to the knitting line, the motion of the packages stretches successive filling thread lengths from the pins on one chain to the pin on the other. These threads each pass through a tension device between two spring-pressed discs, the tension device for each package moving with it. On the warp knitting machine frame is a cam somewhat shorter than the distance between chains, which cam contacts a rod or follower in each tension device and spreads the discs apart by a wedge at one end while the filling thread is fed out from each package, tension being renewed for a short distance at either end of the length of filling thread from chain to chain.

4 Claims, 5 Drawing Figures



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SHEET 1 OF 2

FIG. 1

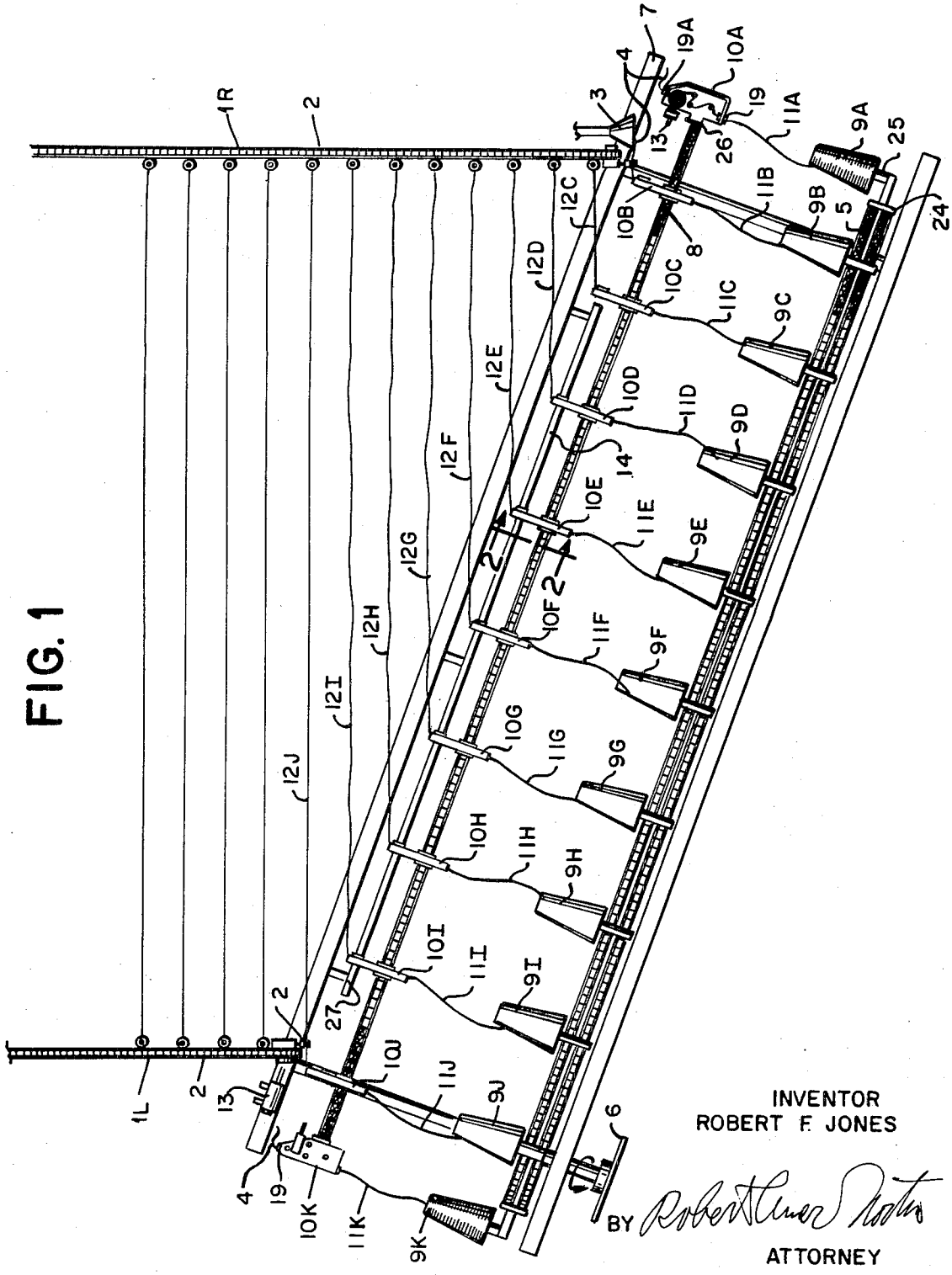

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FIG. 2

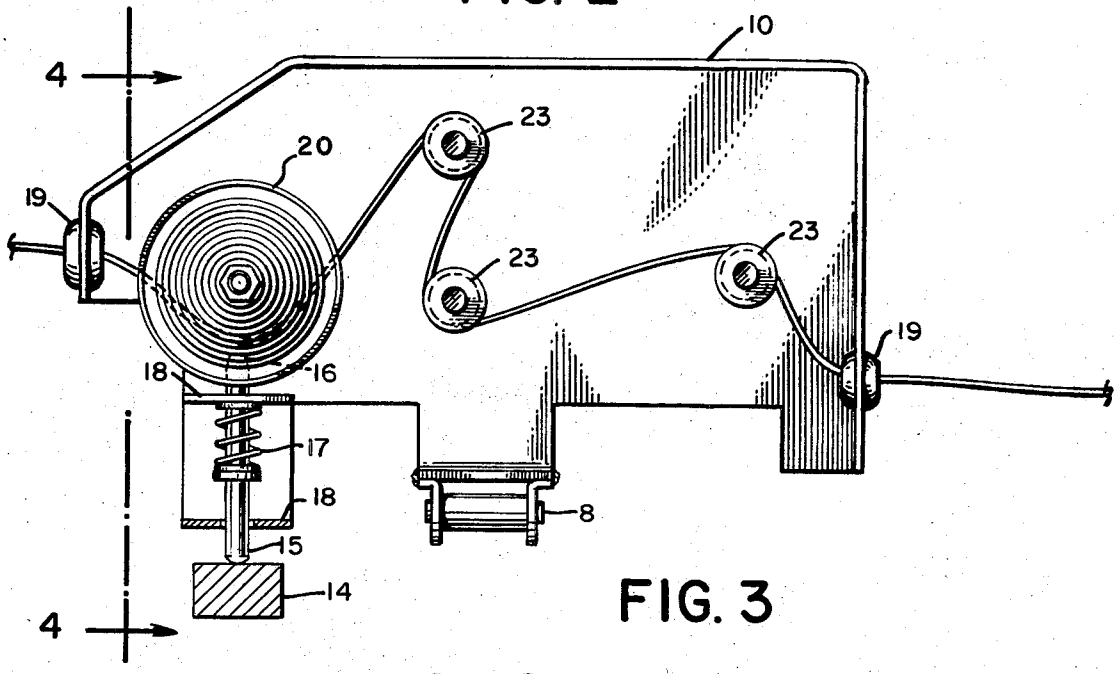


FIG. 3

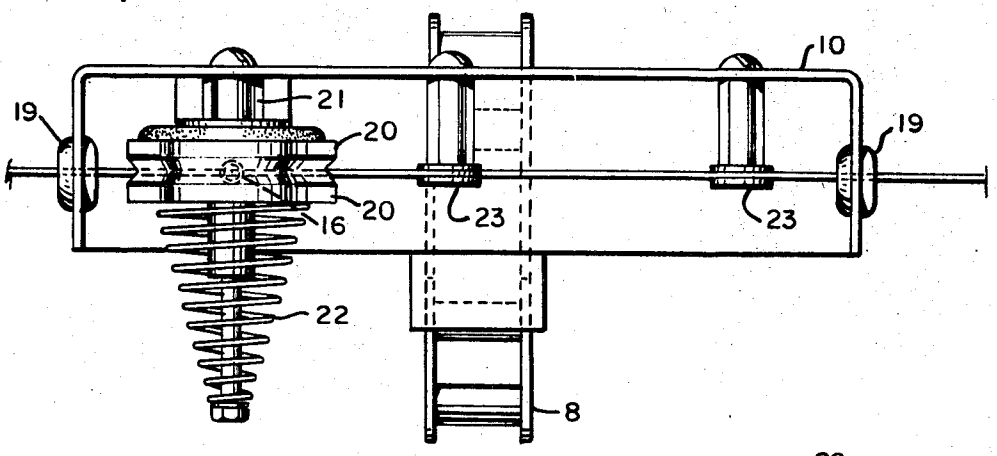


FIG. 4

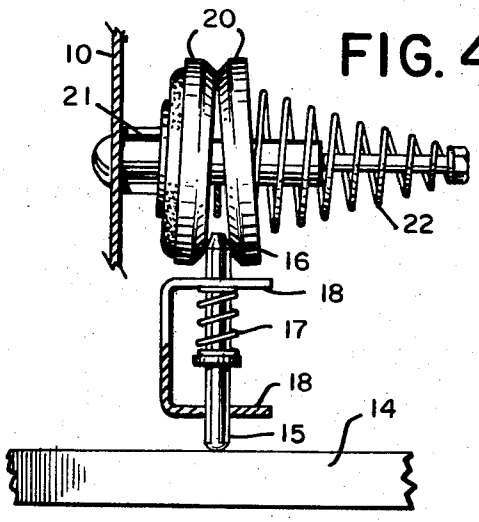
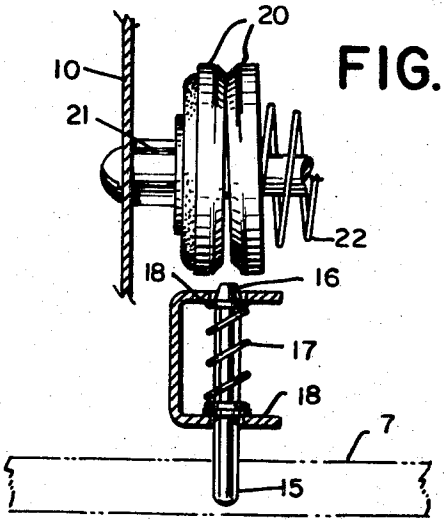


FIG. 5



TENSION-RELAXING DEVICE FOR FEEDING FILLING THREADS TO A WARP KNITTING MACHINE

BACKGROUND OF THE INVENTION

Warp knitting machines with inserted weft or filling threads at the knitting line have achieved great commercial success because of the enormous speed possible on the knitting machine as compared with an ordinary loom for weaving. Feeding of the weft thread has presented a serious problem because of the great speed of the machine and hence the speed with which thread is taken from a package.

A few years ago an important advance was made, which is described in the Carman U.S. Pat. No. 3,364,701. In this device a large number, for example 12, 24 or more packages of weft thread, which can be the same type of thread or different ones where such patterns are desired, move around on a chain, and as they move, the thread from each package passes close to a pin on one of two transporting chains, which clamps the thread, and then when the package passes past the pin on another chain, spaced the length of the knitting line from the first chain, it is again clamped and cut off. As a result, the packages string parallel weft threads or yarns across the chains, that is to say, they are at least parallel when they reach the knitting line, and are carried to the knitting line of the machine. Because of the moving around of the packages on their chains, this device is known in the industry as the "-carousel" type of weft-feeding device, and this name will be used in much of the following specification to save awkward language.

Very recently a modification of the carousel has been put into operation in which instead of moving the packages around a chain in a horizontal plane with the packages extending up vertically, the plane of the chain is turned through 90° so that the chain turns in a vertical plane and the packages extend out horizontally toward the carrier chains. This modification of the Carman carousel has proved more convenient and reliable in practical operation than the original carousel and will be referred to as a carousel with horizontally extending yarn packages.

All of the carousel weft-feeding machines carry a tensioning device along with each package, because unless the yarn is under a suitable tension it will not be pulled out between the carrier chains uniformly without sagging. In spite of the tremendous advance in feeding speeds and time of operation of the knitting machine without yarn package replacement, for example a 72 package carousel permits the machine to operate for a much longer time before weft yarn supply is exhausted, certain problems have arisen. In order to provide the required tension so that the successive lengths of weft thread do not sag between chains, a considerable amount of friction on the yarn in the tensioning devices is required. This may limit, in some cases, the speed of a warp knitting machine with very fragile weft yarns; and even where the weft yarns can withstand the friction at maximum feeding speed, the rubbing of the surface of the yarn gradually produces lint, which of course is never desirable in the environment of any fabric-making machine. These problems are a small price to pay for the great advantages of the carousel type of feed, but leave still something to be desired. It is with the elimination or substantial elimination of these problems that the present invention deals. It should, therefore, be considered as an improvement on carousel feeds and is particularly applicable in carousel feeds of the type where the chain moves in a vertical plane and the packages extend out horizontally.

SUMMARY OF THE INVENTION

The present invention provides a new type of tensioning mechanism for the yarn fed from each package as the packages move around the carousel chain. The yarn passes through yarn-tensioning means, such as two discs, which are pressed together with a suitable spring, producing the necessary friction to maintain any desired tension on the yarn. However, these tensioning devices are associated with means for releasing tension during most of the travel of the yarn between carrier chains. A very simple and preferred modification is a rod or cam follower with a wedge-shaped end and with a suitable spring maintaining the end of the rod in contact with a cam, which is stationary on the feed mechanism or, in some cases, the actual warp knitting machine itself. This cam extends with its raised portion between the chains carrying the weft thread but not extending quite to each chain. As a result, the yarn is under the predetermined tension when it is first caught by a pin or other clamping means on the first chain, and then almost immediately, as the package, and with it its tensioning means, moves, the rod is raised by the cam and the tension ceases because the tension discs are wedged apart. During most of the travel of the package and stringing of the yarn between chains, it is under no tension. However, as the second chain is approached, the cam follower rod drops down, the tension discs apply tension to the yarn, and the desired tension results. Thus instead of the yarn passing between the tension devices for the whole of the path of stringing, it is only under tension for very short distances at either end. Strain on the yarn is greatly reduced because tension is applied for only a short period of time, and there is always a certain small amount of resiliency in any yarn, and so high knitting speeds can be maintained even with delicate yarns. Because of the extremely short paths where the yarn is passing through tension discs, linting is eliminated substantially or reduced to a small fraction of its former amount, which with many yarns may be considered negligible, and operation of the warp knitting machine can go on for long periods of time without accumulating undesirable amounts of lint. Twisting of the weft yarns is also greatly reduced.

The above brief description is of the preferred type of tensioning, but of course the principle of the present invention can use any kind of intermittent tensioning. For example, although this adds expense and complications, the individual yarn tensioners may be provided with solenoids which are energized during the portion between chains when tension is to be released. Of course the solenoid could operate in the opposite direction and only be actuated when tension is to be applied. Because of the ruggedness and reliability of the cam and cam follower rod with wedge end, this is preferred for practical operation and is the form which will be described in detail in the specific description of the drawings and preferred embodiments below, but of course as far as the new results of the present invention are concerned, any means for relaxing the tension at the proper times will perform the desired result. The preferred rod and cam type of tension release is most easily and conveniently applied to a modified Carman carousel in which the chain moves in a vertical plane and the packages extend out horizontally. This, however, is no drawback of the present invention as the modified carousel is what is customarily used today.

It is an advantage of the present invention that except for the proper mounting of the cam and the tensioning means of the present invention, no significant change is required in the carousel, and of course all of the advantages of the carousel feed are fully retained.

Since none of the parts of the warp knitting machine, carrier chains, etc., are changed by the present invention, only so much of the machine will be shown in specific description so that it can be seen where the present invention comes into play. Also, the elements that are shown are for the most part in diagrammatic form as their specific details of construction are not changed by the present invention. In any carousel feed device, whether of the original form or the modified form, it is, of course, essential that the various elements move in proper synchronism, and of course the same holds true when the improvement of the present invention is applied. However, synchronous drive will not be specifically shown as it is not changed.

Carrier chains have been described as this is the preferred modification. However, other endless carriers may be used so long as there are first and second carriers to transport the

wefts to the knitting line and a third endless carrier to carry the yarn packages.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the weft feed transport and carousel in semidiagrammatic form;

FIG. 2 is a section along the line 2—2 of FIG. 1;

FIG. 3 is a section at right angles to FIG. 2;

FIG. 4 is a section along the line 4—4 of FIG. 2; and

FIG. 5 is similar to FIG. 4 but with a retracted cam follower.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1, while a plan view of the packages on the carousel, is not all in one plane as the two weft carrier chains 1L and 1R for left and right chains extend up at an angle from the plane of the carousel itself. The chains carry conventional clamping pins 2 which are opened on chain 1R as it approaches the yarn, as will be described, and of course open when the weft has been carried to the knitting line. The drawing does not extend this far and the knitting line is not shown as it is not changed by the present invention. The opening and closing of the clamping pins is by conventional cam means on the sprockets for the chains. As the opening and closing means are of conventional design, they are not specifically illustrated on the drawing in order to avoid confusion and so this portion of the drawing is essentially in purely diagrammatic form.

The modified carousel portion of the device is built on a frame 7 and shows an endless carrier in the form of two chains, a wider chain 5 on which the yarn packages are carried and a narrower chain 8 on which the tensioning devices for each package are carried. As can be seen from FIG. 1, the packages which are numbered 9A to 9K are horizontal; in other words, the drawing shows a modified carousel rather than the form in the original carousel patent mentioned above. Drive for the chains 1L and 1R and for the chains 5 and 8 is taken from the main drive from the machine, as diagrammatically indicated at 6. The mechanical connections are not specifically illustrated as they would only confuse the drawings and are not changed in the slightest by the present invention. Similarly, only the 11 packages which can be seen by looking down on the carousel are shown, but of course the chains 5 and 8 are endless.

Each package has its own tensioning device, labeled 10A to 10K, the lettering corresponding with the packages. Yarn from the packages is numbered 11A to 11K and runs from each package to its tensioning device. Before describing the construction of the tensioning devices and their auxiliary equipment, which constitutes the heart of the present invention, the general operation will be described. The chains 5 and 8 move from right to left, as can be seen by the arrow, on the shaft from the drive 6, and the chains 1L and 1R move diagonally upward. The chains are, of course, endless and return, but in FIG. 1 the return is not shown. Packages 9A and 9K are turning around an end sprocket, (not shown), of chain 5 and illustrate that the mounting of the package on the chain includes a bracket 24 to the spindle 25 of the package. Similarly, the tension devices 10A and 10K for packages 9A and 9K are mounted on chain 8 by brackets 26. This bracket mounting is more clearly shown in FIG. 2.

Of course, each of the packages has its own spindle, but in order not to confuse the drawings only the spindle 25 of package 9A is numbered. Also, it will be seen that only tensioning device 10A is shown in section in FIG. 1. At this point it will be seen that the yarn 11A from package 9A passes into and out of the tensioning device 10A through grommets 19 which have smooth ceramic surfaces. The passage of the yarn through the tensioning device is more clearly shown in FIG. 2 and will be described in detail below. It will be seen that there are short tails 4 of the yarn extending from one of the grommets 19 in each tensioning device. Similar tails are, of course, extending from the tensioning devices for the packages on the bottom or return of the chain 5. In FIG. 1 only three of the tails are shown.

Package 9B has moved to a point so that the tail is opposite a clamp or pin 2 on the chain 1R. This pin has been temporarily opened by the conventional opening and closing mechanism, not specifically shown. In order to be sure that the tail 4 is across the opened pin 2 there is a vacuum funnel 3 which pulls out the tail. As this is conventional in all carousel machines, it is shown only diagrammatically. As the chain 1R moves, the pin which has received the tail 4 clamps, and of course this has occurred with the tails of the preceding packages 9C to 9J. As a result, yarns 12C to 12J are strung between the chains as the packages move. This is the same general result as in an ordinary horizontal package carousel machine. After package 9J has moved past the chain 1L and has been clamped by the corresponding pin 2 which was opened and closed, as has been described in connection with the pin 2 which clamped onto the tail 4 on the right-hand chain, a cutter 13 cuts the yarn, leaving a tail which can be seen as 4 in the yarn from the package 9K which has moved on and is getting ready to turn around the sprocket of the chain 5.

A cam 14 is mounted on the frame 7 with an entrance ramp just beyond the tensioning device 10C and an exit ramp just beyond the tensioning device 10I. As FIG. 1 is a plan view, the gentle slope of these ramps does not show.

Turning to FIG. 2 it will be seen that the yarn enters through one grommet 19, passes around guiding rolls 23, and then between two discs 20. These discs are mounted on a bolt 21 and can move against tension of the spring 22. This can best be seen in FIGS. 3, 4 and 5. In FIG. 2, which represents the position occupied by tensioning device 10E in FIG. 1, and which, incidentally, is the same position for tensioning devices 10D and 10F to 10I, a rod 15 has been moved up by the cam 14. This rod moves in an extension 18 of the housing 10 against a spring 17 and is provided at its upper end with a wedge-shaped taper 16, which can be seen best in FIGS. 4 and 5. As the rod has been forced up by the cam 14 it has separated the discs 20 as shown in FIG. 4, and therefore the yarn passing between the discs is not held by friction and can run freely. This is also the case with the yarn from tensioning devices 10D to 10I inclusive. As a result, the yarns 12D to 12I are somewhat loose and there is no friction between the discs 20, which results in no strain on the yarn and also minimizes accumulation of lint and yarn twisting.

When a tensioning device reaches the exit ramp, which is the case with tensioning device 10I, the rod 15 slides down the exit ramp 27, the slope of which, of course, does not show in FIG. 1, and the rod 15 retracts under the urging of its spring 17. This is the position shown in FIG. 3 and in more detail for the discs in FIG. 5. The discs now grip the yarn 12I and there is sufficient tension so that it is straightened out until it is caught by the pin 2 on the chain 1L. This is shown for the yarn 12J from the tensioning device 10J. The tension is sufficient so that the yarn 12J is pulled taut and caught by the clamping pin 2. The chains then carry these yarns in strict parallelism to the knitting line of the weft-insertion knitting machine, which line is not shown in FIG. 1. As has been mentioned above, the yarn is cut by the cutter 13, leaving a tail, shown at 4, which tail remains as package 9K moves around to the position occupied by package 9B, and the sequence of operations is repeated as described above.

I claim:

1. In a weft-thread-feeding device for warp knitting machines comprising first and second endless carriers with yarn clamping means thereon for opening and closing to clamp on weft threads, a third endless carrier provided with a plurality of yarn packages, each package having associated with it and moving therewith a tensioning means for the yarn, the endless carriers being synchronously driven and positioned so that as a package comes adjacent to the clamping means on the first carrier, the clamping means opens, clamps the yarn from the package, and the yarn is then strung over to a corresponding clamping means on the second carrier by the movement of the third carrier for the packages and is clamped on said second carrier and the yarn cut, the improvement in which each yarn-tensioning means includes means for apply-

ing tension to the yarn intermittently, and means, controlled by the position of a package between the first and second carriers, for actuating said yarn tension-applying means, tension being applied as the yarn is grasped by the clamping means on the first carrier and maintained for a short distance beyond, the tension then being released until the package approaches the clamping means on the second carrier and reactuated for a short distance as the package transfers its yarn to said clamping means on the second carrier, the yarn being tension free during the major portion of the travel of each package between carriers and strains on the yarn and excessive lint formation thereby avoided.

2. A device according to claim 1 in which the carrier for the packages rotates in a vertical plane and the packages extend horizontally toward the plane of the first and second carriers.

3. A device according to claim 2 in which the yarn-tension-applying means comprise two discs, spring urged against each other, and between which the yarn passes, and the means for actuating said yarn-tension-applying means is a rod with a wedge-shaped end adjacent the discs and spring-urged away from the discs, and a cam, stationary with respect to the moving packages, contacting the other end of each rod and positioned and shaped so that as each package of weft yarn passes beyond the clamping means on the first carrier, the rod is forced by the cam profile between the discs, relieving tension, and just before a package reaches the clamping means on the second carrier the cam profile drops and the rod moves under spring pressure to restore contact between the discs and hence yarn tension.

4. A device according to claim 1 in which the yarn-tension-applying means comprise two discs, spring urged against each other, and between which the yarn passes, and the means for actuating said yarn-tension-applying means is a rod with a wedge-shaped end adjacent the discs and spring-urged away from the discs, and a cam, stationary with respect to the moving packages, contacting the other end of each rod and positioned and shaped so that as each package of weft yarn passes beyond the clamping means on the first carrier, the rod is forced by the cam profile between the discs, relieving tension, and just before a package reaches the clamping means on the second carrier the cam profile drops and the rod moves under spring pressure to restore contact between the discs and hence yarn tension.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,636,731 Dated January 25, 1972

Inventor(s) Robert F. Jones

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Assignee: J. P. Stevens & Co., Inc., New York, New York

Signed and sealed this 17th day of October 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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