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STORAGE APPARATUS

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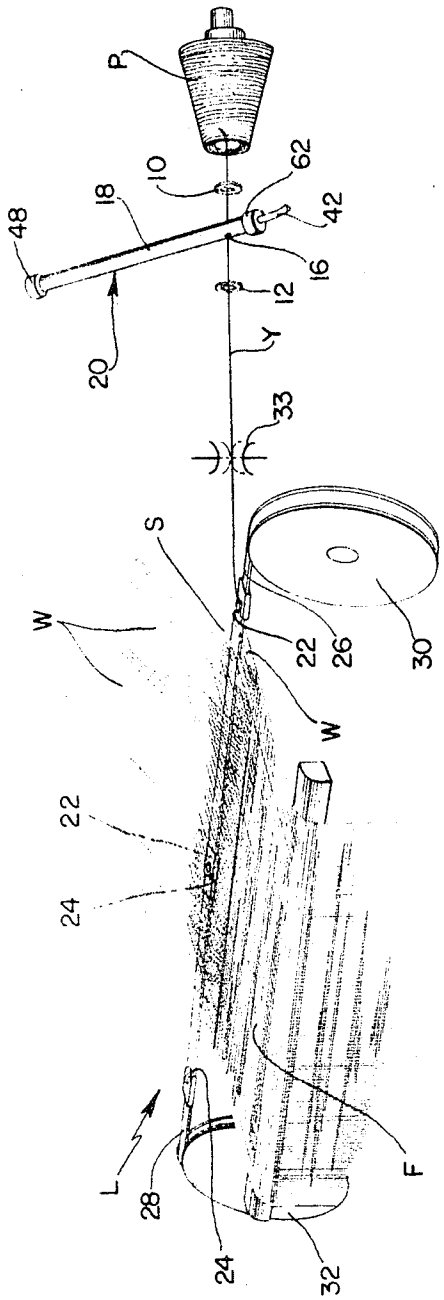

FIG. 1

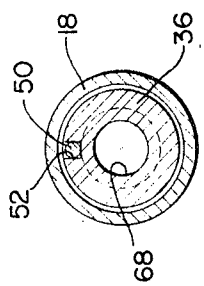

FIG. 3

FIG. 2

INVENTORS
CHARLES W. BROUWER
HANS H. RICHTER
BY Albert P. Davis
Burnett W. Norton
ATTORNEYS

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STORAGE APPARATUS

Charles W. Brouwer, East Greenwich, and Hans H. Richter, Cranston, R.I., assignors to Leesona Corporation, Warwick, R.I., a corporation of Massachusetts

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ABSTRACT OF THE DISCLOSURE

Apparatus for continuously unwinding yarn from a supply and releasably storing the yarn. Yarn is threaded into and out of an elongated chamber and is slidably engaged by a piston movable in the chamber. Pressurized fluid urges the piston in one direction for storing the yarn, but when tension in the yarn is increased, the piston is drawn by the yarn in the opposite direction for releasing the stored yarn.

The present invention relates generally to textile machinery and more specifically to apparatus for releasably storing a strand of yarn.

In the following specification, the term "yarn" is employed in a general sense to denote all kinds of strand material, either textile or otherwise, and the term "package" denotes the product of a winding machine, whatever its form.

In certain textile operations, a strand of yarn is drawn intermittently and at high speed from a supply package. One typical operation involves a so-called shuttleless weaving machine in which, during the course of a pick, one yarn carrier draws a substantially doubled length of yarn from the supply package through a portion of a shed of a fabric being woven. The doubled length of yarn, which is sufficiently long to reach across the width of the fabric, is then transferred within the shed to another carrier which takes no additional yarn from the supply package but draws the yarn already provided through the remainder of the shed. Thus yarn is withdrawn from the supply package of a shuttleless weaving machine only during one half of a pick. Further, since an entire pick consumes only a fraction of the time period involved in a complete operating cycle of the shuttleless weaving machine, it follows that yarn is withdrawn from the supply package during a small portion of the operating cycle and remains dormant during the remainder of the cycle. This results in intermittent high speed withdrawal of yarn from the supply package and imposes on the strand high tensile forces which are particularly harmful to yarns of a staple variety. These high tensile forces often cause yarn breakage at the supply package itself or shelling of yarn from the supply package which eventually results in yarn breakage.

From experience, it is known that if yarn were to be continuously, instead of intermittently, withdrawn from the supply package, the speed of withdrawal could be substantially reduced. In a typical operation of a shuttleless weaving machine, the speed of withdrawal could be reduced by a factor of between five and eight times over the conventional operation. For this reason, various mechanisms have been devised for continuously withdrawing the yarn from the supply package and storing it in a suitable manner until called for by a yarn carrier which

operates to draw filling yarn through the shed formed by warp yarns. These devices which include elaborate linkages, rotating discs and drums, and various other mechanical expedients, are often complicated in their design, costly to produce, and may even be harmful to the yarn.

According to the present invention, yarn from the supply package is threaded through opposed openings in an elongated chamber and is slidably engaged by a piston movable in the chamber in a first direction toward a position distant from the openings to store the yarn and in a second direction toward a position adjacent the openings for substantially releasing the yarn. Pressurized fluid is directed into the chamber and, applying a substantially constant force to the piston, urges the piston toward the distant position. However, when tension in the yarn is increased above a pre-established limit, as when yarn is called for by a yarn carrier, the movement of the piston is reversed to release the stored yarn. Readily adaptable to existing machinery, the invention is inexpensive to produce, harmless to the yarn, and is effective in withdrawing yarn from all sizes and shapes of yarn packages.

Accordingly, it is an object of the invention to provide new and improved yarn storage apparatus.

Another object of the invention is to provide new and improved yarn storage apparatus adapted to deliver yarn to an intermittently operated take-up device while continuously unwinding yarn from a supply package.

Yet another object of the invention is the provision of new and improved yarn storage apparatus which is fluid operated.

Still another object of the invention is the provision of new and improved yarn storage apparatus including an elongated chamber through which yarn is threaded, a piston slidably engaging the yarn and movable in the chamber, and a source of pressurized fluid directed into the chamber to yieldably move the piston from a yarn releasing position to a yarn storing position.

A further object of the invention is to provide a new and improved weaving machine having fluid operated storage apparatus for releasably storing yarn intermediate the supply package and the filling carrier.

Other and further objects and advantages of the invention will be obvious or will be presented in the description which follows, taken together with the accompanying drawings.

In the drawings:

FIG. 1 is a fragmentary schematic view, in perspective, of a shuttleless weaving machine embodying the invention;

FIG. 2 is a longitudinal view substantially in section illustrating the invention; and

FIG. 3 is a section view taken substantially along line 3—3 in FIG. 2.

Refer now to the drawings and initially to FIG. 1 in which a supply package P is suitably mounted on a weaving machine L of the so-called shuttleless variety. Filling yarn Y is drawn from the package P and guided by a pair of spaced apart guides **10** and **12** so as to be threadedly received through opposed openings **14** and **16** (FIG. 2) in a casing **18** of a yarn storage device **20**.

Drawing the filling yarn Y from the package P are a pair of cooperating carriers **22** and **24** operable for inserting the filling yarn Y through a shed S formed by warp yarns W in the course of weaving a fabric F. The

carriers 22 and 24 are fixed, respectively, to the ends of flexible tapes 26 and 28 which in turn have their opposite ends fixed to a pair of rotatable tape wheels 30 and 32. In a suitably synchronized operation, the tape wheels 30 and 32 are oppositely rotated so as to advance the respective carriers 22 and 24 in opposite directions through the shed S. When the carriers 22 and 24 meet at a location near the center of the fabric F (indicated by broken lines in FIG. 1), the filling yarn Y carried by the carrier 22 from the right edge of the fabric F (FIG. 1) is transferred to the carrier 24 for the remainder of the pick or travel through the shed S, upon reversal of the tape wheels 30 and 32. At the moment of transfer, a suitable yarn clamp 33 adjacent the right edge of the fabric F being woven (FIG. 1) is closed, that is, moved from the solid line to the dotted line position to firmly hold the filling yarn Y while the carrier 24 draws the free end of the filling yarn toward the left edge of the fabric F (FIG. 1).

Turning now to FIG. 2, the casing 18 defines an internal chamber 34 which slidably receives a piston 36, preferably of a light weight material, for movement in the longitudinal direction relative to the casing 18. Integral with one end of the piston 36 is an eyelet 38 loosely engaging the strand of yarn Y as it proceeds from the opening 14 to the opening 16.

Pressurized fluid, such as air from a schematically represented source 40 (FIG. 2), is directed into the chamber 34 via a tubular flexible conduit 42 and a hollow fitting 44 releasably fixed to a seal 46 secured to one end of the casing 18. By means of a valve 47 in the conduit 42, the pressure of the fluid within the chamber 34 can be selectively adjusted, then maintained at a pre-established value. When the valve 47 has been suitably adjusted and the yarn clamp 33 suitably moved to the closed position, the pressurized fluid applies a substantially constant force on the piston 36 and urges the piston in a first direction or toward the left to a yarn storage position indicated by solid lines in FIG. 2. In this position, the piston 36 is spaced from a cap 48 which is suitably fixed to an end of the casing 18 opposite the fitting 44.

The leftward movement (FIG. 2) of the piston 36 within the chamber 34 serves to draw the yarn Y under constant tension from the supply package P and into the chamber 34. When the piston 36 approaches the solid line position (FIG. 2), at which time the length of yarn contained within the chamber 34 is less than the length of a pick or width of the fabric F, the yarn clamp 33 is opened and the carrier 22 begins its travel into the shed S. Momentarily, the tension in the length of yarn extending between the carrier 22 and the piston 36 increases relative to the tension in the length of yarn extending between the supply package P and the piston 36 with the result that the yarn stored in the chamber 34 is drawn through the opening 16 and urges the piston 36 in a second direction or toward the right (FIG. 2) against the opposing force of the pressurized fluid. In order to achieve continuous withdrawal of yarn from the package P, a length of yarn in addition to that already contained within the chamber 34 is drawn from the package P as the piston moves toward the right and is of a length sufficient to complete the requirement of the carrier 22. By the time the piston 36 approaches a maximum yarn release position indicated in phantom in FIG. 2, the pick has been completed, and the yarn carriers 22 and 24 have returned to their rest positions adjacent the tape wheels 30 and 32. With the yarn clamp 33 suitably closed, the pressurized fluid causes the piston 36 to reverse its movement and return toward the solid line position (FIG. 1). The piston 36 is operable to unwind yarn from the package P as it travels, and as the piston 36 approaches the solid line position (FIG. 2), the carrier 22 again calls for yarn for the ensuing pick, and the above-described operation is repeated.

The speed of the piston 36 toward the yarn storage position and the tension in the strand of yarn being drawn into the chamber 34 are functions of the pressure differential between the opposite ends of the piston. In order to synchronize piston speed with the speed of the carrier 22 through the shed S, as well as to preset the yarn tension at a desired level, the valve 47 is set to correspond with an opening 49 in the cap 48. It will be appreciated that an entire range of piston speeds and yarn tensions can be accommodated by adjusting the valve 47 and by providing the casing 18 with a variety of caps 48 having different sized openings 49. It is even within the scope of the invention to replace the cap 48 with a suitable valve (not shown). Thus, during the operation of the weaving machine L, the piston 36 is effective to continuously unwind the yarn from the supply package P and by so doing maintain a substantially constant and reduced tension in the yarn. Further, because the construction disclosed compensates for momentary or sudden changes in yarn tension, yarn breakage is held to a minimum.

To avoid yarn entanglement within the chamber 34, the piston 36 is prevented from rotating about its longitudinal axis by a strand 50 of wire or monofilament or other elongated or strand-like material which extends substantially the length of the casing 18 within the chamber 34. Grooves 52 in flanges 54 at opposite ends of the piston 36 serve as keyways to slidably receive the strand 50 and thus prevent rotation of the piston as it moves through the chamber 34. At one end of the storage device 20, the strand 50 passes through a suitable aperture 56 in the cap 48 and is fixed to the cap by a screw 58 threadedly engaged with the cap. At the opposite end of the storage device 20, the strand 50 extends through an aperture 60 in the casing 18 and is fixed to a collar 62 by a screw 64 threadedly engaged with the collar. The collar 62 is suitably fixed to the casing 18 as by a press fit.

A longitudinal bore 68 extends through the piston 36 and together with the opening 49 in the cap 48 provides for removal of lint from the yarn Y advancing through the storage device 20 while serving simultaneously to maintain pressure of the fluid on the right side of the piston 36 (FIG. 2) at a substantially constant level.

It will be appreciated that although the description has been limited to the application of one storage device 20 for use with a weaving machine L, it is within the scope of the invention to provide two or more of the devices 20 in series, for example, to accommodate a machine having a considerable width. Further, while a specific form of the invention has been disclosed, it will be understood that various other changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. Strand storage apparatus comprising a member adapted to engage a strand of yarn, said member being movable in a first direction for storing a portion of the strand and in a second direction for releasing said portion, means for guiding the strand for engagement by said member, and biasing means including a source of pressurized fluid and means introducing fluid from said source against said member for yieldably biasing said member in said first direction.

2. Strand storge apparatus as set forth in claim 1 including a casing defining a chamber having inlet and outlet means for the strand, said member being movable in said first and second directions within said chamber.

3. Strand storage apparatus as set forth in claim 2 wherein said casing is a cylinder and said member is a piston having a longitudinally extending bore, and including an eyelet on said piston for slidingly engaging the strand.

4. Strand storage apparatus as set forth in claim 3 including key means for preventing rotation of said piston in said chamber.

5. Strand storage apparatus as set forth in claim 4 wherein said key means includes a longitudinally extending wire and a keyway through said piston for slidably receiving said wire.

6. Strand storage apparatus as set forth in claim 5 wherein said biasing means includes a hollow fitting fixed to one end of said cylinder and communicating with said chamber and a tubular conduit connecting said source with said fitting, and including a cap fixed to an end of said cylinder opposite said one end and having an opening communicating with said chamber and smaller than the inner diameter of said cylinder.

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HENRY S. JAUDON, Primary Examiner

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