United States Patent [19]

Pfarrwaller

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[54] **STORAGE APPARATUS FOR FILAMENTARY MATERIAL**

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May 14, 1970 Switzerland 7181/70

[52] **U.S. Cl.** **242/47.01,** 242/47.12

[51] **Int. Cl.** **B65h 51/20**

[58] **Field of Search** ..... 242/36, 37, 39, 47.01, 242/47.08, 47.12, 47.13, 128; 66/132; 139/122, 127 P; 57/106

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[57] **ABSTRACT**

A device for the storage of filamentary material includes a storage member supported from a support member for rotation with respect thereto, the storage member having a free end over which stored material can be taken off, the storage member having at its free end a cross-sectional area declining toward that free end, the device comprising an annular member surrounding the storage member adjacent the free end thereof, the opening of the annular member having a cross-sectional area declining toward the free end for checking ballooning of the filamentary material during take-off.

3 Claims, 10 Drawing Figures

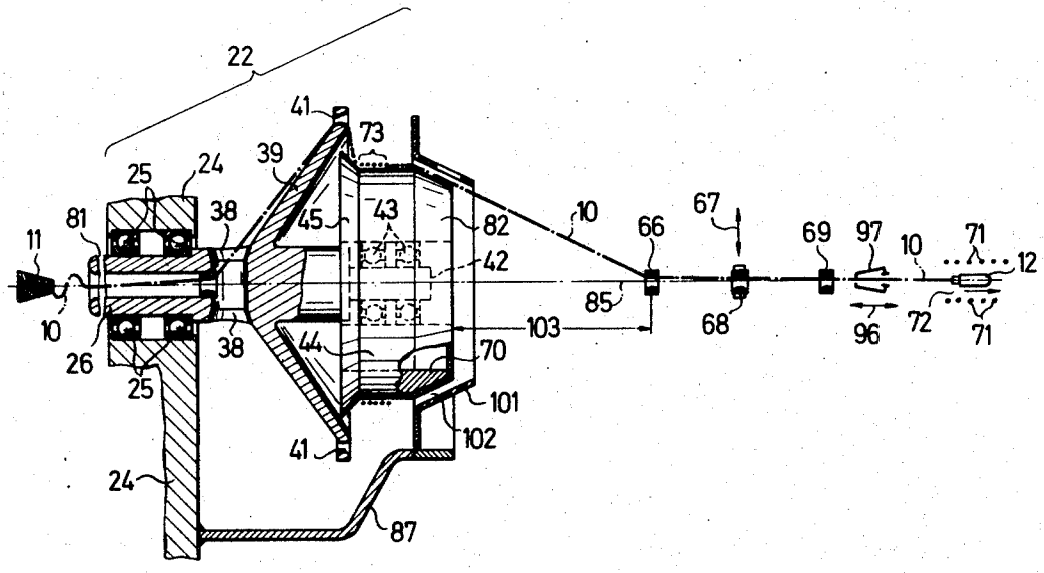

Fig. 1

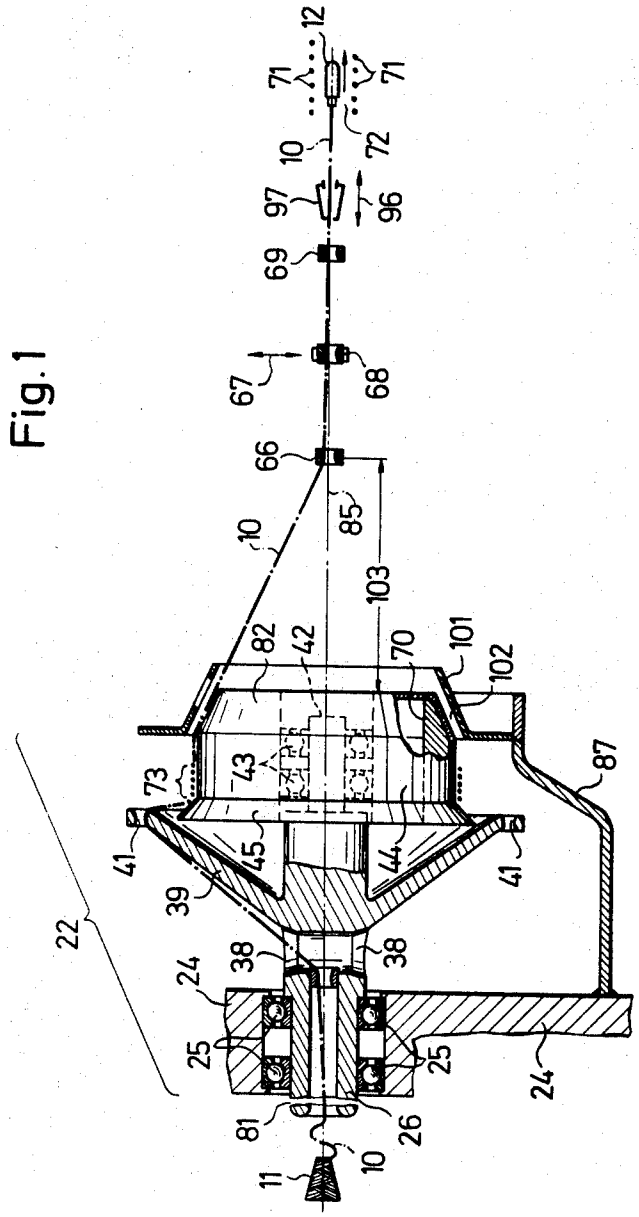

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Fig.2

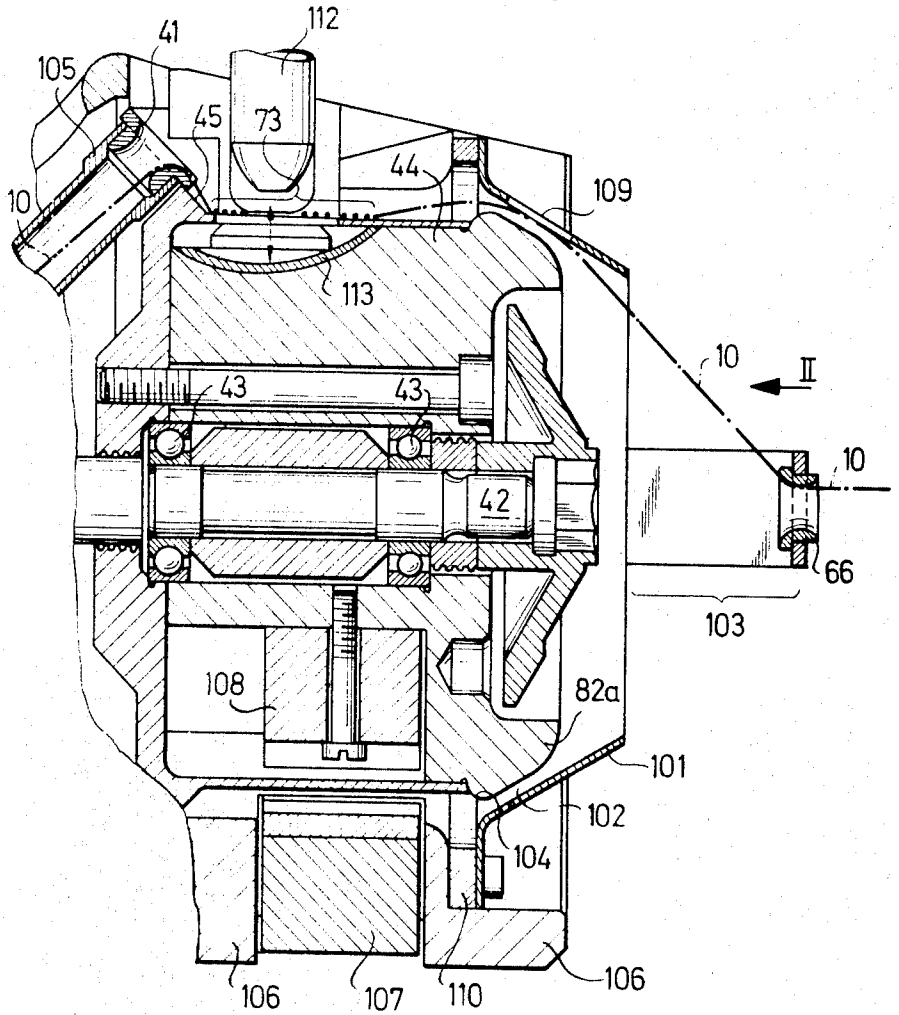

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Fig. 3

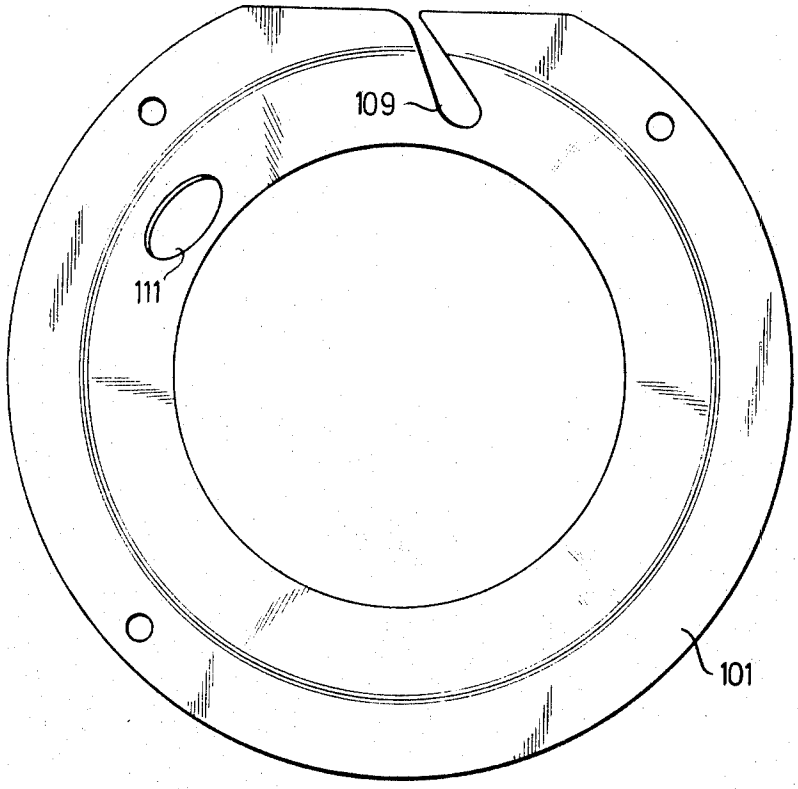


Fig. 4

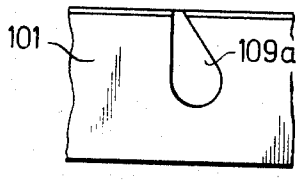
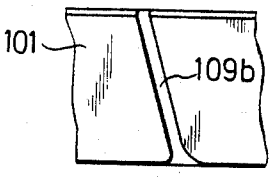


Fig. 5



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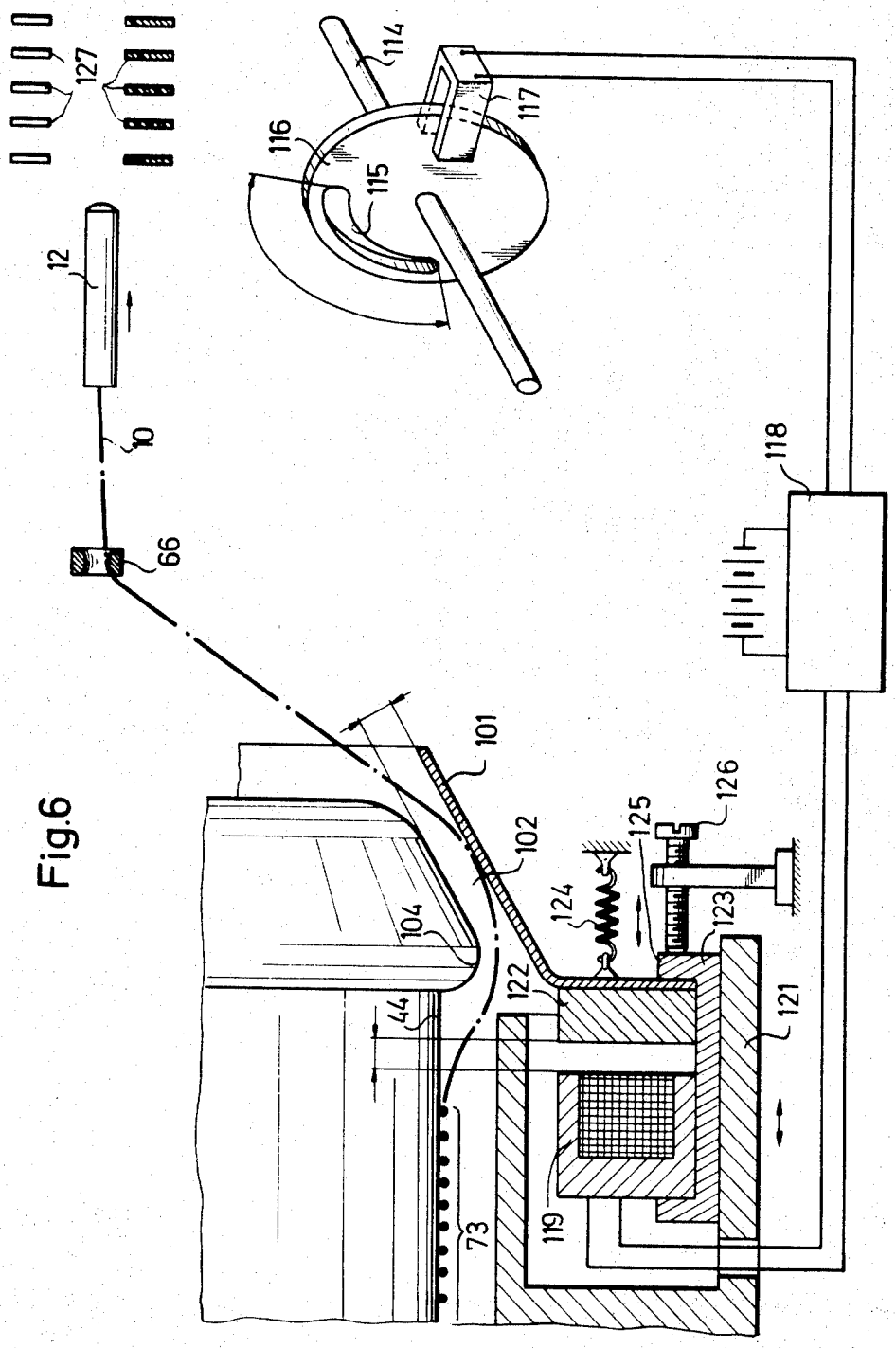

Fig.6

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Fig.7

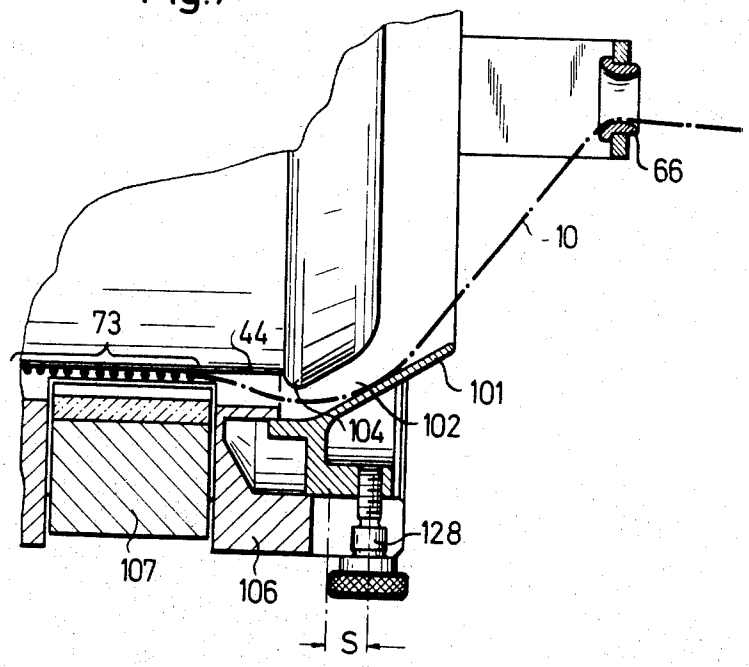

Fig.8

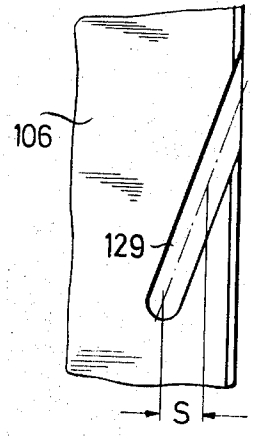

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Fig.9

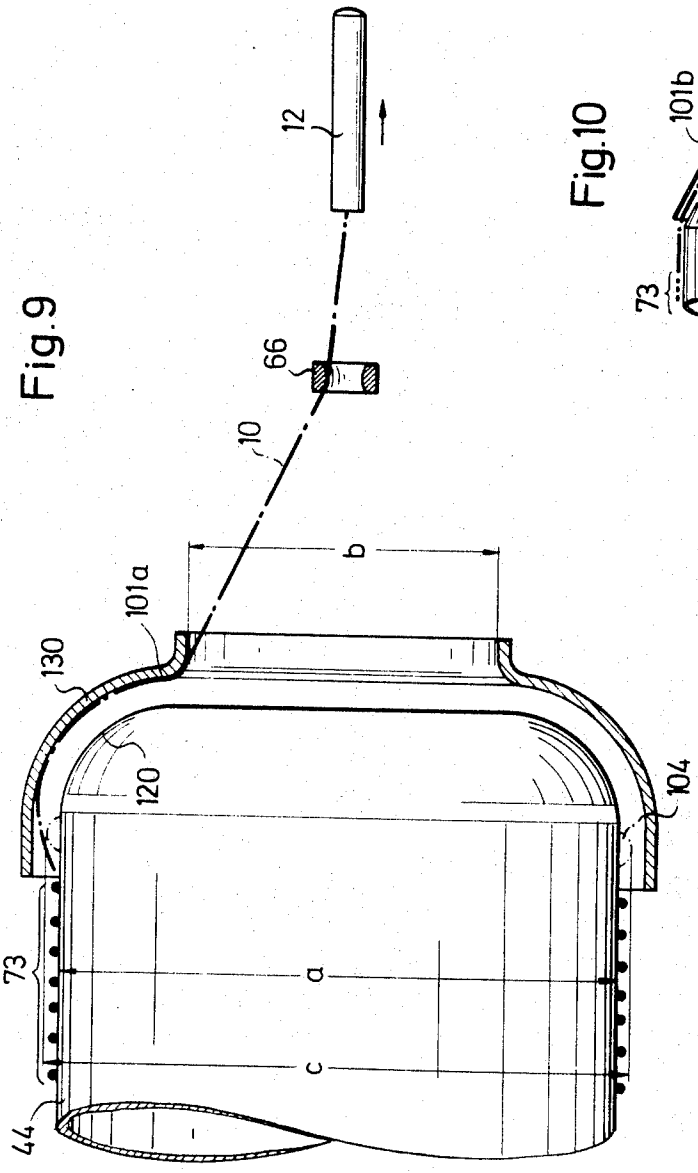
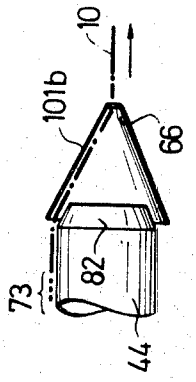


Fig.10



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STORAGE APPARATUS FOR FILAMENTARY MATERIAL

The present invention relates to storage devices for filamentary material such as yarn, thread, wire or the like (hereinafter sometimes called "thread" for brevity), and is particularly useful in conjunction with textile machines such as looms, among others. The present invention constitutes an improvement on that disclosed in my U.S. Pat. No. 3,411,548 assigned to the assignee hereof. That patent discloses a thread storage apparatus which includes a rotating flyer or thread guide having a hollow shaft through which the thread is passed to an arm on the flyer, and a drum supported on and rotatable with respect to that shaft. By rotation of the flyer the thread is wound onto the drum, at a portion thereof of conical shape sloping radially inwardly toward the free end of the drum. Successive coils of thread laid onto this concial part push previous coils onto the cylindrical part of the drum to form a length of thread stored thereon and available to be pulled off. Weights or magnets are provided to hold the drum against rotation without interfering with pulling of the thread off the free end of the drum as the thread is picked through the shed of the loom, for example in a loom of the gripper shuttle type.

In one form of apparatus disclosed in that patent the drum incudes at its free end a conical portion of diameter declining toward the free end, and with the drum there is associated an annular array of radially inwardly directed bristles which engage this conical portion and constitute a braking ring. In another form of apparatus disclosed in that patent the drum is cylindrical, except for the conical part onto which the thread is laid by the flyer. In particular the drum is cylindrical at the free end thereof, and a ring of short axial length and inwardly bounded by a cylindrical surface surrounds the free end of the drum with clearance therefrom. The thread pulled off the drum by the gripper shuttle in the course of a pick must pass through an eye situated on the axis of the drum, and in the apparatus disclosed in that patent this eye must be disposed at a relatively long axial distance from the drum. This relatively long axial distance is required to avoid too sharp a change in direction of the thread toward the axis during the pull-off motion. As a result of this distance, however, the storage device must be relatively far from the machine with which it cooperates.

According to the present invention a storage device includes a storage member onto which filamentary material is wound. The storage member has a free end over shich stored material is taken off, the end having a progressively reduced cross-sectional area. The storage device also includes an annular member in the region of the free end of the storage member, the opening of the annular member having a progressively reduced cross-sectional area for checking ballooning of the filamentary material during take-off. The material to be taken off can then be diverted towards the storage member axis immediately after it leaves the storage member. There is a very little friction between the material and the storage member or the balloon checking member, and the ballooning of the material taken off is very slight, so that the material processed is subject to less stress and its take-off tension is reduced. The free end of the storage member and the annular balloon checking member are adapted to the course followed by the material, and the material takes a very short path

to the eye through which it must pass on the axis of the storage member. Since the distance between this eye and the storage member can therefore be reduced, the storage device takes up less space beside the associated textile machine.

The gap between the storage member and annular member may be variable. Preferably the annular member is axially movable. If the material to be processed on the storage device is, for example, very thin or easily tangled yarn the gap can be made smaller than in the case of thicker material such as jute. In the latter case the gap may be made large enough to allow any knots, impurities in the yarn or the like, to pass through unhindered.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described in terms of a number of exemplary embodiments and with reference to the accompanying drawings in which:

FIG. **1** is a diagrammatic axial sectional view through a storage device for filamentary material in accordance with the invention as applied to intermediate weft thread storage in association with a gripper shuttle loom schematically indicated;

FIG. **2** is a fragmentary axial section through another form of storage device for filamentary material according to the invention;

FIG. **3** is a view in elevation taken in the direction indicated by the arrow II in FIG. **2**, of the member **101** of FIG. **2**;

FIGS. **4** and **5** are fragmentary views similar to that of FIG. **3**, but showing variant shapes for the slot **109** seen in FIG. **3**;

FIGS. **6**, **7** and **9** are fragmentary axial sections through other forms of storage device for filamentary material according to the invention;

FIG. **8** is a fragmentary view in side elevation of the base member **106** in the embodiment of FIG. **7**; and

FIG. **10** is a diagrammatic view of still another form of storage device for filamentary material according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1**, a hollow shaft **26** is rotatably mounted in ball bearings **25** in a base **24** fixed to the frame of a loom. The shaft is pierced laterally by at least one hole **38** providing an exit for a weft **10**, which comes from a weft supply bobbin **11** on the loom. During operation of the loom, the bobbin **11** remains permanently outside a shed indicated at **72**, formed from warp yarns **71** by a shedding mechanism not shown and constituting part of the loom. After the weft has passed through the temporary weft store of the invention, generally indicated at **2** in FIG. **1**, it runs through a fixed eye **66** in the loom and then through a yarn tensioner **68** and another fixed eye **69** in the loom. The yarn tensioner **68** moves up and down during loom operation as indicated by arrow **67**. After the weft **10** leaves the eye **69**, a yarn feeder and positioner **97** feeds it to a gripper shuttle **12** before each pick, and this shuttle grips the weft and picks it into the shed **72**. The yarn feeder **97** reciprocates as indicated by an arrow **96**.

In the temporary weft thread storage device or store generally indicated at **22**, a cone **39** is mounted on the hollow shaft **26**, the right-hand end of which extends beyond the cone to a stub **42**, on which a yarn storage

member or drum **44** is mounted by means of ball bearings **43.**

The shaft **26,** shown broken away at **81,** is rotated by suitable means not shown, which may for example be of the character shown in U. S. Pat. No. 3,411,548. A weight **70,** cast in the bottom of the drum **44** or otherwise fastened thereto, unbalances the drum and therefore prevents it from rotating with the shaft **26.**

The storage drum **44** has a conical extension **45** on the (in FIG. **1**) left-hand end thereof and a conical portion **82** on its free right-hand end. An annular member **101** is provided in the region of the conical portion **82** and has on its inside surface substantially the same conicity as the portion **82.** Thus, at the free end of the drum, its cross-sectional area declines progressively toward that free end, and the cross-sectional area of the opening in the annular member **101** similarly declines toward that free end.

The weft is taken off the bobbin **11,** runs through the hollow shaft **26,** through a hole **38** and a feed eye **41** on the cone **39** and then reaches the conical extension **45** on the drum **44.** A coil of weft forms on this extension **45,** but because the extension is conical this coil slides to the right in FIG. **1** on to the smooth surface of the drum. As each further coil is formed, the coil which has slipped off is pushed further to the right. As soon as there are several coils on the drum, the entire single-layer winding **73** is moved further to the right thereon.

During each pick a supply of weft equal to the weaving width of the loom is pulled off the drum **44,** over the free conical end **82** thereof. During this operation the weft **10** runs through the conical gap **102** between the conical portion **82** and the annular member **101,** which latter is provided to prevent the formation of a balloon of weft.

Since the weft being taken off the drum is diverted directly towards the drum axis **85** due to the conicity of the portion **82** and the member **101,** i.e. due to the conical shape of the gap between them, and since practically no ballooning of the yarn can occur in the vicinity of the portion **82** and the member **101,** the temporary weft store **22** can be located relatively close to the fixed eye **66** in the loom. The distance **103** is therefore relatively short.

In FIG. **1** therefore the shaft **26** constitutes a support member from which the storage drum or member **44** is supported for rotation with respect to that support member. The storage member **44** has at its free end a cross-sectional area, in planes perpendicular to the axis of relative rotation of the members **26** and **44,** which declines toward the free end of the storage member. The ring **101** constitutes an annular member surrounding the storage member **44** adjacent the free end of the latter, and the cross-sectional area of the opening in the member **101** likewise declines toward the free end of the storage member.

In the temporary weft store of FIG. **2,** the drum **44** has on its free right-hand end a shoulder **104,** provided to prevent the individual coils of weft **10** at the right-hand end of the layer **73** from slipping off prematurely. The axial length of the layer **73** required on the drum **44** for a given yarn supply is greater in the case of thicker, heavier yarn than in the case of thinner, lighter yarn. With heavier yarn the right-hand end of the winding **73** may come close to the shoulder **104** during operation.

Another difference in the modification shown in FIG. **2** is that the rotating cone **39** of FIG. **1** is replaced by a rotating feed tube **105,** to whose outer end the feed eye **41** is fixed. The cone **39** and the feed tube **105** may both be described as a flyer arm. Instead of the weight **70,** the modification of FIG. **2** has a magnetic arrangement to prevent the drum **44** from rotating. This comprises a first permanent magnet **107,** housed in a fixed base portion **106,** and a second permanent magnet **108** situated inside the drum **44** and cooperating with the first permanent magnet. The conical annular member **101** is fixed to the base portion **106,** a spacer ring **110** being inserted between them. The conical gap **102** can be varied by inserting thicker or thinner spacer rings **110** according to the yarn being processed.

As FIG. **3** shows, the annular member **101** contains a tear-shaped slot **109,** through which to pull the yarn. The spacer ring **110** also has a slot located in FIG. **2** on the left of slot **109.** Furthermore the member **101** contains a hole **111** through which the operator can insert his finger when operation begins, before there is a coil **73** of weft on the drum. The weft **10** is first threaded through the tube **105,** inserted in the slot **109,** so that its free end is pushed in FIG. **2** to the right. Afterwards the free end of the thread is pulled out through the end of the member **101** to the right in FIG. **2.** At the same time the thread passes through the slot of spacer ring **110.** It is then passed through components **66, 68** and **69,** shown in FIG. **1,** to the yarn feeder **97.** When the temporary weft store has been switched on and the rotor **105** set into rotation, the finger or some other article is inserted through the hole **111** and held on the shoulder **104.** The coil **73** then forms immediately.

FIG. **2** also shows a device comprising a stationary light source **112** and a reflector **113** on the drum by means of which rotation of the tube **105** can be braked or stopped when the winding **73** extends far enough to the right on the drum to interrupt a light beam extending from the source **112** to the reflector **113.** When subsequent picks have used up enough of the yarn supply at **73** for the light beam to pass from the source **112** to the reflector **113** again, rotation of the feed tube **105** is resumed.

FIGS. **4** and **5** show modifications **109***a* and **109***b* of the yarn slot **109.** The slot **109***b* extends continuously across part of the annular member **101.**

The temporary weft store shown in FIG. **6** has a device, synchronized with the picking action of the loom, for adjusting the conical gap **102** between the conical or substantially conical outer surface on the storage member **44** and the conical or substantially conical inside surface of the annular member **101.** The synchronization is provided by a plate **116** which is mounted on the main shaft **114** of the loom, or coupled thereto to turn revolution for revolution therewith. The plate **116** contains a slit **115** which cooperates with a signal generating device **117.** The device **117** may be of known construction and may be photoelectric in nature, or may operate on principles of electromagnetic induction or otherwise, to generate a periodic electrical signal at the rate of rotation of the plate **116.** The device **117** is connected to a switching device **118,** by means of which an electromagnet **119** is periodically energized, once for each rotation of plate **116.** This magnet **119** is housed in a fixed base portion **121,** and its armature is formed by a member **122** to which the annular member **101** is fixed. The members **122** and **101** are mov-

able horizontally in FIG. 6 in a bearing element 123 and are biased by a spring 124 in the direction of a stop 125.

Toward the end of each pick the slit 115 in the plate 116 passes the device 117 permitting light to pass between the two limbs of the device so that the electromagnet 119 is energized by the switching device 118. The member 101, with the armature 122, thereupon moves to the left in FIG. 6, overcoming the bias of the spring 124, until components 119 and 122 touch. The gap 102 is thereby reduced, optionally to the extent of producing a slight braking action on the yarn.

The gap 102 is then restored when the electromagnet 119 is de-energized. The resistance to passage of the thread through the gap 102 is thereby made low at the beginning of each pick.

The position of the stop 125 is adjustable by means of a setscrew 126. FIG. 6 also shows teeth 127 for guiding the gripper shuttle 12 as it flies through the shed.

In the embodiment shown in FIGS. 7 and 8, the gap 102 between the annular member 101 and the shoulder 104 on the drum 44 is adjustable manually by means of an adjusting screw 128 inserted in an oblique slot 129 in the base member 106, as shown in FIG. 8.

In the embodiment shown in FIG. 9, the winding diameter *a* of the drum 44, which has a rounded-off or cambered free end 120, is greater than the diameter *b* at the small end of the annular checking member 101*a*, which is shaped with a corresponding rounded-off or cambered reduction 130. The drum 44 may be provided with a shoulder 104 whose diameter *c* is greater than the diameter *b*. In this embodiment either the winding diameter *a* or, if there is a shoulder 104, the diameter *c* of this shoulder is greater than the exit diameter *b* of the checking member 101*a*.

Alternatively the annular member 101 may extend further to the right in FIG. 1, optionally as far as or almost as far as the fixed eye 66. The eye 66 may be constituted by the right-hand end of the annular checking member (FIG. 10), so that this member forms a complete funnel 101*b*.

The yarn 10 may also be fed to the drum 44 from a point fixed with reference to the loom, if the drum 44 itself rotates. In this case the drum 44 must be driven. In such an embodiment the base or other stationary bearing member in which the drum is journaled constitutes the support member, in place of the rotatable shaft 26 of FIG. 1. The drum constitutes the storage member as before, and the annular member may be of substantially the same construction as in the embodiments heretofore described, notwithstanding the relative motion between it and the storage member which occurs during laying of coils onto the storage member.

Particularly if, as is desirable, the gap 102 is small, the two members 82 and 101 of FIG. 10 cooperate to form a funnel-shaped guide pointing in the direction of the eye 66, for the purpose of stabilizing the yarn 10.

In a further embodiment, the free end of the drum 44 may be rounded off or cambered and the associated annular member 101 may be conical, or vice versa. Instead of a drum 44 a reel or cage-like storage member may be used. Also, the annular member 101 may be split.

The storage device can also be used, for example, as a feed wheel unit for the knitting points of a knitting machine, or with winding frames, wire winding machines and the like.

It will thus be seen that the invention provides a device for the storage of filamentary material comprising a support member 26, and a storage member 44 supported from the support member for rotation with respect thereto. The storage member has a free end over which stored material can be taken off, and the storage member has at its free end a portion of cross-sectional area declining toward that free end, for example as indicated at 82 in FIG. 1. The device further comprises an annular member 101 surrounding at least a portion of the storage member adjacent the free end thereof, the opening of the annular member having a cross-sectional area declining toward that free end for checking ballooning of the filamentary material during take-off.

According to another feature of the invention, the annular member may be made movable lengthwise of the axis of relative rotation of the support member and storage member, and there may be provided means, as illustrated for example in FIG. 2, to impose a cyclical relative motion on the storage member and annular member parallel to that axis. The storage member may include an annular radially extending shoulder, for example as illustrated at 104 in FIG. 2, axially adjacent the annular member. The annular member may include a slot, as shown for example at 109 in FIG. 3, through which the filamentary material can pass. The annular member may be apertured opposite the surface of the portion of the storage member of declining cross-section, for example as shown at 111 in FIG. 3. Desirably the smallest diameter of the storage member on the side of that portion which is remote from the free end of the storage member is greater than the smallest diameter of the opening through the annular member. The annular member may also have the shape of a funnel, as shown at 101*b* in FIG. 10. The portion of the storage member of declining cross-section may have a conical surface, as indicated at 82 in FIG. 1. It may however have a surface conforming, for example, to a zone of a sphere, or other surface of revolution generated by a curve concave toward its axis of revolution.

While the invention has been described hereinabove in terms of a number of presently preferred exemplary embodiments, the invention itself is not limited thereto but rather comprehends all modification of and departures from those embodiments falling within the scope of the appended claims.

I claim:

1. A device for the storage of filamentary material comprising a support member, a storage member supported from the support member for rotation about an axis with respect thereto, the storage member having a free end over which stored material can be taken off, the storage member having at its free end a portion of cross-sectional area declining toward that free end, the device further comprising an annular member surrounding at least a portion of the storage member adjacent the free end thereof, the opening of the annular member having a cross-sectional area declining toward said free end for checking ballooning of the filamentary material during take-off, the device further including means to impose a cyclical relative motion on the storage member and annular member parallel to said axis.

2. A device for the storage of filamentary material comprising a support member, a storage member supported from the support member for rotation about an axis with respect thereto, the storage member having a

free end over which stored material can be taken off, the storage member having at its free end a portion of cross-sectional area declining toward that free end, the device further comprising an annular member surrounding at least a portion of the storage member adjacent the free end thereof, the opening of the annular member having a cross-sectional area declining toward said free end for checking ballooning of the filamentary material during take-off, the device further including means to adjust the position of the annular member relative to the storage member lengthwise of said axis to adjust the resistance to passage of a thread through the opening formed between the annular member and the storage member.

3. Apparatus for the accumulation and temporary storage of lengths of filamentary material withdrawn from a supply, said apparatus comprising a hollow rotatable shaft, a bearing supporting the shaft for rotation, a storage member rotatably supported at one end from the shaft, means restraining the storage member against rotation, a flyer arm affixed to the shaft and extending radially and axially into exterior overlapping relation with the storage member at said one end thereof, the storage member having a smooth exterior surface conforming substantially to a surface of revolution, said exterior surface including at said one end a substantially frusto-conical portion aligned with said flyer arm, the large end of said portion being adjacent said shaft, a filamentary material passing through the hollow rotatable shaft and over the flyer arm being laid on said exterior surfaces of the storage member into a single layer wrapping of filamentary material on said surfaces whereby the turns of the single layer wrapping of the filamentary material so laid onto said member by said flyer arm are readily axially slideable toward the opposite end of said storage member, said exterior surface further including at said opposite end of the storage member a substantially frusto-conical portion the small end of which is remote from said one end, said apparatus further comprising an annular member surrounding with clearance said last-named portion, the opening of the annular member having over at least part of the axial length of said last-named portion a cross-sectional area declining toward said opposite end.

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