Jan. 8, 1963 B. FRIED 3,072,359

YARN TENSIONING DEVICE

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Fig. 1

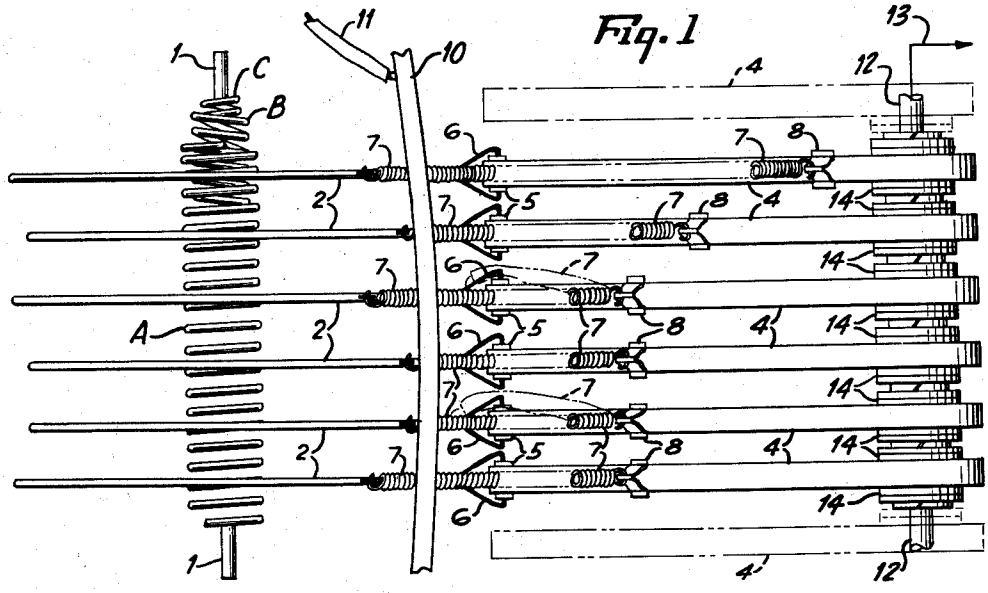

Fig. 2

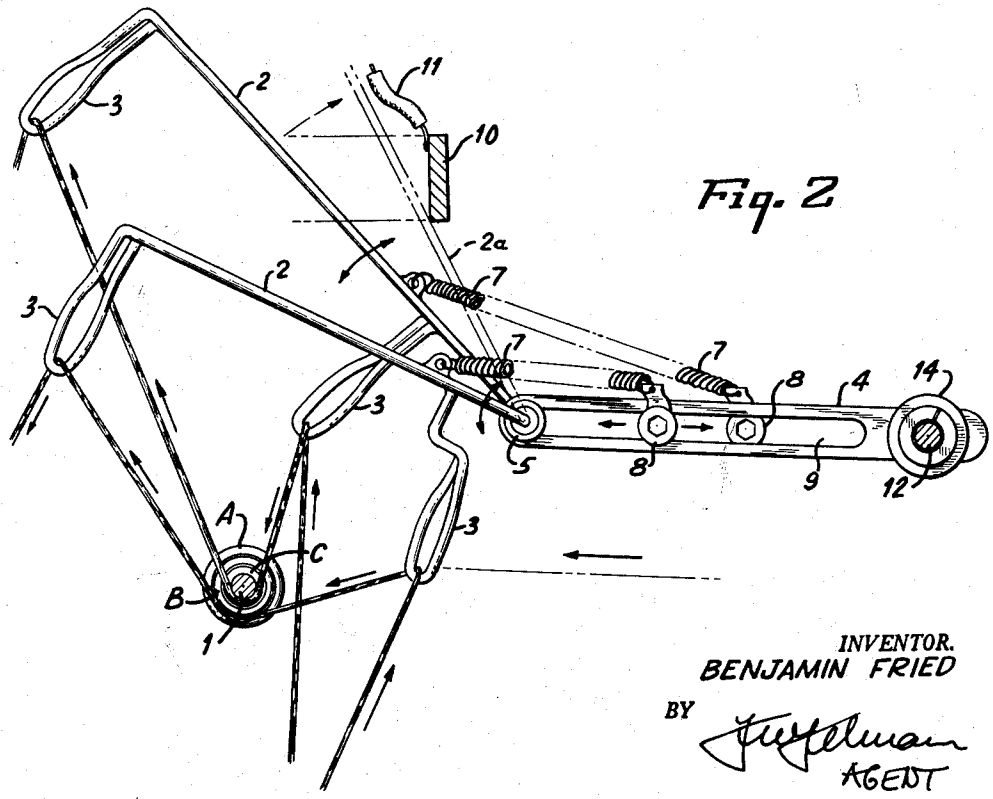

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Fig. 3

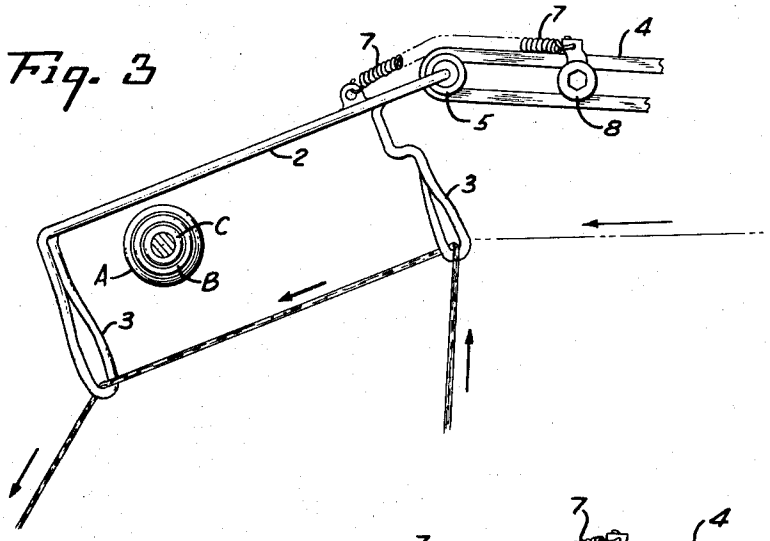
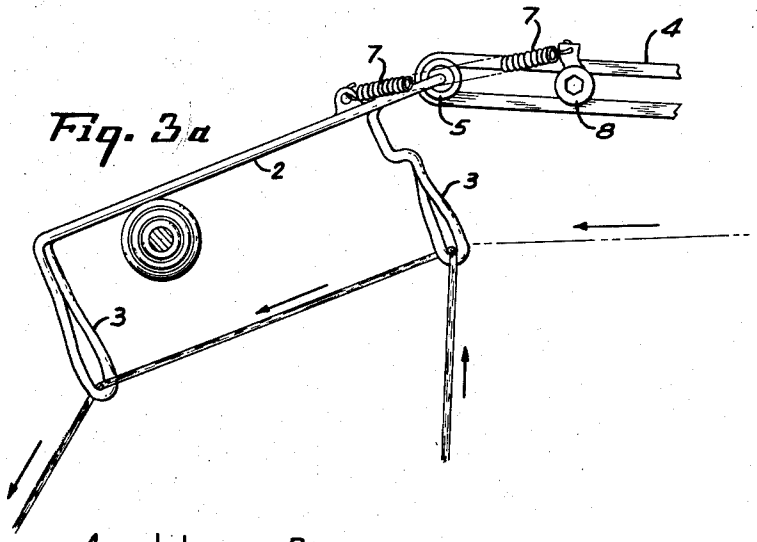


Fig. 3a



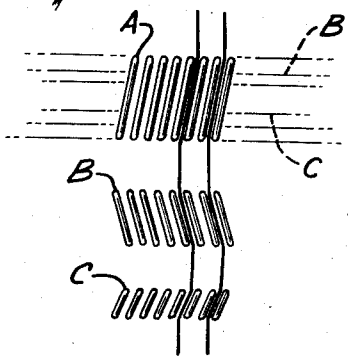


Fig. 4

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YARN TENSIONING DEVICE

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4 Claims. (Cl. 242—153)

The present invention relates to improvements in yarn tensioning devices designed to feed yarns traveling from a yarn package to any yarn handling machine, such as warp winding machines, for instance, and will be described particularly as used with, but is in no way limited to, fabric producing machines, such as circular knitting machines, warp knitting machines, weaving machines and like means requiring yarn to be fed thereto at a given and preferably uniform tension.

It is one object of this invention to impart substantially even and uniform tension to such traveling yarns.

It is another object of the invention to provide automatic means for stopping the yarn handling machine in response to the breakage of any yarn being fed thereto.

It is also an object of the invention to provide a plurality of individual yarn guide and tensioning means for each individual yarn in a relatively small space, thus producing individual control of each yarn and stoppage upon breakage of any yarn.

It is yet another object of the invention to provide yarn tension control means designed to equalize the tension of all yarns being fed to the yarn handling machine.

It is a further object of the invention to provide simple and fast means for inactivating any given yarn guide means.

The above and other objects are accomplished in accordance with the present invention by providing, in combination with a yarn guide means, a yarn tension control means positioned between the yarn guide means and the yarn handling machine, preferably above the path of the traveling yarn. The yarn tension control means comprises elements which force any traveling yarn through a zig-zag path when the yarn contacts the control means.

According to a preferred embodiment, the yarn tension control means comprises a plurality, preferably at least three, of helical elements, such as coil springs, positioned concentrically about one another, the helices of alternating elements or springs facing in opposite directions.

The yarn guide means of this invention comprises a plurality of closely adjacent levers with yarn guide means, such as a pair of loops, on each lever. Each lever is swingably mounted on an individual support defining a plane with its lever. A tension spring connects each lever with its support and biases the lever upwardly in the indicated plane about a pivot, which is positioned in the support intermediate the points of connection of the tension spring, when the spring is in this plane. The lever may be put out of action when the tension spring is flipped past the pivot and out of the plane.

The bias of each tension spring determines the tension under which the individual levers are biased upwardly and this bias is preferably adjustable for each individual lever.

Preferably, an electrical contact element is mounted above the levers and their supports and transversely of the planes defined thereby. An electrical control circuit connects the contact element to a means for stopping the fabric producing machine and is actuated upon contact of one of the levers with the contact element.

The above and other objects, advantages and features of the present invention will become more apparent from the following detailed description of a preferred embodiment, taken in conjunction with the accompanying drawing wherein

FIG. 1 is a top plan view of a yarn tensioning device in accordance with this invention;

FIG. 2 is a side view of the device of FIG. 1 showing a plurality of yarn guide means levers in different positions;

FIG. 3 is a side view showing one yarn guide means lever in yet another position;

FIG. 3*a* is similar to FIG. 3 showing an inactivated yarn guide means lever; and

FIG. 4 is a schematic illustration of the zig-zag path taken by the yarn as it passes in contact with the yarn tension control means of the invention.

Referring now to the drawing, wherein like reference numerals indicate like parts in all figures, there is shown a yarn tension control means consisting of three helical springs A, B and C positioned concentrically about one another and supported on a crossbar **1**. The crossbar may be held fixedly or adjustably by any suitable support means (not shown). To show the concentrically arranged springs, the ends of springs A and B are broken off in FIG. 1 so as to reveal the respective underlying spring coils. As is apparent from FIG. 1 and the schematic showing of FIG. 4, the helices of alternating springs face in opposite directions so that any yarn in contact therewith is forced into a zig-zag path as it travels through the springs (see FIG. 4).

The yarn guide means positioned in the paths of yarns traveling from yarn packages (not shown) to a fabric producing machine (also not shown) comprises a plurality of levers **2** and yarn guide means on each lever, the illustrated yarn guide means consisting of a pair of loops **3**. As shown, the yarn tension control means A, B, C is positioned between the loops **3** and below the levers **2**. Each lever has a suport **4** defining a plane with its lever and the path of the yarn traveling through the respective lever loops. The levers are swingably mounted on the supports for pivotal movement in the respective planes, a pivot **5** on each support holding a forked end **6** of each lever. Tension spring **7** connects each lever with its support, the pivots **5** being intermediate the points of connection of the tension springs and their supports. Each tension spring biases its lever upwardly toward the respective support about pivot **5** when the tension spring is in the plane defined by the lever and the support (see FIG. 1). When a specific yarn guide means lever is to be put out of action, its tension spring is merely flipped aside past the pivot and out of this plane whereby the lever will come to rest against the yarn tension control means without further movement, as shown in FIG. 3*a* and in broken lines showing some of the tension springs out of action in FIG. 1.

The bias of the tension springs determines the tension under which the levers **2** are biased upwardly against the pull of the yarns passing through loops **3**. In accordance with the preferred embodiment illustrated herein, the tension spring bias is adjustable. The specifically illustrated bias adjusting means comprises an anchoring element **8** for one end of each tension spring. The anchoring element is a simple nut-and-bolt assembly movably mounted in longitudinally extending slot **9** provided in each lever support **4** whereby the distance between the anchoring element and the respective pivot **5** may be adjusted, varying distances being shown in connection with different levers. One end of each tension spring **7** is simply attached to a lug on the anchoring element and is automatically moved farther away or closer to its pivot **5** as the anchoring element is slid along slot **9** to the desired distance and the corresponding bias of the tension spring is obtained.

All elements of the yarn tensioning device are preferably of an electrically conductive material, such as metal, for instance steel, and an electrical contact element **10**, for instance of steel, is shown mounted above levers **2** and supports **4**. Contact element **10** extends transversely of

the levers and supports. As shown at 2*a* in FIG. 2, when a yarn passing through lever loops 3 breaks and thus releases all downward pull on the lever, the lever will snap upwardly under the bias of its tension spring and contact the element 10. The contact element 10 forms part of an electrical control circuit which is closed when an electrically conductive lever 2*a* contacts the element 10, cable 11 leading from contact element 10 to a suitable means (not shown) for stopping the fabric producing machine to which the yarns travel. The electrical control circuit comprises the lever and support, all supports being fixedly mounted on conductive crossbar 12 which is connected to electrical conductor wire 13 receiving power from a suitable voltage source. The supports are spaced apart by washers 14 positioned between adjacent supports.

The operation of my improved yarn tensioning device will partly be self-evident from the above description of its structure and will partly be elucidated hereinafter. As will be evident, any desired number of yarn guide means levers may be positioned side-by-side and quite close together, for instance about ⅜" apart or even closer, thus permitting individual yarn tension control for a considerable number of yarns coming from any suitable yarn supply, for instance a plurality of yarn cones feeding yarn to a knitting machine. Obviously, this type of individual yarn control may also be useful in other fabric producing machines where it is desirable to receive the yarns under even and uniform tension.

On its travel from the yarn package to the fabric producing machine, each yarn is guided through lever loops 3, as best shown in FIG. 2. When the yarn comes off the package tightly and when it is under the desired tension (see FIG. 3), it will pull the lever 2 down a little against the bias of spring 7 so that the yarn path by-passes the tension control means and the yarn is not in contact therewith. However, when yarn comes off the package under normal tension and when the bias of spring 7 is stronger than the pull of the tension of the yarn, lever 2 will be pivoted upwardly (see FIG. 2) so that the yarn engages the helical springs of the tension control means, passing between their resilient helices in a zig-zag path and causing corresponding friction to the yarn. This friction will automatically control the tension of the yarn so that it will emerge from the tension control means with approximately the same tension as the tension with which the yarn comes off the package, the tension of the yarns increasing as the yarn rides up in the tension control means wherethrough it normally passes at its bottom third. In this manner, the tension of all the yarns is equalized and all yarns are fed to the fabric producing machine under substantially uniform tension. Knots will pass through the tension control means, causing each coil spring to move first in one and then in the opposite direction to accommodate the knot while the other springs hug the yarn in the zig-zag path for proper control.

It is often desired, in knitting vertical yarns, for instance, to eliminate the feeding of a number of yarns for a given period of time. In accordance with the present invention, each yarn guide means lever may readily be put out of action very simply by merely flipping its tension spring sideways out of the plane of the lever (see FIG. 3*a*), whereby the tension spring will pull the lever against the tension control means and keep it inactive and out of contact with the electrical contact element 10. Since knitting operations often involve the feeding of hundreds of yarns and a hundred or so must often be temporarily discontinued for different fabric designs, this fast and simple inactivation of a great number of individual yarn guide means constitutes an enormous operational advantage.

Furthermore, the desired tension may be readily and infinitely adjusted by the simple tension spring adjustment means of the invention, as described and illustrated.

Finally, the fabric producing machine will be stopped instantly when any individual yarn fed thereto breaks because its guide means lever will promptly snap into contact with element 10 under the bias of spring 7 when no yarn pulls the lever down, thus closing an electrical control circuit which actuates any conventional means for stopping the machine.

Support rod 1 for the coil springs may be eliminated entirely. If used, the tops of the coil springs are preferably attached to the rod (or to each other, if no rod is used) so as to give the yarns passing through the control means room to move to the upper third of the coils to seek additional friction for proper tension control.

While I have described my improved yarn tensioning device in connection with a preferred embodiment thereof, it will be clearly understood that many variations and modifications may occur to those skilled in the art without departing from the spirit and scope of the present invention as defined in the appended claims.

What I claim is:

1. In combination with a yarn tensioning device comprising a yarn guide means in the path of a yarn traveling from a yarn package to a yarn handling machine; a yarn tension control means positioned between the yarn guide means and said yarn handling machine, said yarn tension control means extending transversely of said yarn path and comprising a plurality of helical resilient elements positioned concentrically one about the other, the helices of adjacent elements facing in opposite directions and the yarn tension control means being arranged above the path of the traveling yarn, the yarn tensioning device being arranged to guide any yarn into contact with said helical elements whereby said yarn is forced through a zig-zag path as it travels therethrough.

2. In combination with a yarn tensioning device comprising, yarn guide means in the path of a yarn traveling from a yarn package to a yarn handling machine; yarn tension control means positioned between the yarn guide means and said yarn handling machine, said yarn tension control means extending transversely of said yarn path and comprising a plurality of helical resilient elements positioned concentrically one about the other, the helices of adjacent elements facing in opposite directions and the yarn tension control means being arranged above the path of the traveling yarn, the yarn tensioning device being arranged to guide any yarn into contact with said helical elements whereby said yarn is forced through a zig-zag path as it travels therethrough, said yarn tension control means comprising at least three of said helical resilient elements.

3. A yarn tensioning device, comprising yarn guide means in the paths of yarns traveling from a plurality of yarn packages to a yarn handling machine, said guide means comprising a plurality of adjacent levers, yarn guide means on each of said levers, an individual support for each of said levers, each lever and its support defining a plane with a respective one of said yarn paths, each support including a pivot swingably mounting a respective one of said levers in a respective one of said planes, a tension spring connecting each lever with its support, each pivot being intermediate the points of connection of the tension spring to the lever and the support respectively, the spring connecting points and the lever pivot defining a single plane, each tension spring biasing the lever connected thereto upwardly toward its support about said pivot when said tension spring is in said plane and putting the lever out of action when said tension spring is flipped past said pivot and out of said plane, and the bias of said tension springs determining the tension under which said levers are biased upwardly, and yarn tension control means positioned between the yarn guide means and said yarn handling machine, said yarn tension control means comprising resilient elements extending transversely of said yarn paths and out of contact with said yarns when the yarn tension is sufficient to pull the levers down against the tension spring bias, said yarns being pulled into contact with said elements when the tension spring

bias overcomes the yarn tensions and pivots the respective lever upwardly, the yarn tension control elements being shaped to force any yarn traveling in contact therewith through a zig-zag path, the zig-zag path of each of said yarns extending transversely to the respective yarn paths, said yarn tension control means comprising a plurality of helical springs positioned concentrically one about the other, the helices of adjacent springs facing in opposite directions.

4. A yarn tensioning device, comprising yarn guide means in the paths of yarns traveling from a plurality of yarn packages to a yarn handling machine, said guide means comprising a plurality of adjacent levers, yarn guide means on each of said levers, an individual support for each of said levers, each lever and its support defining a plane with a respective one of said yarn paths, each support including a pivot swingably mounting a respective one of said levers in a respective one of said planes, and a tension spring connecting each lever with its support, each pivot being intermediate the points of connection of the tension spring to the lever and the support respectively, the spring connection points and the lever pivot defining a single plane, each tension spring biasing the lever connected thereto upwardly toward its support about said pivot when said tension spring is in said plane and putting the lever out of action when said tension spring is flipped past said pivot and out of said plane, the bias of said tension spring determining the

tension under which said levers are biased upwardly, said yarn tension control means positioned between the yarn guide means and said yarn handling machine, said yarn tension control means comprising resilient elements extending transversely of said yarn paths and out of contact with said yarns when the yarn tension is sufficient to pull the levers down against the tension spring bias, said yarns being pulled into contact with said elements when the tension spring bias overcomes the yarn tension and pivots the respective lever upwardly, the yarn tension control elements being shaped to force any yarn traveling in contact therewith through a zig-zag path, the zig-zag path of each of said yarns extending transversely to the respective yarn paths, said yarn tension control means comprising at least three helical springs positioned concentrically one about the other, the helices of adjacent springs facing in opposite directions.

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