Nov. 11, 1969 C. W. BROUWER ETAL 3,477,476

STORAGE DEVICE

Filed Feb. 26, 1968

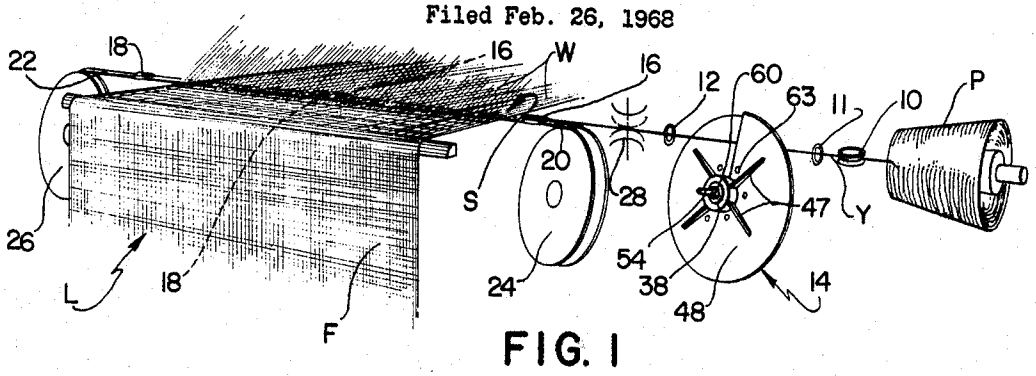

FIG. 1

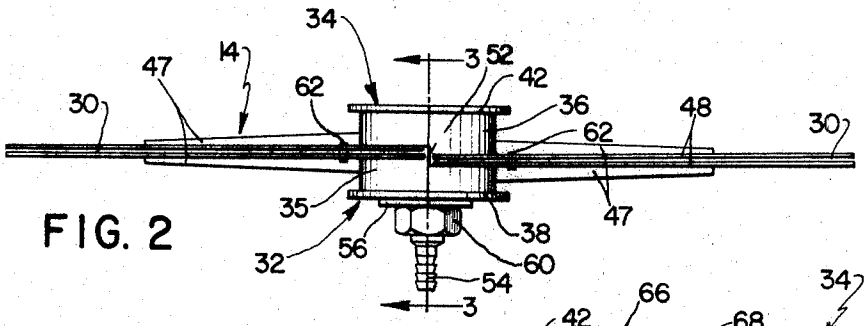

FIG. 2

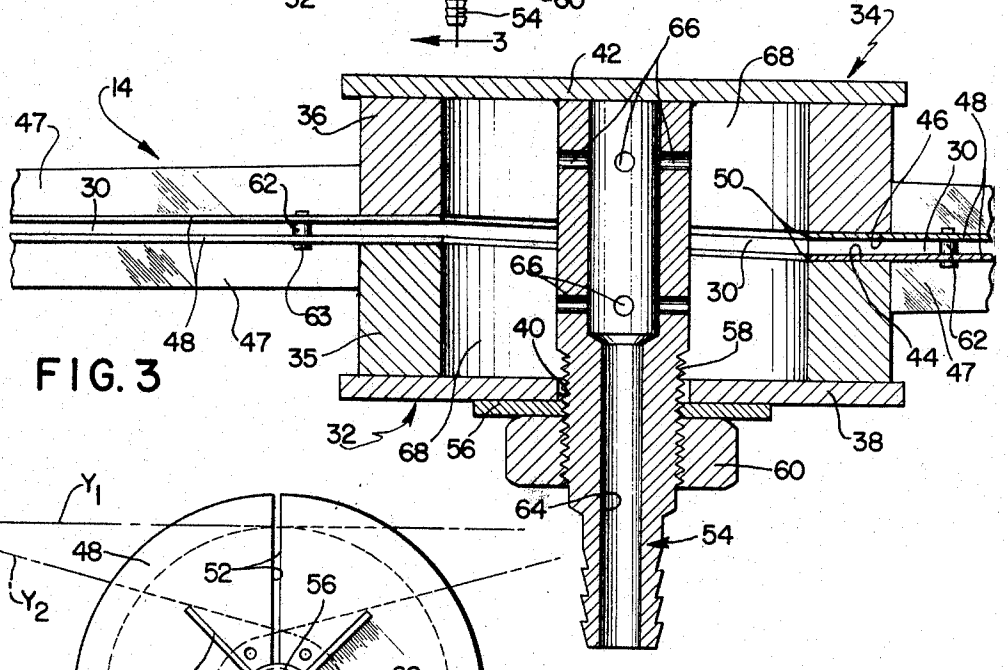

FIG. 3

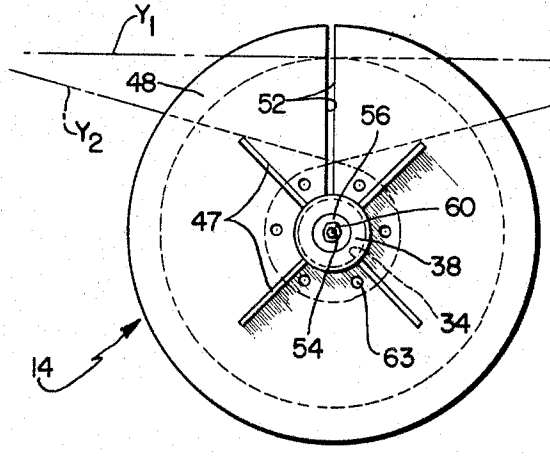

FIG. 4

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3,477,476

Patented Nov. 11, 1969

3,477,476

STORAGE DEVICE

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Filed Feb. 26, 1968, Ser. No. 708,272

Int. Cl. D03d *47/30;* B65h *59/22*

U.S. Cl. 139—122 4 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for continuously unwinding yarn from a supply and releasably storing the yarn. The yarn is guided into a helical loop having more than 180° of arc and pressurized fluid from within the loop is directed outwardly against the yarn. As tension in the yarn decreases, the yarn expands outwardly to form a larger loop, and as tension in the yarn increases, the yarn contracts to form a smaller loop.

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 a 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 between five and eight times over the conventional operation. For this reason, various mechanisms have been devised for continuously withdrawing the yarn from a 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 into and out of a storage device in which the yarn is guided into a helical loop having more than 180° of arc. Pressurized fluid from within the loop is directed outwardly against the yarn. As tension in the yarn decreases, as when there is no demand for yarn, the yarn expands outwardly to form a larger loop. However, when tension in the yarn is increased above a pre-established limit, as when yarn is demanded by a yarn carrier, the yarn is drawn inwardly against the pressurized fluid to form a smaller loop. Readily adaptable to existing machinery, the invention is inexpensive to produce, harmless to the yarn, has no moving parts, and is effective in withdrawing yarn from all sizes and shapes of yarn packages.

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

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

Yet another object of the invention is the provision of a new and improved yarn storage device which is fluid operated. A related object is the provision of such apparatus having no moving parts. Another related object is the provision of such apparatus which can be readily threaded up.

Still another object of the invention is the provision of a new and improved yarn storage device adapted to guide a strand of yarn into a path including a loop having more than 180° of arc and responsive to tension in the strand for varying the magnitude of the loop.

A further object of the invention is to provide a new and improved weaving machine having a fluid operated storage device 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 an enlarged top plan view of a yarn storage device illustrated in FIG. 1;

FIG. 3 is a further enlarged, fragmentary section view taken substantially along line 3—3 in FIG. 2; and

FIG. 4 is a front elevation view of the device illustrated in FIG. 2, to a reduced scale.

Refer now to the drawings and initially to FIG. 1 in which a supply package P is suitably mounted adjacent a weaving machine L of the so-called shuttleless variety. Filling yarn Y is drawn from the package P through a suitable tensioner **10** by a pair of spaced apart guides **11** and **12**, or the like, so as to be threadedly received for passage into and out of a yarn storage device **14**.

Drawing the filling yarn Y from the package P are a pair of cooperating carriers **16** and **18** operable for in-

serting the filling yarn Y through a shed S formed by warp yarns W in the course of weaving a fabric F. The carriers **16** and **18** are fixed, respectively, to the ends of flexible tapes **20** and **22** which in turn have their opposite ends fixed to a pair of rotatable tape wheels **24** and **26**. In a suitably synchronized operation, the tape wheels **24** and **26** are oppositely rotated so as to advance the respective carriers **16** and **18** in opposite directions through the shed S. When the carriers **16** and **18** meet at a location adjacent the center of the fabric F (indicated by broken lines in FIG. 1), the filling yarn Y carried by the carrier **16** from the right edge of the fabric F (FIG. 1) is transferred to the carrier **18** for the remainder of the pick or travel through the shed S upon reversal of the tape wheels **24** and **26**. At the moment of transfer, a suitable yarn clamp **28** adjacent the right edge of the fabric F being woven (FIG. 1) is closed, that is, moved from a solid line position to a dotted line position to firmly hold the filling yarn Y while the carrier **18** draws the free end of filling yarn toward the left edge of the fabric F (FIG. 1).

Turning now to FIGS. 2 and 3, the yarn Y is guided into a helical-shaped passage **30** defined between a front assembly **32** and a rear assembly **34** of the storage device **14**. Initial thread-up of the yarn from the supply package P through the storage device **14** can be readily accomplished by a circular pass of yarn around the outer peripheral edge of the device so as to follow a helical loop or path through the passage **30**. The assemblies **32** and **34** are similarly constructed, each assembly including, respectively, an annular support **35** and **36**. Suitably fixed as by welding to an outer end of the annular support **35** is a front plate **38** having a central aperture **40**. Corresponding to the front plate **38** but absent a central aperture, a rear plate **42** is welded to an outer end of the annular support **36**. The inner ends of the annular supports **35** and **36** opposite their respective plates **38** and **42** are provided with parallel but spaced apart helical surfaces **44** and **46** to which are respectively welded a pair of parallel discs **48** having central apertures **50** (FIG. 3) and extending radially outwardly from the annular supports **35** and **36**.

In order for the discs **48** to conform to the helical surfaces **44** and **46**, each disc is slit radially and laterally offset along a generally radial zone **52** (FIGS. 2 and 4) extending from its central aperture **50** (FIG. 3) to its peripheral rim. A plurality of stiffeners in the form of ribs **47** are welded to the outer surfaces of the discs **48** and to the outer peripheral surfaces of the annular supports **35** and **36** from which they radially extend.

One end of a nozzle **54** is welded to the inner surface of the rear plate **42** and extends through the supports **35** and **36** and the aperture **40** in the front plate **38**. A gasket washer **56** is fittingly received over a threaded portion **58** of the nozzle **54** and a nut **60** engaging the threaded portion **58** is tightened to draw the front assembly **32** and the rear assembly **34** towards one another. Between the discs **48** a plurality of uniform spacers **62** are suitably held by fasteners **63** and arranged at circumferentially spaced locations having a common radial distance from the nozzle **54**. The spacers **62** serve to separate the assemblies **32** and **34** and therefore the discs **48** to a predetermined extent, which may vary by suitably employing spacers of different lengths enabling the storage device **14** to accommodate accordingly different weights or sizes of yarns.

Thus, when pressurized fluid such as air from a suitable source (not shown) is directed into a conduit **64** (FIG. 3) extending longitudinally through the nozzle **54**, the fluid flows through radial apertures **66** in the nozzle **54** into a plenum chamber **68** defined by the annular supports **35** and **36** and by the plates **38** and **42**, then radially outwardly into the passage **30**. The pressure of the fluid within the plenum chamber **68** can be suitably adjusted, then maintained at a pre-established value. When the yarn clamp **28** has been suitably moved to the closed position, the pressurized fluid applying a radial force on the yarn within the passage **30** urges the yarn outwardly away from the spacers **62** toward a storage position indicated by a yarn path Y_1 in FIG. 4 and draws the yarn under constant tension from the supply package P.

It will be appreciated that the yarn within the passage **30** is suitably guided, as by the guides **11** and **12** into a loop having more than 180° of arc. As the arc of the loop of yarn within the passage **30** increases above 180°, so does the capacity of the storage device **14** increase for a given diameter of the device. Further, as the arc of the yarn loop increases above 180°, the smaller is the peripheral opening permitting escape of the pressurized fluid, the escape of fluid being negligible when the arc is substantially 360°. Thus, although the invention is directed to apparatus operable for guiding a strand of yarn into a path including a loop having more than 180° of arc, it is preferable for reasons of economy and capacity to provide a loop having approximately 360° of arc.

As the yarn approaches the storage position, at which time the length of yarn contained within the passage **30** is still less than the length of a pick or the width of the fabric F, the yarn clamp **28** is opened and the carrier **16** begins its travel into the shed S. Momentarily, the tension in the length of yarn extending between the carrier **16** and the storage device **14** increases relative to the tension in a length of yarn extending between the supply package P and the storage device with the result that the yarn stored in the passage **30** is released to the carrier **16**. That is, the stored yarn is drawn radially inwardly toward the spacers **62** against the pressure of the fluid issuing from the nozzle **54** and contracts to form a smaller loop as indicated by the yarn path Y_2 in FIG. 4. In order to achieve continuous withdrawal of yarn from the package P, a length of yarn in addition to that already contained within the passage **30** is drawn from the package P as the size of the yarn loop contracts and is of a length sufficient to complete the requirement of the carrier **16**. By the time the yarn approaches its maximum release position, the pick has been completed, and the yarn carriers **16** and **18** have returned to their rest positions adjacent the tape wheels **24** and **26**. With the yarn clamp **28** suitably closed, pressurized fluid causes the yarn to reverse its movement within the passage **30** and return toward the storage position, continuing to drawn the yarn from the package P under substantially constant tension. Thereupon, the carrier **16** again calls for yarn for the ensuing pick, and the above-described operation is repeated.

Thus, the construction disclosed provides a device which is of a simplified construction having no moving parts and which operates to compensate for momentary or sudden changes in yarn tension whereby yarn breakage is held to a minimum.

It will be appreciated that although the description has been limited to the application of one storage device **14** for use with a weaving machine L, it is within the scope of the invention to provide two or more of the devices **14** 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 means for guiding a strand into a path including a loop having more than 180° of arc, means for maintaining the strand so looped along said path, and biasing means responsive to tension in the strand for varying the magnitude of said loop.

2. Strand storage apparatus as set forth in claim **1** in which said biasing means is within said loop.

3. Strand storage apparatus as set forth in claim **1** wherein said guiding means includes a member having a helical passage adapted to receive the strand and said

biasing means is operable to direct pressurized fluid into said passage and against the strand.

4. Strand storage apparatus comprising means for guiding a strand into a path including a loop having more than 180° of arc, said guiding means including a pair of parallel plates spaced from each other and therebetween defining a helical passage adapted to receive the strand and each having a central portion and a peripheral rim, said plates having substantially parallel opposed slits extending from said central portion to said rim and each being offset from itself along its slit, and biasing means responsive to tension in the strand for varying the magnitude of said loop, said biasing means including a plenum chamber at said central portion, a source of fluid under

constant pressure in communication with said plenum chamber, and an orifice adapted to direct said fluid from said chamber into said passage and against the strand.

References Cited

UNITED STATES PATENTS

2,741,443	4/1956	Klein.
3,303,857	2/1967	Scheffel.
3,323,754	6/1967	Nixdorf et al.

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U.S. Cl. X.R.

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