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Pfarrwaller

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[54] **METHOD AND APPARATUS FOR BRAKING FILAMENTARY MATERIAL UNWOUND FROM A PACKAGE**

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[52] **U.S. Cl.** **242/47.01,** 57/58.86

[51] **Int. Cl.** **B65h 51/02**

[58] **Field of Search** 242/47.01, 47.12, 47.13, 242/129, 147, 149; 57/58.86

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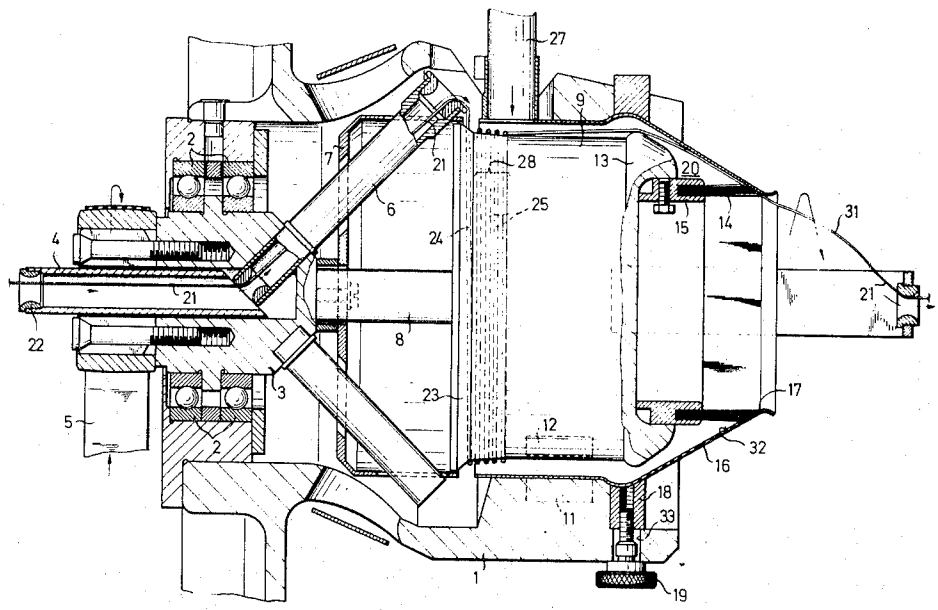
[57] **ABSTRACT**

The braking device is constructed and positioned to act on the filamentary material from within the balloon formed by the material during an unwinding step, for example, for a pick in a weaving machine. The braking device can be used in cooperation with a balloon limiter or not. Braking occurs as soon as no further material is needed for a picking operation.

18 Claims, 9 Drawing Figures



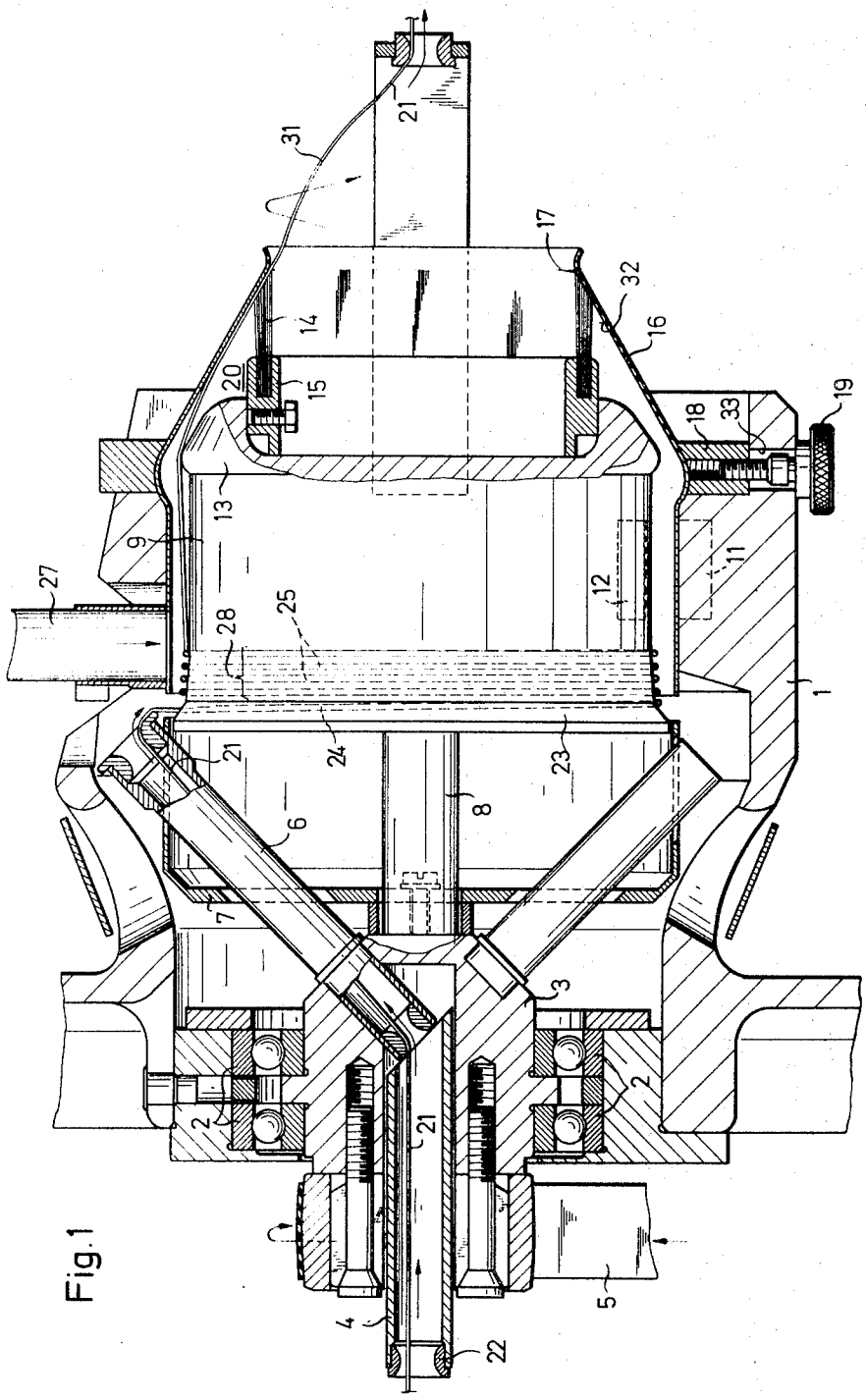

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Fig.1

Fig. 2

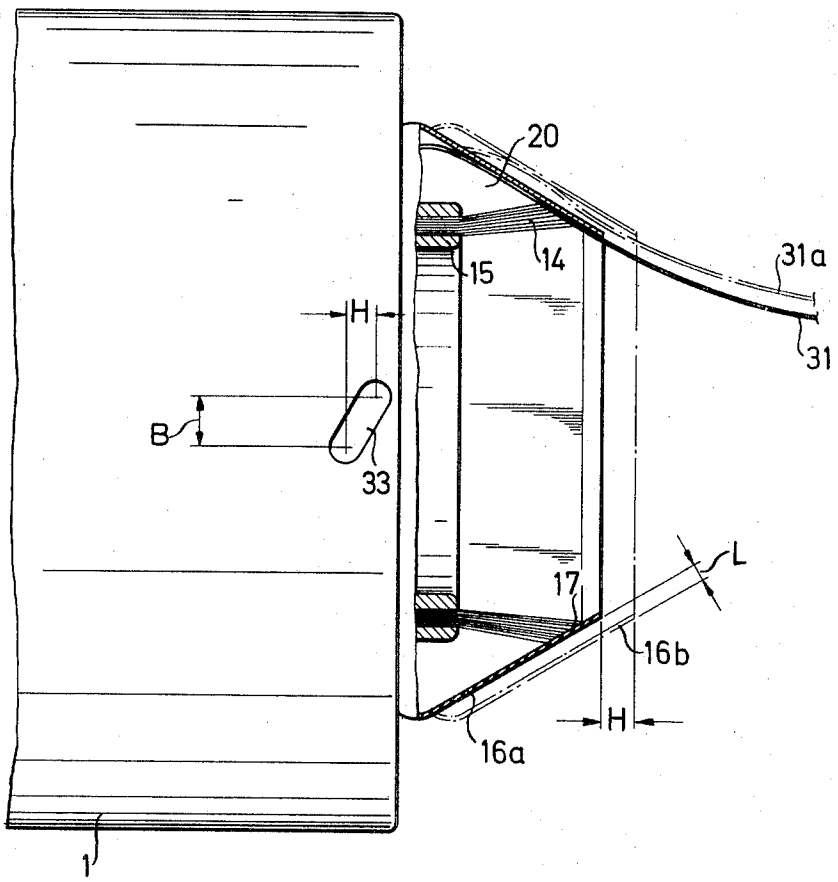

Fig.3

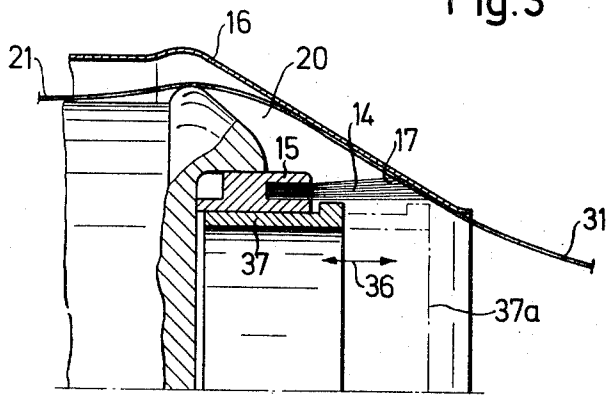
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Fig.4

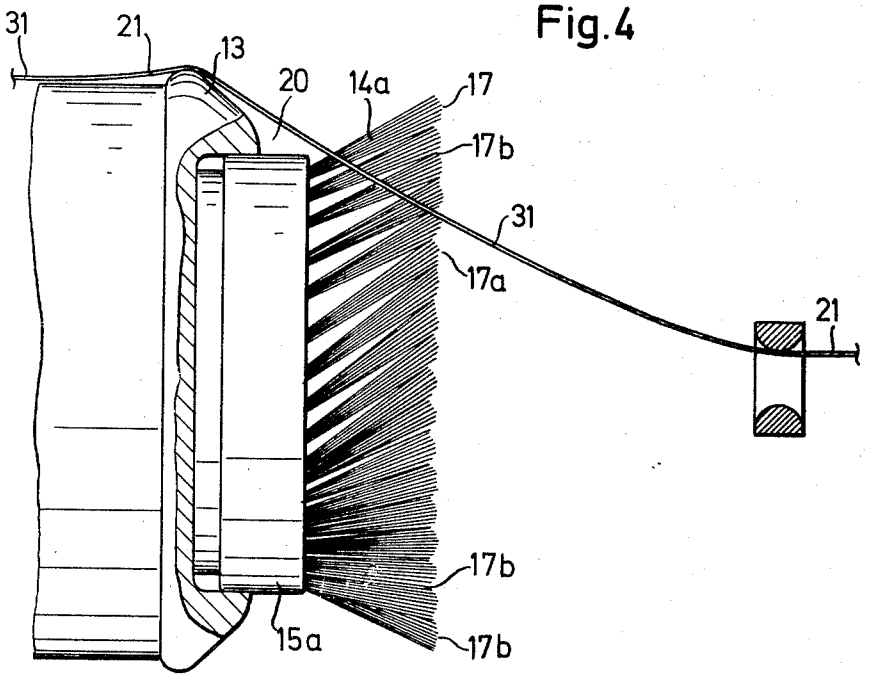
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Fig. 5

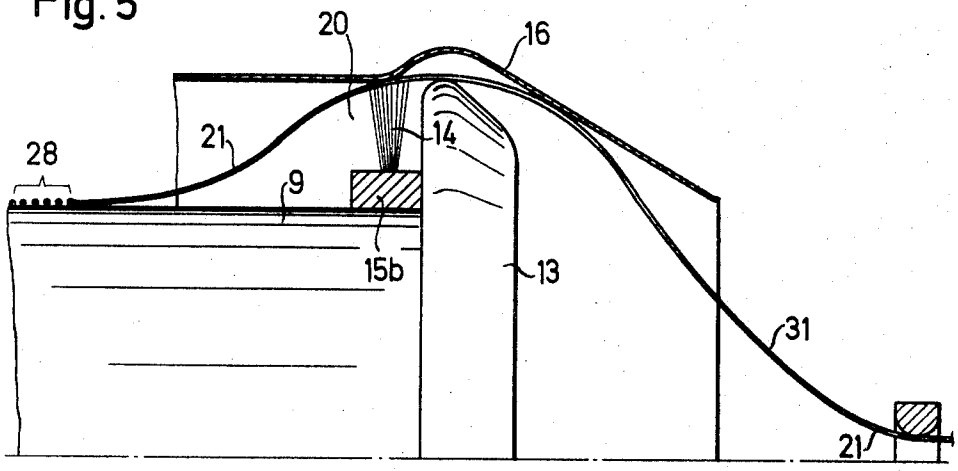


Fig. 9

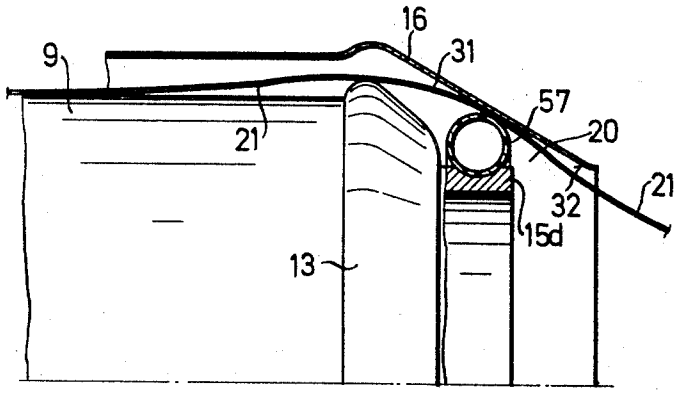


Fig.6

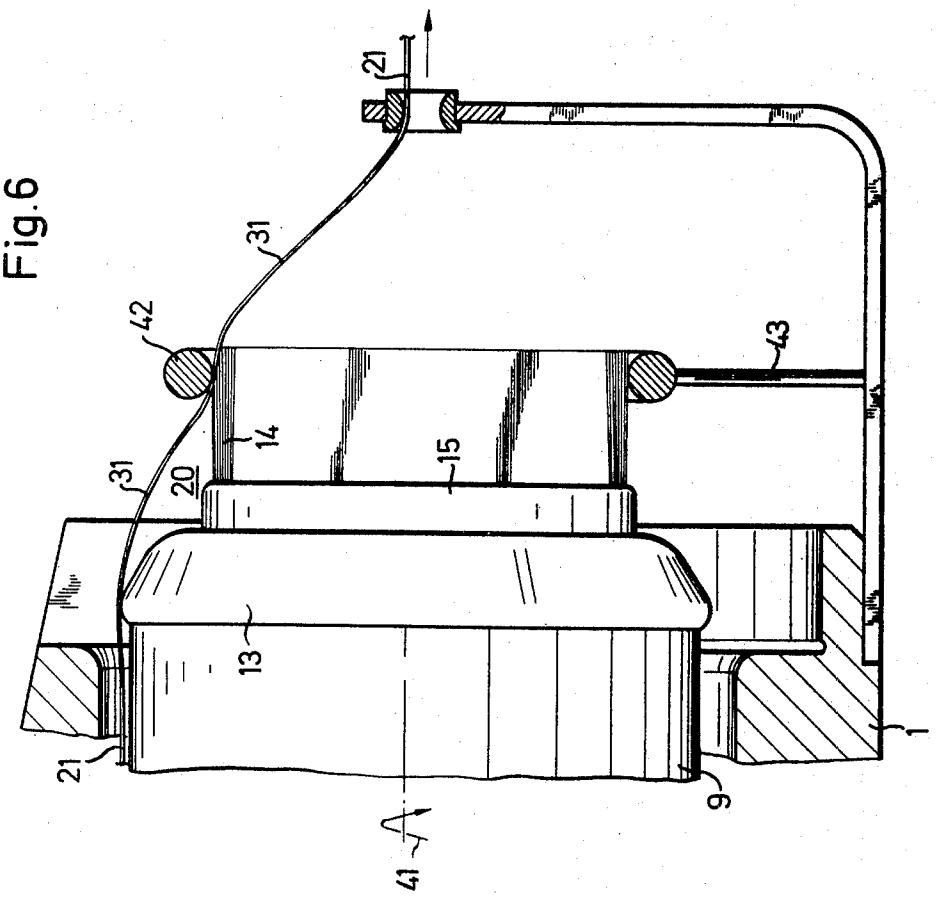


Fig.7

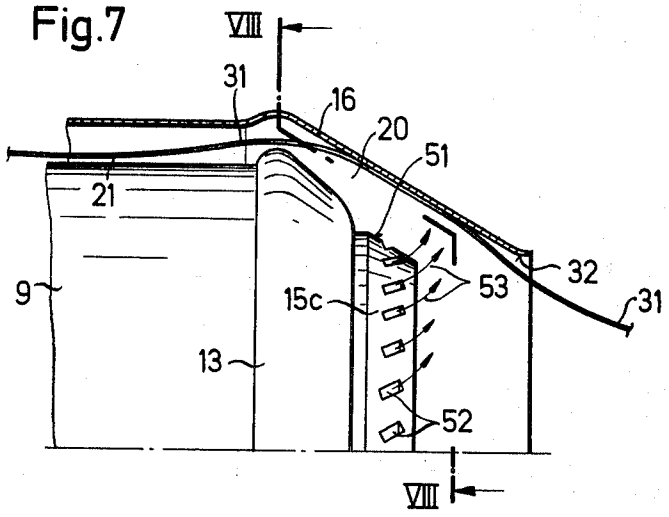
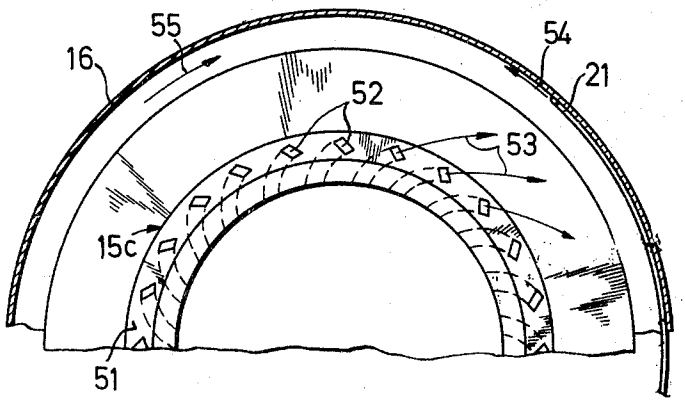


Fig.8



METHOD AND APPARATUS FOR BRAKING FILAMENTARY MATERIAL UNWOUND FROM A PACKAGE

This invention relates to a method and apparatus for braking filamentary material unwound from a package, particularly, by over-end unwinding.

Heretofore, it has been known to unwind filamentary material from substantially cylindrical packages by an over-end winding technique. Generally, this technique causes the material to be unwound from a drum-shaped package while being braked by a bristle ring which is disposed on the package to engage around the package in resilient contact therewith. In order to brake the material, the balloon of material which forms in the region where the package is unwound as a result of centrifugal force is pressed against the package from outside. Assuming yarn to be the material, the yarn is usually pressed into the bristles of the brake ring due to varying degrees by centrifugal force during unwinding. Further, during unwinding and deflection of the yarn, the yarn must bend aside each bristle tip consecutively to reach the next bristle, and so on. The yarn is thus placed under considerable stress so that, if the yarn is used as a weft yarn for picking in a weaving machine, there is a relatively great likelihood of weft yarn breakage.

The devices which have employed the above techniques have had two requirements imposed thereon. First, the yarn must be braked under relatively slight forces. Thus, the brake ring is required to have soft bristles. Second, the brake ring bristles must have some strength for concentric retention of the ring and for synchronous running of the ring and the rotating package. These requirements, however, are in conflict with one another. Thus, only a compromise solution has been obtainable.

Accordingly, it is an object of the invention to provide a braking apparatus for unwinding filamentary material which combines a relatively light braking force with relatively high strength.

It is another object of the invention to provide a simple and effective technique for braking the unwinding of filamentary material from a package for picking in a weaving machine.

It is another object of the invention to use a brittle ring having relatively soft bristles for braking a filamentary material unwound in an over-end manner from a storage drum.

Briefly, the invention provides a method of braking an over-end winding of filamentary material, for example, yarn, thread, etc. from a substantially cylindrical storage drum in a storage device for textile machinery for further processing of the material, for example, for picking as weft yarn in the shed of a weaving machine. The method comprises the steps of forming a supply of wound coils of filamentary material on the storage drum, of unwinding the filamentary material over one end of the storage drum while forming a balloon; and of applying a braking force on the filamentary material from the interior of the balloon in the region of the balloon to brake the filamentary material. The braking force can be applied in any suitable manner, such as mechanically or pneumatically, to brake the filamentary material to a stop, for example, at the completion of a picking operation of the filamentary material in a weaving machine.

The invention also provides a storage device for receiving a plurality of coils of filamentary material, for example, for subsequent delivery to a shed in a weaving machine, with an apparatus for braking the filamentary material unwound over-end from the storage device from the inside of a balloon formed by the material unwound from the storage device. The apparatus comprises a brake means disposed within the balloon for directing a braking force from within the balloon outwardly relative to the balloon. This brake means can be of a mechanical type or a pneumatic type.

In one embodiment, the brake means is in the form of an annular brake member mounted in one end of the storage device with flexible elements, such as bristles, directed outwardly towards the balloon. This brake member can cooperate with a balloon limiter means or not.

In another embodiment, the brake means is in the form of an inflatable tube which is adapted to press the filamentary material against a balloon limiter disposed concentrically about the storage device.

In still another embodiment, the brake means is in the form of a nozzle which directs air flows outwardly to press the filamentary material against a balloon limiter.

As a result of the steps according to the invention, the yarn is driven away from the operative brake means during unwinding as a result of the centrifugal force present in the yarn balloon during unwinding. Where an annular brake member with bristles is used in combination with a balloon limiter, the yarn always runs over the tips of the bristles as a result of centrifugal force and at the same time along the inner surface of the balloon limiter. The bristles are thus only bent slightly by the yarn in the direction of movement, if at all, and the yarn is therefore subjected to very little stress. Thus, yarn breakages can be prevented during further processing, for example, during picking of the yarn into the shed of a weaving machine.

These and other objects and advantages of the invention will become more apparent from the following detailed description and appended claims taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a cross-sectional view through a weaving machine weft yarn storage device utilizing an apparatus constructed according to the invention in a partly diagrammatic representation;

FIG. 2 illustrates an enlarged view of a detail of FIG. 1;

FIG. 3 illustrates a view of a modified brake member which is adjustably mounted in a storage device;

FIG. 4 illustrates a cross-sectional view of a further modification of a brake member according to the invention;

FIG. 5 illustrates a cross-sectional view of a modified braking arrangement according to the invention;

FIG. 6 illustrates a cross-sectional view of a modified braking means using a ring-like balloon limiter;

FIG. 7 illustrates a cross-sectional view of a pneumatic braking means according to the invention;

FIG. 8 illustrates a view taken on line 8—8 of FIG. 7; and

FIG. 9 illustrates a cross-sectional view of a modified braking member in the form of an inflatable annular tube.

Referring to FIG. 1, a storage device for storing a length of filamentary material for subsequent delivery

to a shed of a weaving machine (not shown) includes a machine frame **1** in which a rotatable member **3** is mounted via a ball bearing **2.** The member **3** houses a hollow shaft **4** which is rotated by a belt drive **5.** A tubular yarn guide **6** which extends outwardly at an angle is connected to the hollow shaft **4** and passes through a protective ring **7,** which also rotates. The hollow shaft **4** continues, to the right as shown, in the form of a shaft stub **8,** on which a cylindrical winding drum **9** is disposed to be rotatable, for example, via ball-bearings (not shown in detail). During operation, the drum **9** is secured against rotation by a permanent magnet **11** which is disposed in the member **1** and which cooperates with a permanent magnet **12** fastened in the drum **9.**

The right-hand end of the drum **9,** as viewed, has a bevelled bead **13** as well as a recess within the bead **13.** A brake ring **15** provided with bristles **14** is secured to the end face of the drum **9** within the recess by means of one or more locking bolts as shown. The bristles **14** are directed against a balloon limiter ring **16** disposed in the machine frame **1** and, as illustrated, contact the ring **16** by the tips **17** of the bristles. The balloon limiter ring **16** is mounted in a bearer ring **18** which can be loosened from the frame **1** by means of a screw **19.**

A yarn **21** passes from the left, as viewed, through an eye **22** in the hollow shaft **4** and then via the shaft **4** and yarn guide **6** to an entry cone **23** of the drum **9.** During operation, the first partial turn **24** running onto the cone **23** slips to the right, as viewed, so that the other prior turns **25** continuously slip to the right on the drum **9.** The winding **28** is monitored at the right-hand end by means of a photoelectric control device **27.** When the winding exceeds a given amount, the control device **27** stops the drive of the hollow shaft **4** so that, as the unwinding of the weft yarn **21** progresses to the right, the length of the winding decreases. The drive of the shaft **4** is then started again so that more yarn is wound onto the drum **9,** and so on.

During an unwinding operation, a yarn balloon **31** forms in the region of the end of the drum **9** from which the yarn is unwound and is limited by the funnel-shaped balloon limiter ring **16.** The centrifugal force in the balloon **31** ensures that the yarn **21** constantly runs along the inner surface **32** of the balloon limiter. The yarn is thus taken past the outer tips **17** of the bristles **14** by centrifugal force and is braked.

Referring to FIGS. **1** and **2,** the frame **1** has an inclined slot **33** through which the screw **19** is introduced. When released, the screw **19** can be adjusted in the slot **33** both in the axial region H and in the radial region B (FIG. **2**). In these conditions, the balloon limiter ring **16** is passed from the position **16***a* shown in solid lines in FIG. **2,** in which the ring **16** contacts the bristles **14,** into the chain-line position **16***b* to an increasing degree, in which position there is a clearance L between the tips **17** of the bristles and the balloon limiter ring **16.** When the parts **16, 14** are in the contact position, the yarn describes the balloon **31,** while with the clearance L, the yarn describes the balloon **31***a.*

Referring to FIG. **3,** wherein like reference characters indicate like parts as above, the brake ring **15** has a ring **37** on the inside which is adapted to slide to and fro in the direction indicated by the arrow **36** and be locked in place. The ring **37** allows the bristles **14** to be supported particularly in the region of their tips **17** so that, in the position **37***a* shown in broken lines, the tips **17** produce an increased braking effect at the balloon limiter ring **16.**

Referring to FIG. **4,** wherein like reference characters indicate like parts as above, a limiter ring can be eliminated where a brake ring **15***a* has bristles **14***a* which extend outwardly at an angle and which are inclined in the direction of rotation of the balloon **31** so that the yarn **21** passes through the bristles **14***a.* The yarn **21** is thus braked at the bristles **17** over which the yarn balloon **31** runs. The bristles or their tips are so cut that each bunch of bristles forms a curvature **17***a* on the outside whereby the yarn **21** always undergoes maximum braking at the highest point, while remaining steady in the gaps **17***b* during picking intervals. As shown, the yarn **21** is directed through a guide ring to the right, as viewed, prior to passage, for example, to the picking mechanism of a weaving machine.

Referring to FIG. **5,** wherein like reference characters indicate like parts as above, the braking ring **15***b* is mounted on the periphery of the drum **9** upstream of the lead **13** while the bristles **14** are disposed in a plane perpendicular to the axis of the winding drum **9.** As above, the bristles **14** contact the limiter ring **16** to press the yarn **31** against the limiter ring **16** under a braking force sufficient to brake the yarn **21** when unwinding is interrupted but insufficient to interfere with unwinding of the yarn **21** during normal unwinding.

Referring to FIG. **6,** assuming the drum **9** is driven in the direction of arrow **41** and rotates about its own axis during operation, a ring **42** is disposed on the frame **1** and cooperates with the bristles **14** of a brake ring **15.** This ring **42** may be mounted in a mount **43** so as to be fixed or rotatable. If required, the ring **42** can be kept in synchronism with the drum **9** by any suitable means. The ring **42** acts as a balloon limiter against which the bristles **14** contact for the above purpose braking the yarn **21.** As shown, a yarn guide is mounted on the frame **1** downstream of the brake ring **15** via a bracket to direct the yarn, e.g. to a picking mechanism in a weaving machine.

Referring to FIGS. **7** and **8,** a ring **15***c* is secured on the end face of the drum **9.** The ring **15***c* has a conical outer part **51** in which a plurality of air exit nozzles **52** are disposed. The nozzles **52** connect to a source of compressed air via suitable passage means (not shown) so that jets of compressed air **53** can be expelled in the direction indicated during operation.

During operation, while the yarn **21** performs a rotation in the direction indicated by arrow **54** during unwinding, a turbulent flow of air in the direction indicated by arrow **55** forms in the intermediate space between the ring **15***c* and the balloon limiter **16** and is directed in opposition to the rotation of the yarn **21.** The yarn is thus held and braked at the inner surface **32** of the balloon limiter ring **16.** The compressed air supply may be controlled in the rhythm of a weft pick so that, during the unwinding of the yarn, a short air turbulence is produced in the direction of arrow **55** while during the picking intervals, no air emerges from the nozzles **52.** The limiter ring **16** may have radially disposed holes (not shown) for the air exit.

A liquid, for example, water, may also be used as a flowing medium for injection through the nozzles **52.**

Referring to FIG. **9,** the brake means may alternatively be an air-inflated tube **57,** for example, rubber or plastics, which bear against the inner surface **32** of the

balloon limiter ring **16** and which is disposed on a ring **15***d*, for example, being glued thereon.

All the brake means illustrated act from the inside **20** of the balloon **31** on the yarn **21** or other material, so that the yarn **21** is braked. This braking is desirable to prevent further turns **25** from being drawn off from the drum **9** as a result of the inertia forces of the yarn **21** acting, for example, in the region of the balloon **31** towards the end of the picking operation when the picked piece of yarn is suddenly stopped. In this respect, it is required that the unwinding of turns of yarn, etc. should stop immediately when no more yarn is picked into the shed.

What is claimed is:

1. A method of braking an over-end winding of filamentary material comprising the steps of

forming a supply of wound coils of the filamentary material on a storage device;

unwinding the filamentary material over one end of the storage device while forming a balloon; and

subsequently pneumatically applying a braking force on the filamentary material from the interior of the balloon in the region of the balloon to brake the filamentary material.

2. A method as set forth in claim **1** wherein a turbulent air flow is directed in opposition to the direction of rotation of the balloon of filamentary material.

3. A method as set forth in claim **2** wherein the air flow is controlled in synchronism with the unwinding of the filamentary material to produce the air flow only during braking.

4. In combination with a storage device for receiving a plurality of coils of filamentary material thereon, an apparatus for braking the filamentary material unwound over-end from said storage device from the inside of a balloon formed by the material unwound from said storage device, said apparatus comprising an annular brake member disposed within said balloon and having flexible elements directed outwardly towards said balloon for directing a braking force from within said balloon outwardly relative to said balloon.

5. The combination as set forth in claim **4** wherein said elements are bristles.

6. The combination as set forth in claim **5** which further comprises an annular ring slidably mounted within said brake member to support said bristles at different selected regions.

7. The combination as set forth in claim **5** wherein said bristles are inclined outwardly of said brake member to permit the yarn to pass through said bristles and individual bunches of said bristles each form a curvature on the outside thereof.

8. The combination as set forth in claim **6** wherein said annular ring is slidable axially of said storage device and is lockable in selected positions.

9. The combination as set forth in claim **6** wherein said storage device is a substantially cylindrical drum and said brake member is an annular ring mounted concentrically about a periphery of said drum at one end thereof.

10. In combination with a storage device for receiving a plurality of coils of filamentary material thereon, an apparatus for braking the filamentary material unwound over-end from said storage device from the inside of a balloon formed by the material unwound from said storage device, said apparatus comprising a brake means disposed within said balloon for directing a braking force from within said balloon outwardly relative to said balloon, and an annular balloon limiting means disposed about said storage device and said brake means for limiting the size of said balloon, said brake means being directed against said limiting means.

11. The combination as set forth in claim **10** wherein said brake means is an annular brake member having flexible elements in contact with said limiting means.

12. The combination as set forth in claim **11** wherein said brake member is mounted on one end of said storage device.

13. The combination as set forth in claim **10** wherein at least one of said limiter means and said brake means is slidably mounted on said storage device to vary a spacing between said brake means and said limiter means.

14. The combination as set forth in claim **10** wherein said brake means is an air inflated tube.

15. In combination with a storage device for receiving a plurality of coils of filamentary material thereon, an apparatus for braking the filamentary material unwound over-end from said storage device from the inside of a balloon formed by the material unwound from said storage device, said apparatus comprising a brake means disposed within said balloon for directing a braking force from within said balloon outwardly relative to said balloon, and an annular balloon limiting means about said storage device and wherein said brake means includes a ring having a plurality of exit nozzles directed towards said limiting means for directing jets of a flowing medium angularly towards said limiting means.

16. The combination as set forth in claim **15** wherein said brake means includes an annular ring mounted in said storage device, said ring having a conical part including said nozzles therein.

17. A method of braking an over-end winding of yarn delivered to a picking mechanism of a weaving machine, said method comprising the steps of

forming a supply of wound coils of the yarn on a storage device;

unwinding the yarn over one end of the storage device while forming a balloon; and

applying a relatively slight braking force on the yarn from the interior of the balloon and in the region of the balloon at the completion of a picking operation of the yarn in the weaving machine.

18. A method as set forth in claim **17** wherein the yarn is unwound intermittently from the storage device.

* * * * *