United States Patent

[11] 3,583,619

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[54] **YARN ACCUMULATOR**
3 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **226/113,** 226/119
[51] **Int. Cl.** **B65h 17/42**
[50] **Field of Search** 226/113, 114, 118, 119, 195

[56] **References Cited**

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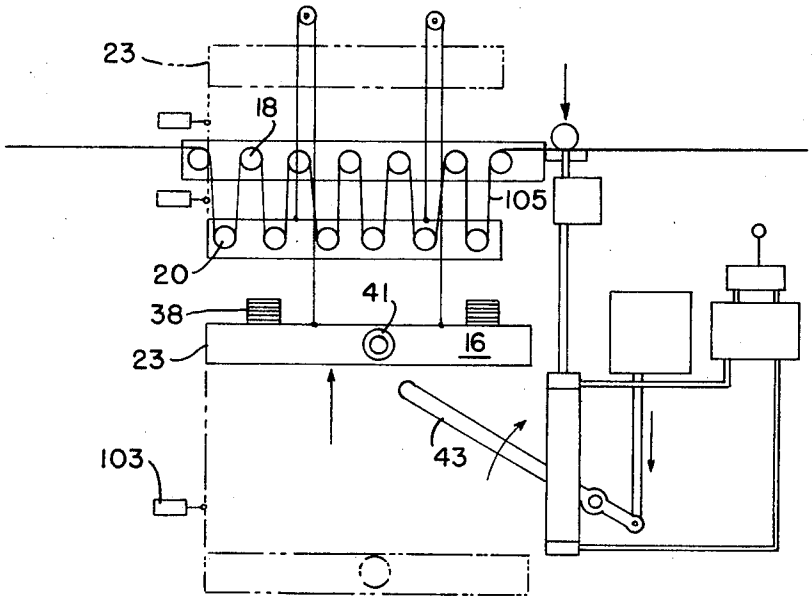
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Primary Examiner—Richard A. Schacher
Attorney—David Rabin

ABSTRACT: A yarn accumulator for collecting and intermittently storing and supplying a plurality of yarns in sheet form in various lengths responsive to operating conditions including tension in which a plurality of fixed rotatable yarn-engaging rolls cooperate with a plurality of vertically displaceable tension rolls movable in unison in accordance with a predetermined load on the yarn warp sheet to store and supply yarn as required during warping operation.



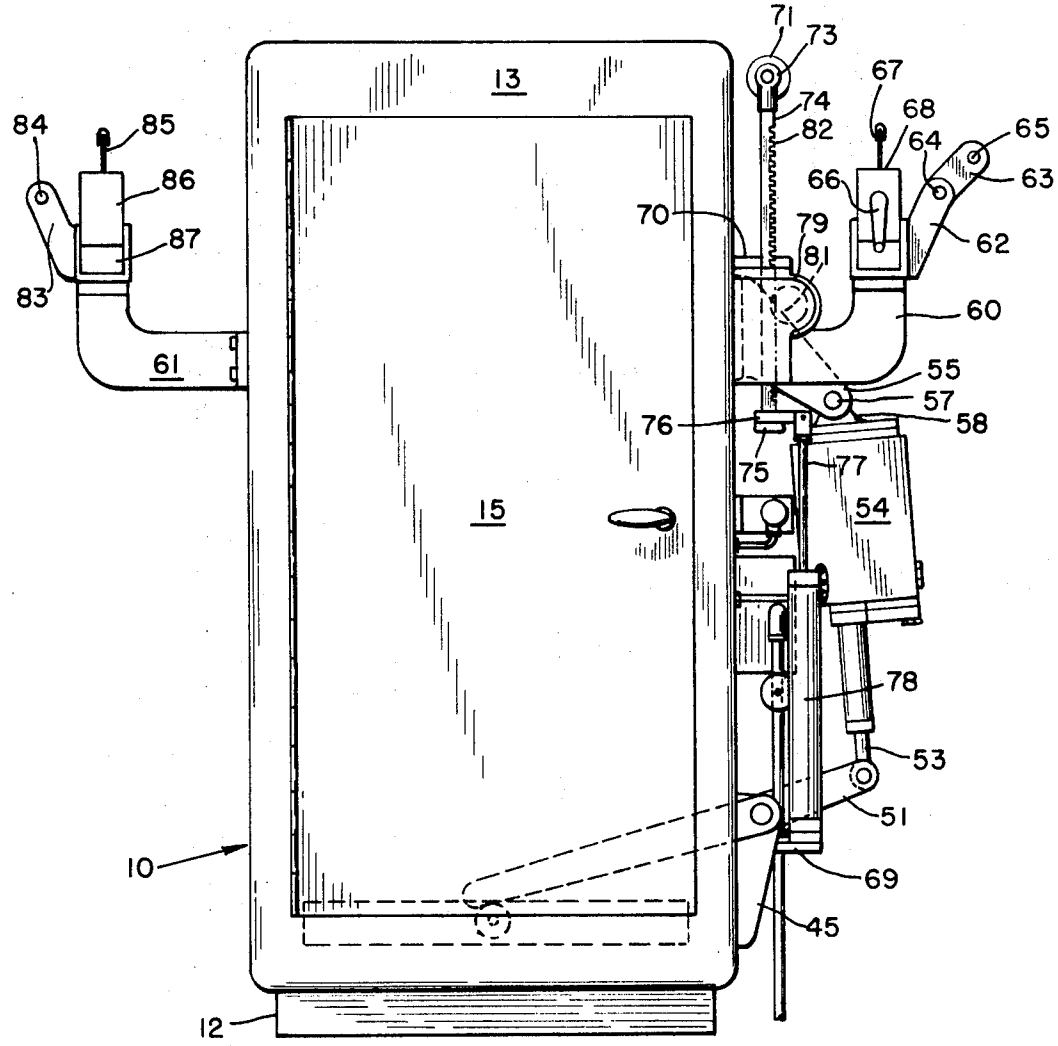
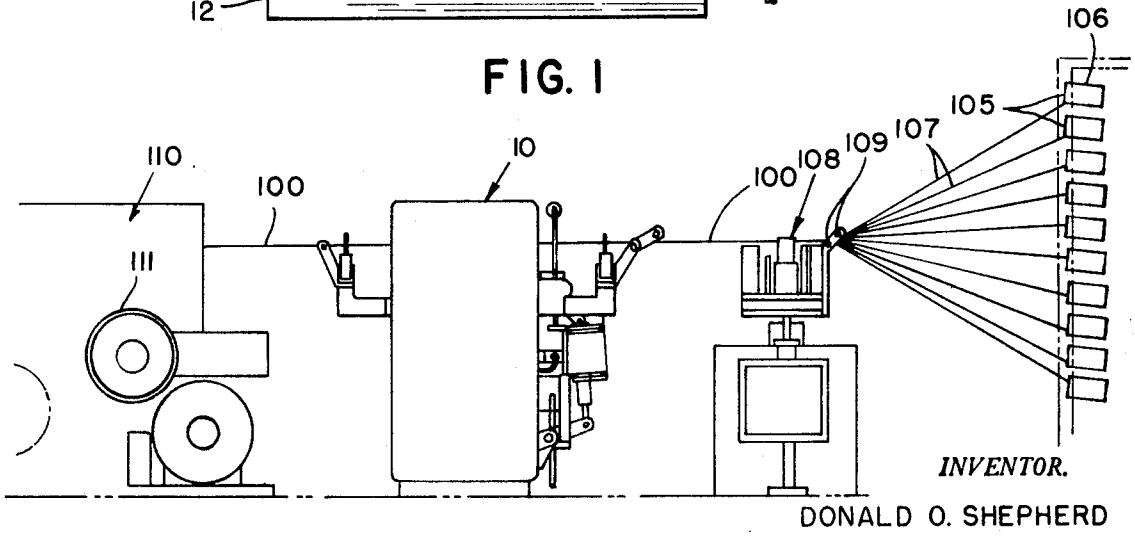


FIG. 1



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FIG. 7

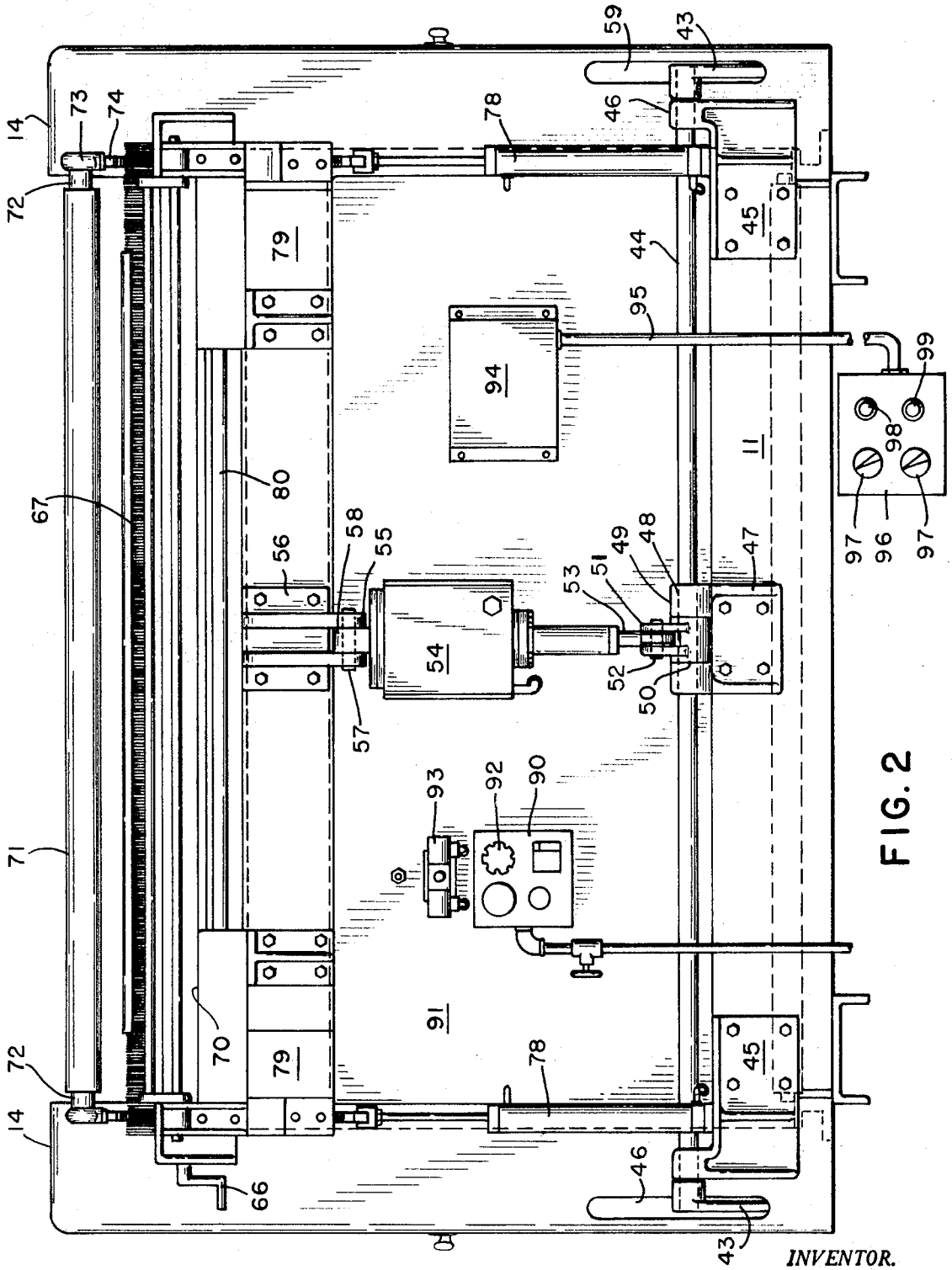


FIG. 2

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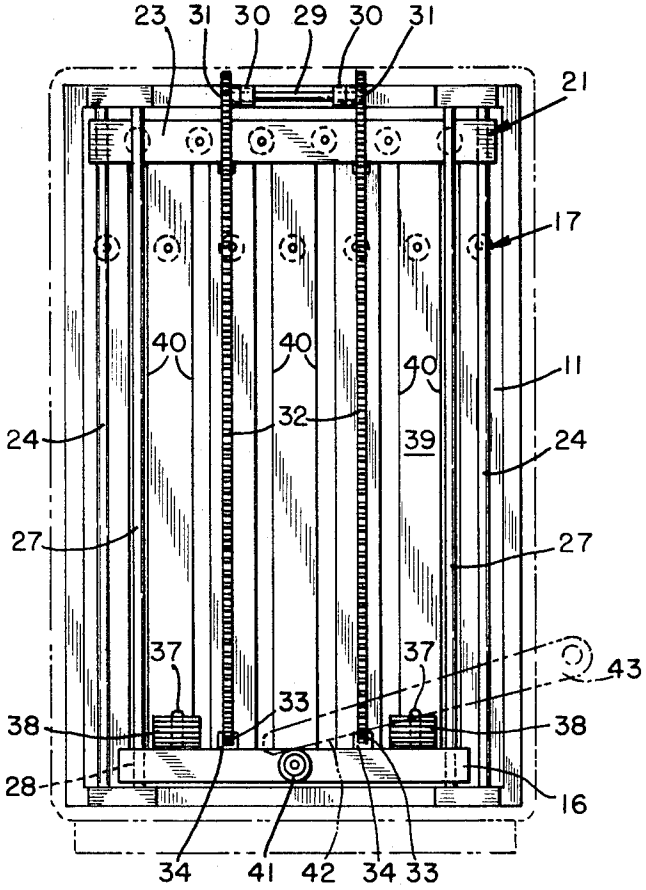


FIG. 3

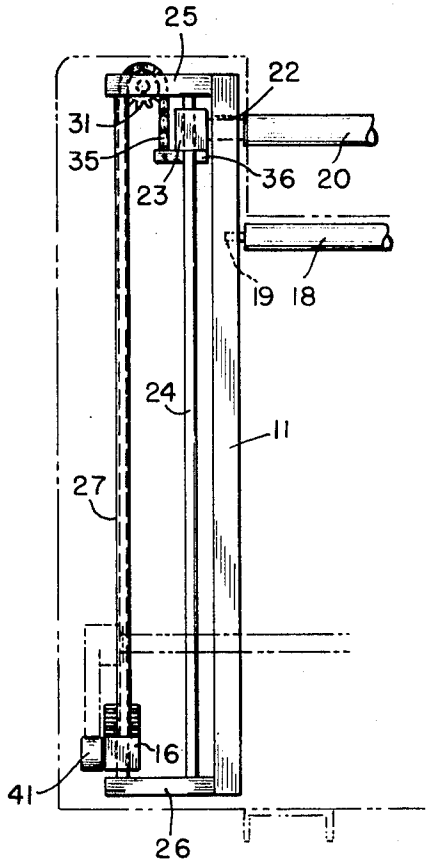


FIG. 4

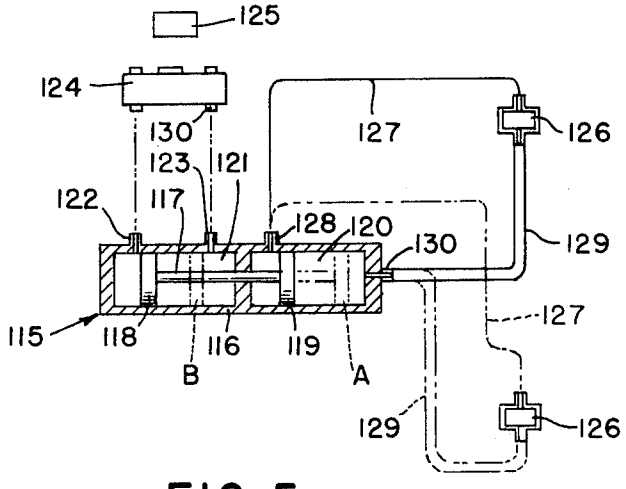


FIG. 5

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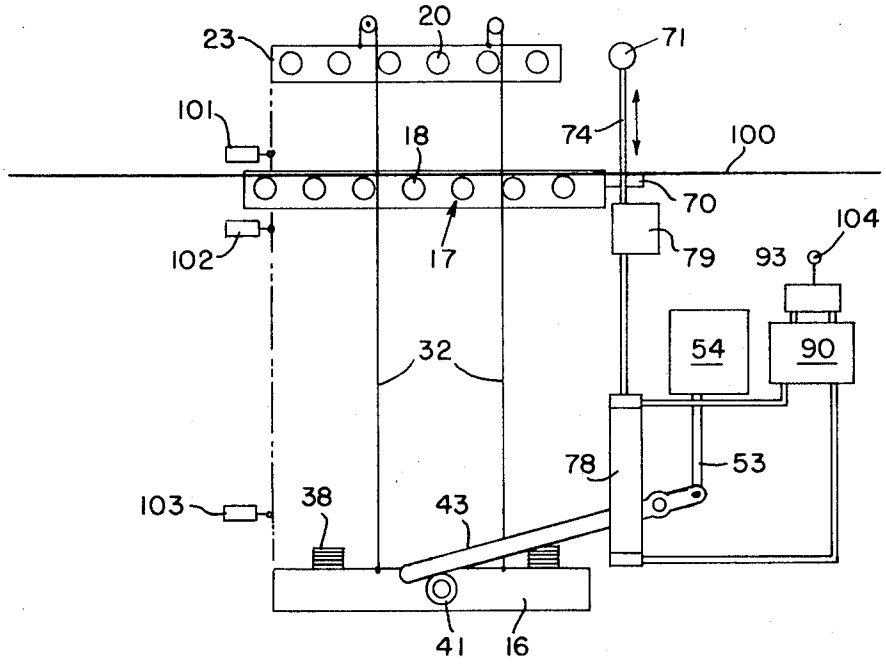


FIG. 6a

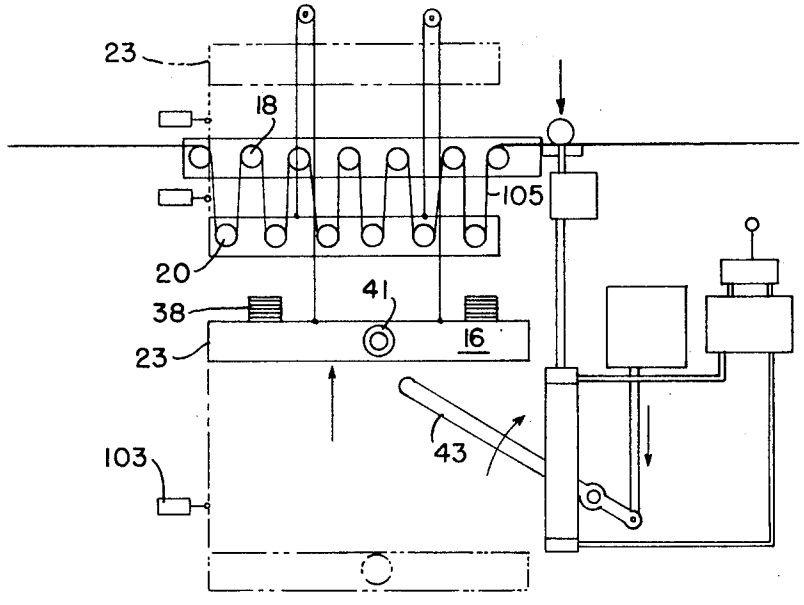


FIG. 6b

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YARN ACCUMULATOR

BACKGROUND OF INVENTION

The invention herein concerns improvements in yarn accumulators for collecting, storing and supplying yarns in sheet form continuously without the necessity for any independent drive power supply to the accumulator as the power supply is derived from a warper or other reeling drive motor or assembly. In precision warping particularly, it is necessary to control accurately the letoff of the warp, the tensioning of the yarns of the warp as the yarns are guided through suitable eyeboards, reeds or combs in order to achieve uniformity through out the warp in preparation for either slashing or weaving operations. Various devices are employed for detecting yarn defects and for other type of yarn inspection including signalling devices as well as stop motions to achieve optimum warp beam package formation.

Various types of yarn storage devices have been utilized and many require independent drive motors. Furthermore, presently available yarn accumulators have not been entirely satisfactory for intermittent yarn storage and for uniform yarn tension control.

DESCRIPTION OF INVENTION

The yarn accumulator of this invention incorporates a frame which supports a first plurality of rotatable yarn-engaging rolls that are laterally spaced apart from each other and fixedly supported by the frame a suitable distance above the base with the spacing between rolls being adequate to receive cooperatively therebetween freely a second plurality of rolls which are movable vertically to form a sinuous path for the warp yarns with the amplitude or vertical distance between the fixed and movable rolls varying depending upon the amount of yarn which must be stored in the accumulator during operation.

A continuous counterbalancing load exerted on the vertically movable plurality of rolls which are normally urged downward by gravity, and movable in unison relative to the stationary rolls, acts through the continuous warp sheet to maintain a uniform tension on the traveling warp yarns through the yarn accumulator to the warp beam or reel on which the package is formed. A yarn-clamping member releasably clamps the warp yarns at predetermined positions. Increase or decrease in yarn tension may be developed by adding or removing selective individual weight members from the counterbalancing load, and increments of load may be added by introducing a fluid to the counterbalancing load selectively during operation.

Accordingly, this invention provides a yarn accumulator capable of accumulating and storing a plurality of yarn ends under substantially uniform tension control throughout accumulation, storage and supply to a beam or reel.

Another objective of this yarn accumulator is to provide an automatic control sequence governed by displacement of yarn tension rolls that are movable between limits as yarn is supplied or withdrawn from the yarn accumulator.

Yet another objective of this invention is to provide a yarn accumulator which may intermittently accumulate and store and supply yarn in warp from under controlled tension to a warper, beamer or winder utilizing the power of the warper, beamer or winder.

This invention further contemplates a yarn accumulator for collecting, storing and supplying yarns in sheet form continuously without independent power supply from the accumulator in which a first plurality of rotatable yarn-engaging rolls are laterally spaced from each other on a machine frame at a suitable elevation to support a sheet of warp yarns with a second plurality of rotatable yarn-engaging tension rolls rotatably spaced from each other and supported for vertical displacement in unison between the fixed rolls to displace the warp sheet of yarns relative to the fixed rolls, Displacement of the movable rolls in unison is controlled by counterweight means. A releasable engaging clamp actuatable between limits of travel of the displaceable tension rolls will permit yarn accumulation and delivery. The counterweight balancing load may be increased or decreased depending upon the desired tension to be exerted on the warp sheet of yarns.

DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the yarn accumulator is illustrated in the accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views, and wherein:

FIG. **1** is an end elevational view of a yarn accumulator embodying my invention with the stationary rolls and tension rolls supported within the accumulator housing;

FIG. **2** is a rear elevational view of FIG. **1**;

FIG. **3** is a reduced end elevational view of a portion of FIG. **1** within the accumulator housing with portions omitted;

FIG. **4** is a partial right elevational view of FIG. **3** showing several rollers in relative relationship to each other;

FIG. **5** is a schematic diagram of a valve for augmenting the counterbalancing weight utilized in FIGS. **3** and **4**;

FIG. **6***a* and **6***b* are schematic illustrations of operation of the yarn accumulator illustrating sequences of operation; and

FIG. **7** is a schematic diagram of the yarn accumulator in conjunction with a supply creel for yarn passing to the yarn accumulator through an automatic yarn inspector before delivery of the warp sheet from the yarn accumulator to a warper or beamer.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings and particularly to FIGS. **1** through **4**, there is illustrated a preferred embodiment of a yarn accumulator **10** mounted in a frame structure **11** having a base **12** above which base are sheet metal housings **13** at each frame end **14** with a hinged closure panel **15** for providing access to the counterbalance weight sections **16** at each frame end. The frame ends **14** are laterally spaced apart from each other a suitable distance to provide for a warp sheet of yarns depending upon the width of the warp beam or reel on which the warp is to be wound and for supporting a stationary roll section formed by a plurality of horizontal, rotatable, spaced-apart rolls **18** mounted for rotation in the frame structure **11** in a plane spaced at a suitable vertical level above the base **12**. The individual rolls **18** are bearingly rotatable on the roll shaft **19**, the ends of which are supported in the frame structure **11** with the lateral spacing between individual rolls **18** being substantially uniform to permit the free passage therebetween of individual rolls **20** mounted to travel or be displaced vertically with the tension roll section **21**. The individual rolls **18** and **20** are substantially the same diameter and length. The plurality of individual rolls **20** are laterally spaced from each other and supported for rotation on the roll shafts **22** which are secured to the horizontal header bracket **23**. The orientation of the individual rolls **20** is in staggered relation to the stationary rolls **18** permitting the individual rolls **20** to pass freely during vertical displacement of the header bracket **23** between the spaced-apart stationary rolls **18**.

Header bracket **23** is guidably supported for vertical displacement by the spaced-apart vertical rods **24** that are positioned at the ends thereof in the top and bottom projecting brackets **25** and **26** that extend from frame **11** and are secured thereto. A second set of vertical counterbalance weight guide rods **27** is supported on the top and bottom brackets **25** and **26** is spaced relation to the rods **24** for cooperatively receiving and guiding the counterbalance weight sections **16** through the guide rod openings **28** therein. A counterbalance weight shaft **29** is rotatably supported in a recess in the top bracket **25** through the projecting bearing bosses **30** to support the chain sprockets **31** mounted at the ends of the shaft to guidably train the vertically depending sections of chain **32** that are secured at one free end **33** to the chain clamps **34** secured to the top of the counterbalance weight sections **16**.

The other free ends 35 of the sections of chain are securely fastened to the chain clamps 36 that are fastened to the header bar 23. Vertically projecting studs 37 extend from the counterbalance weight sections 16 for cooperatively retaining thereon a plurality of individual weights 38.

The frame structure 11 is provided with a sheet metal section 39 in which there is provided a plurality of vertical, spaced-apart, tension roll-receiving openings 40 to support guidably the tension roll shafts 22 that are received therein. A cam roller 41 is rotatably mounted on the counterbalance weight section 16 intermediate the length thereof for cooperatively engaging the flat face 42 of the pivotably lever arm 43.

The tension roll counterbalance positioner lever arm 43 (one for each of the counterbalance sections 16) is mounted at the end of the shaft 44 that extends the width of the accumulator and is supported by means of the end support brackets 45 that are secured to the frame 11 with the shaft 44 being pivotally guided through openings in the bracket bosses 46. An intermediate support bracket 47 is secured to the frame 11 and is provided with a shaft-receiving bore 48 in the projecting boss 49 in which there is an intermediate recess 50 for cooperatively receiving a shaft-mounted bracket 51 that is connected by the pin 52 to the actuating rod 53 of a heavy-duty linear actuator 54 which may be a gear-driven powered reversible motor and drive mechanism for displacing the rod 53 selectively between limits. The linear actuator is of the type made and sold by I.T.T. General Controls Model DL-66. Linear actuator 54 is pivotally mounted on the projecting arms 55 of the frame supported bracket 56 through the pivot pin 57 passing through the actuator-extending eye 58. The pivotal displacement of the levers 43 through the openings 59 in the frame ends 14 will be limited as will be described hereafter.

The warp yarn receiving or entrance section of the accumulator is provided with an upper L-shaped bracket 60 secured to the frame structure 11 with a comparable bracket 71 extending at the discharge end of the accumulator that is also affixed to the frame structure 11. At the upper end of bracket 60 are upwardly inclined rod support arms 62 and 63 which support therein the horizontally extending rods 64 and 65. Crank arm 66 is provided for extending or contracting a comb 67 that is mounted on the vertically movable reed-supporting block 68. A warp sheet clamp bar 70, preferably of a suitable elastic material, is supported on the frame and extends horizontally for the width of the accumulator substantially at the level of the stationary rolls 18 or slightly below. A vertically movable clamping roll 71 that extends for the width of the warp sheet is supported for rotation on the shaft 72 which shaft is secured to the eyelet bracket 73 that is mounted on the upper end of rack 74 with the lower end 75 of the rack being secured to the arm 76 of the displaceable piston rod 77 that is actuated for displacement pneumatically or hydraulically from the cylinder 78 that is supported on the cylinder support 69 attached suitably to the frame structure at each of the frame ends as shown in FIG. 2.

A pair of spaced-apart brackets 79 is mounted adjacent to the sides of the accumulator for rotatably supporting a shaft 80 on which is supported gears 81 (not shown) for engaging the rack teeth 82 of rack 74 and for maintaining uniform displacement of the racks 74 at each side of the accumulator thereby maintaining the horizontal position for clamping roll 71.

The bracket 61 has an upwardly extending arm 83 for supporting the warp sheet rod 84 therein which will receive the warp sheet from the reed 85 supported on the vertically movable reed support block 86 supported in the guide track 87 on the bracket 61.

A linear actuator regulator and indicator panel and control 90 is supported on the panel 91 with a speed control knob 92 for controlling the linear actuator. A directional controller 93 mounted on the panel 91 is used in conjunction with microswitches for controlling the displacement of the clamping roll and actuating the clamping roll upon reaching predetermined conditions in the accumulator to be described hereafter. An electrical junction box 94 mounted on the panel 91 is electrically connected through the conduit 95 to the console 96 which may be mounted at a suitable location for an operator. The console is provided with a selector switch for warp accumulation 97, a selector switch for reversing 97, an indicator light which will be illuminated when yarn is being accumulated, and a spring-loaded pushbutton 99.

In FIGS. 6*a* and 6*b* there is diagrammatically illustrated the yarn accumulator in several positions with a warp yarn sheet 100 passing through the accumulator. Microswitches 101, 102 and 103 are vertically spaced from each other and actuated or deactuated as will be described. In FIG. 6*a*, the warp sheet 100 extends horizontally through the yarn accumulator with the warp sheet above initially the clamping bar 70 and the clamping roll 71 is in the elevated position. The tension rolls 20 supported on the roll header bar 23 are elevated in the uppermost position while the counterbalance weight section 16 is lowered to the lowermost position and retained in position by the linear actuator 54 through the pivotal lever 43 engaging the cam roller 41. The clamping roll cylinder control 90 operatively connected to the directional controller 93 and the speed controller 104 may be activated by the limit switch 101. Upon actuation of the linear actuator 54, lever 43 will be pivoted clockwise to disengage with the roller 41 permitting the tension rolls 20 to move downwardly engaging the warp sheet 100 as the rolls 20 pass between the rolls 18 thereby forming the sinuous configuration 105 shown in FIG. 6*b*. The spacing between the tension rolls 20 and the stationary rolls 18 will determine the length of the warp stored in the accumulator as the counterbalance weight section 16 will be raised and lowered in response to the displacement of the movable tension rolls 20 as they move in unison relative to the stationary rolls 18 to exert a uniform tension on the warp sheet with the tension being determined by the weight of the movable rolls and the counterbalance weight section including the weight load 38 mounted on the counterweight section 16 which may vary depending upon the applied load.

In yarn accumulator operation, in order to accumulate yarn in warp sheet form, the warper is stopped and switch 97 is turned on to an accumulator setting illuminating the indicator light 98 and activating the linear actuator 54 which will displace the arm 53 to pivot lever arm 43 clockwise disengaging cam roller 41 and permitting the counterweight section 16 to move upwardly permitting the chain 32 trained over the sprockets 31 to lower the header bar 23 and the associated tension rollers 20. During the downward displacement of the header bar 23, limit switch 101 is tripped. The clamp roll cylinder control 90 is activated by limit switch 101 supplying fluid to cylinder 78 to draw down the clamp roll 71 against the clamp bar 70 to clamp releasably the warp sheet. Displacement of the lever arm 43 will trip a limit switch (not shown) in the linear actuator to deactivate it. The reverse switch 92 is rotated to a reverse position after which the spring-Loaded pushbutton 99 is depressed permitting the vertically displaceable tension rolls to be displaced downwardly to a lowered position until the pushbutton 99 is released. In the event the switch 99 is depressed for a sufficiently long interval, the header bar will trip the limit switch 103 which is located at a position for maximum accumulator capacity and upon actuation the warper drive mechanism (not shown) reversing will be stopped. Intermediate positions may be achieved between the maximum capacity of the accumulator and the position as shown in FIG. 6*b*.

In order to remove the yarn warp sheet from the accumulator, switch 97 is rotated to the forward position and the switch 99 depressed which will permit the tension rolls 20 and the header bar 23 to move upwardly and in the upward vertical travel microswitch 102 will be tripped activating the linear actuator 54 which will in turn rotate the lever arm 43 in a counterclockwise direction to engage the cam roller 41 urging the counterweight section 16 downwardly thereby elevating the tension rolls 20 ultimately to the position shown in FIG. 6*a*. In

the upward travel of the tension rolls **20**, limit switch **102** will be tripped to activate the controller **90** which will direct fluid to the cylinder **78** urging the clamp roll to the warp disengaged position shown in FIG. **6***a*. The switch **97** may be turned to the warp position which will lock the warper drive into a preset warping speed range at which time the indicator light **98** will be deenergized and the system will be ready to warp.

In FIG. **7** a plurality of yarn packages **105** is mounted on a yarn creel **106** and will feed the yarn ends **107** to a conventional automatic yarn inspector and end break detector **108** is positioned in the path of the yarn travel beyond the vertically spaced-apart guide bars **109** in advance of the yarn accumulator **10**. A warper and drive assembly **110** is positioned after the yarn accumulator to receive and wind the warp on a suitable beam **111**. Suitable electrical connections may be made to the automatic yarn inspector and end break detector of the type manufactured by Lindly & Company, Inc. to deactuate the warper.

In the event it is desirable to increase the weight within limits in the counterbalance section **16**, the yarn accumulator may be provided with a weight transfer mechanism **115** as shown in FIG. **5** in which a cylinder **116** is provided with a double-acting piston **117** having a pistonhead **118** and **119** mounted on the piston rod **117**. Fluid is retained in the cylinder divided into chambers **120** and **121**. Fluid inlet and outlet ports **122** and **123** are provided for communication with a liquid directional flow regulator **124** which will be controlled by the liquid directional flow controller **125**. A pair of hollow reservoir members **126** (one at each end of the section **16**) are connected to the cylinder **116** by a static airline **127** through the opening **128** and by a flexible liquid line **129** connected to the fitting **130** at the end of cylinder **116**. When the reservoir or member **126** is in the upper position of FIG. **5** corresponding to the upper position of counterweight section **16**, FIG. **6***b* the piston **119** is displaced forward to the dotted position A creating a liquid flow through flexible line **129** to the reservoir **126** and retaining liquid in the reservoir **126** thus adding the weight of the liquid to the counterbalance section **16** while at rest in this position and during movement of the reservoir to the lowered position shown in the outline form of the lines **127** and **129**. When the reservoir **126** moves from the lowered or any intermediate position after leaving the elevated position and comes to a stop, this causes a shifting of a solenoid-operated directional control valve (not shown) causing fluid to be introduced to chamber **121** through port **130** of the flow regulator **124**. Piston **118** shown in outline form at position B is then shifted to the full line position to the left thereby displacing piston **119** from position A to the full line position creating a suction in chamber **120** which will tend to compress the static air on the opposite side of piston **119** creating a liquid flow from the reservoir **126** at the lowered outline position to chamber **120** of the double cylinder through the creation of the suction or vacuum on one side of the liquid and a positive pressure on the other side. The next shifting completes the cycle. It is desirable to use the weight transfer section with fluid to compensate for any frictional differences in the vertical travel of the tension rolls **20**, however, the system will operate without this hydraulic and air auxiliary.

I claim:

1. A yarn accumulator for collecting, storing and supplying yarns in sheet form without independent power supply comprising: a frame having a base and a top section a first plurality of rotatable yarn-engaging rolls laterally spaced from each other fixedly supported on said frame a suitable distance above said base to receive a warp sheet thereon, a second plurality of rotatable yarn-engaging tension rolls for drawing the yarn in sheet form into said accumulator and positioned in staggered spaced relation to said first plurality of rolls, said second plurality of tension rolls being cooperatively supported to pass freely in unison between said first plurality of rolls from adjacent to said top section of said frame to a position below said first plurality of rolls and above said base, counterweight means associated with said tension rolls to control the vertical displacement of said plurality of tension rolls and to exert a predetermined tension on a warp sheet of yarns supported on said rolls, and means for releasably clamping a warp sheet of yarns responsive to displacement of said tension rolls.

2. A yarn accumulator for collecting, storing and supplying yarns: a frame having a base and a top section, a first plurality of rotatable yarn-engaging rolls laterally spaced from each other fixedly supported on said frame a suitable distance above said base to receive a warp sheet thereon, a second plurality of rotatable yarn-engaging tension rolls for drawing the yarns in sheet form into said accumulator and positioned in staggered spaced relation to said first plurality of rolls, said second plurality of tension rolls being cooperatively supported to pass freely in unison between said first plurality of rolls from adjacent to said top section of said frame to a position below said first plurality of rolls and above said base, counterweight means associated with said tension rolls to control the vertical displacement of said plurality of tension rolls and to exert a predetermined tension on a warp sheet of yarns supported on said rolls, warp yarn sheet clamping means having stationary and movable members for engaging and disengaging a warp sheet, and means responsive to yarn accumulation for actuating said warp yarn sheet clamping means to engage or disengage a warp sheet.

3. A yarn accumulator for collecting, storing and supplying yarns in sheet form without independent power supply comprising: a frame having a base and a top section, a first plurality of rotatable yarn-engaging rolls laterally spaced from each other fixedly supported on said frame a suitable distance above said base to receive a warp sheet thereon, a second plurality of rotatable yarn-engaging tension rolls for drawing the yarns in sheet form into said accumulator and positioned in staggered spaced relation to said first plurality of rolls, said second plurality of tension rolls being cooperatively supported to pass freely in unison between said first plurality of rolls from adjacent to said top section of said frame to a position below said first plurality of rolls and above said base, counterweight means associated with said tension rolls to control the vertical displacement of said plurality of tension rolls and to exert a predetermined tension on a warp sheet of yarns supported on said rolls, said counterweight means being adjustable to vary the counterweight load and including a member having removable weights thereon, a header bar for supporting said tension rolls for vertical displacement in unison, flexible means connecting said counterweight means and said header bar for transferring displacement of said counterweight means to said header bar, warp yarn sheet clamping means having a fixed member and a movable member in spaced relation to said fixedly supported rolls, means responsive to tension roll displacement for actuating said clamping means into and out of engagement, and means responsive to displacement of said tension rolls for displacing said counterweight means to a lowered position thereby elevating said tension rolls out of engagement with a warp yarn sheet.