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(54) **Yarn feeder with storage drum**

(57) A drum (12) has a plurality of yarn loops (Y) wound thereon, which are adapted to be unwound from a delivery end (12r) of the drum (12) upon request from a downstream machine (L). A thin-walled, hollow braking member (18) has a substantially frustoconical profile yielding elastically in the radial direction, which is biased to coaxially engage the delivery end (12r) of the drum

(12) with its inner surface by elastic means (20) under tension between a stationary support (22) and the braking member (18). The braking member (18) is rotatably supported about its axis with respect to the stationary support (22) by a rolling bearing (26) which is operatively interposed between the braking member (18) and the elastic means (20).

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## Description

**[0001]** So called "storage" yarn feeders are known which are provided with a drum having a plurality of yarn loops wound thereon, which are adapted to be unwound upon request from a downstream machine, such as a loom or a knitting machine.

**[0002]** The yarn is withdrawn from a spool arranged upstream of the feeder, and may be wound on the drum either by a swivel arm, as shown, e.g., in EP 0 534 263, or by rotating the drum, as shown, e.g., in US 4,068,807.

**[0003]** The yarn coming from the drum is maintained under tension by a weft-braking device.

**[0004]** A general weft-braking device comprises a circular braking member which is abutted against the delivery edge of the drum for braking the unwinding yarn by friction, which yarn is pressed between the braking member and the drum while running.

**[0005]** With the above-cited EP 0 534 263, the braking member comprises a thin-walled, hollow frustoconical member, which generally consists of a sheet made of a flexible synthetic material such as PVC, PET, PEI, or composite materials such as a tissue impregnated with resins, which is coaxially biased by elastic means against the delivery edge of the drum with its inner surface.

**[0006]** With the above cited US 4,068,807, the braking member comprises an elastic rubber ring which axially engages the delivery edge of the drum with its inner edge. The elastic ring is supported at the larger base of a rigid, hollow frustoconical member which, in turn, is rotatably supported about its axis by a bearing, so that it follows the drum when it rotates for winding new loops.

**[0007]** A drawback of the known storage drums, such as the above-cited ones, is the any bumps, such as knots or tangles, on the yarn unwinding from the drum may cause high peaks of tension on the yarn as the bump passes between the braking member and the drum, which are pressed against each other. Such peaks of tension may affect the quality of the mesh produced and even cause the yarn to break.

**[0008]** Therefore, it is a main object of the present invention to provide a storage yarn feeder with a weft-braking device which is capable of considerably reducing the peaks of tension deriving from any bumps, such as knots or tangles, on the yarn.

**[0009]** The above object and other advantages, which will become apparent from the following description, are achieved by a yarn feeder having the features recited in claim 1, while the dependent claims state other advantageous, though secondary features of the invention.

**[0010]** The invention will be now described in more detail, with reference to a few preferred, non exclusive embodiments shown by way of non-limiting example in the attached drawings, wherein:

Fig. 1 is a lateral, broken-away view of the yarn feeder according to the invention;

Fig. 2 separately shows a component of the yarn feeder of Fig. 1 to an enlarged scale;

Figs. 3 to 5 are three diagrammatical, lateral views of the yarn feeder according to the invention in respective three, consecutive operative steps.

**[0011]** With reference to the above Figures, a storage yarn feeder 10 comprises a drum 12 having a plurality of loops of yarn Y wound thereon, which are adapted to be unwound upon request from a downstream machine L, such as a loom or a knitting machine, which is only diagrammatically shown in Fig. 1.

**[0012]** With the embodiment described herein by way of example, drum 12 can axially rotate, under control of a motor M, for withdrawing yarn from a reel R arranged upstream of the feeder and winding it upon itself. To this purpose, drum 12 may be conventionally provided with sensor means (not shown) for actuating motor M when the amount of yarn stored on drum 12 is about to run out.

**[0013]** Yarn Y unwinding from drum 12 is maintained under tension by a weft-braking device 14 which is anchored to an arm 16 projecting from the motor housing.

**[0014]** In a way known per se, weft-braking device 14 comprises a thin-walled, hollow braking member 18 having a frustoconical profile elastically yielding in the radial direction. Preferably, braking member 18 consists of a sheet made of a synthetic material, such as PVC, having a thickness in the range 0.1 to 0.5 mm. Alternatively, a different synthetic material such as PET or PEI may be used, or a composite material such as a tissue impregnated with resins. In any case, for the reasons which will be discussed below, it is preferable to use materials having a modulus of elasticity in the range 1 to 4 Gpa, and a braking member having a moment of inertia in the range 200 to 2000 g·mm<sup>2</sup>.

**[0015]** Having particular reference to Fig. 2, braking member 18 is biased to coaxially engage a delivery end 12r of drum 12 with its inner surface by elastic means, which are under tension between an annular support 22 connected to arm 16 and a ring 24 which supports braking member 18. In a way known per se, annular support 22 is connected to arm 16 by a screw mechanism (not shown) which is incorporated in arm 16 and allows the pressure exerted by braking member 18 on drum 12 to be adjusted by a knob 25 (Fig. 1).

**[0016]** In the present embodiment, the elastic means consist of a spider assembly of helical springs 20 having their inner ends 20a anchored to ring 24 and their outer ends 20b anchored to annular support 22.

**[0017]** According to the invention, braking member 18 is rotatably supported about its axis with respect to annular support 22 by a rolling bearing 26 which is operatively arranged between braking member 18 and helical springs 20.

**[0018]** Advantageously, a bearing having a low rolling friction and low inertia is used.

**[0019]** In more detail, braking member 18 is housed in

a seat 24a of ring 24 and is coaxially connected to rolling bearing 26 via a hollow, trumpet-shaped support 28.

**[0020]** Hollow support 28 has a cylindrical end portion 28a on which the inner ring 26a of bearing 26 is fitted. A tube 28b projecting from cylindrical end portion 28a has a diverging profile in the shape of a trumpet. Tube 28b terminates with a frontally open annular groove 30, which is engaged by the smaller-in-diameter end 18a of braking member 18.

**[0021]** In more detail, a cylindrical projection 18c extending from the smaller-in-diameter end 18a of braking member 18 is slidably fitted to an axial, cylindrical surface 30a of annular groove 30. Braking member 18 is axially sandwiched between an annular ridge 32 rising along the inner edge of annular groove 30 and engaging the inner surface of braking member 18, and an O-ring 34, which is received in a respective annular seat 36 surrounding annular groove 30 and engages the outer surface of the braking member.

**[0022]** In operation, the yarn is unwound from drum 12 upon request from downstream machine L, and while running it is pressed between drum 12 and braking member 18, thereby receiving a braking action by friction from them which maintains the yarn under a slight tension.

**[0023]** During the yarn-feeding process, drum 12 is periodically rotated at a speed  $\omega_1$  (Fig. 3) for winding new yarn upon itself, which yarn is withdrawn from the spool. As the drum rotates, braking member 18 is also driven to rotate by friction at the same speed  $\omega_2 = \omega_1$ .

**[0024]** In case of bumps, such as knots or tangles, on the yarn wound on drum 12, the system behaves as shown in Figs. 4 and 5.

**[0025]** When the bump, e.g., a knot K, reaches the area of contact between drum 12 and braking member 18, the rotation of the latter is immediately braked ( $\omega_2 < \omega_1$ ), because the yarn is unwound in the opposite direction with respect to the direction of rotation of drum 12 and braking member 18. This quick reaction is ensured by the low inertia of braking member 18. Accordingly, yarn Y wound on drum 12 upstream of braking member 18 is liable to slacken (Fig. 4), while the yarn downstream of braking member 18 remains under tension. This difference in the tension upstream and downstream of braking member 18 helps knot K to pass under the braking member, while dampening the peak of tension; braking member 18 and drum 12 then start again to rotate at the same speed  $\omega_2 = \omega_1$  (Fig. 5).

**[0026]** In other words, the yielding of braking member 18, i.e., the capability of rotating axially with respect to drum 12 in response to a tangential thrust generated by any bumps on yarn Y, which is pressed while running between the drum and the braking member, has the effect of dampening the impact of any bumps against the braking member, thereby limiting the rising of excessive peaks of tension on the yarn.

**[0027]** The person skilled in the art will appreciate that this result is achieved even when drum 12, and consequently braking member 18, are not in motion. In this

case, as knot K reaches the area of contact between drum 12 and braking member 18, the latter rotates a few degrees in the unwinding direction of the yarn in response to the tangential thrust exerted by knot K, until knot K passes under braking member 18. Therefore, this solution is also suitable for yarn feeders in which the yarn is not loaded by rotating the drum but it is wound on the drum by a swivel arm.

**[0028]** A uniform braking action is guaranteed by the capability of braking member 18 of accurately self-centering with respect to drum 12, when the two parts are put in contact. This self-centering capability is firstly due the fact that braking member 18 is elastically supported on springs; in addition, it is further improved by the system which connects braking member 18 to trumpet-shaped support 28. In fact, as the person skilled in the art will appreciate, this locking system is not completely rigid, because braking member 18 is externally abutted against an O-ring 34 which is conventionally made of an elastically yielding material. This provides braking member 18 with a further degree of freedom in its self-centering movements with respect to drum 12. Moreover, the elastic yielding of the braking member with respect to the radial deformations helps both any bumps to pass through the brake, and the braking member to self-centering with respect to the drum. Therefore, braking members should be excluded which, though having a hollow, frustoconical profile, give a substantially rigid response to the radial deformations in virtue of their thickness and/or of the modulus of elasticity of the material of which they are made.

**[0029]** A preferred embodiment of the invention has been described herein, but of course many changes may be made by a person skilled in the art within the scope of the claims. For instance, with the above-described embodiment, the pressure exerted by the braking member on the drum may be manually adjusted by a screw mechanism. Of course, an automatic adjusting system may be provided, which controls the pressure exerted by braking member 18 on drum 12 by a feedback control loop, in order to stabilize the yarn tension on a predetermined value, in a conventional way per se. In addition, the elastic means which support the braking member may be configured in a different way with respect to what described and illustrated herein. For instance, elastic ropes may be used, as well as springs anchored with both their ends to the annular support and hooked at an intermediate area to the inner ring.

## Claims

1. A yarn feeder comprising:

- a drum (12) having a plurality of yarn loops (Y) wound thereon, which are adapted to be unwound from a delivery end (12r) of the drum (12) upon request from a downstream machine (L),

and

- a thin-walled, hollow braking member (18) having a substantially frustoconical profile yielding elastically in a radial direction, which is biased to coaxially engage said delivery end (12r) of the drum (12) with its inner surface by elastic means (20) under tension between a stationary support (22) and said braking member (18),

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**characterized in that**

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said braking member (18) is rotatably supported about its axis with respect to said stationary support (22) by a rolling bearing (26) which is operatively interposed between said braking member (18) and said elastic means (20).

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- 2. The yarn feeder of claim 1, **characterized in that** said braking member (18) is connected to an inner ring (26a) of said rolling bearing (26) via a hollow support (28), against which said braking member (18) axially abuts via a ring made of an elastically yielding material (34). 20
- 3. The yarn feeder of claim 2, **characterized in that** said braking member (18) has a hollow, cylindrical protrusion (18c) which axially projects from its smaller-in-diameter end (18a) and is slidably fitted on an axial, cylindrical surface (30a) of said hollow support (28), said braking member (18) being axially clamped between said ring made of an elastically yielding material (34) and an annular ridge rising from said axial, cylindrical surface (30a) and engaging the inner surface of the braking member (18). 25  
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- 4. The yarn feeder of any of claims 1 to 3, **characterized in that** said braking member (18) is made of a sheet of a synthetic material having a thickness in the range 0,1 to 0,5 mm. 35
- 5. The yarn feeder of any of claims 1 to 4, **characterized in that** the material of said braking member (18) has a modulus of elasticity in the range 1 to 4 GPa. 40
- 6. The yarn feeder of any of claims 1 to 5, **characterized in that** said braking member (18) has a moment of inertia in the range 200 to 2000 g·mm<sup>2</sup>. 45

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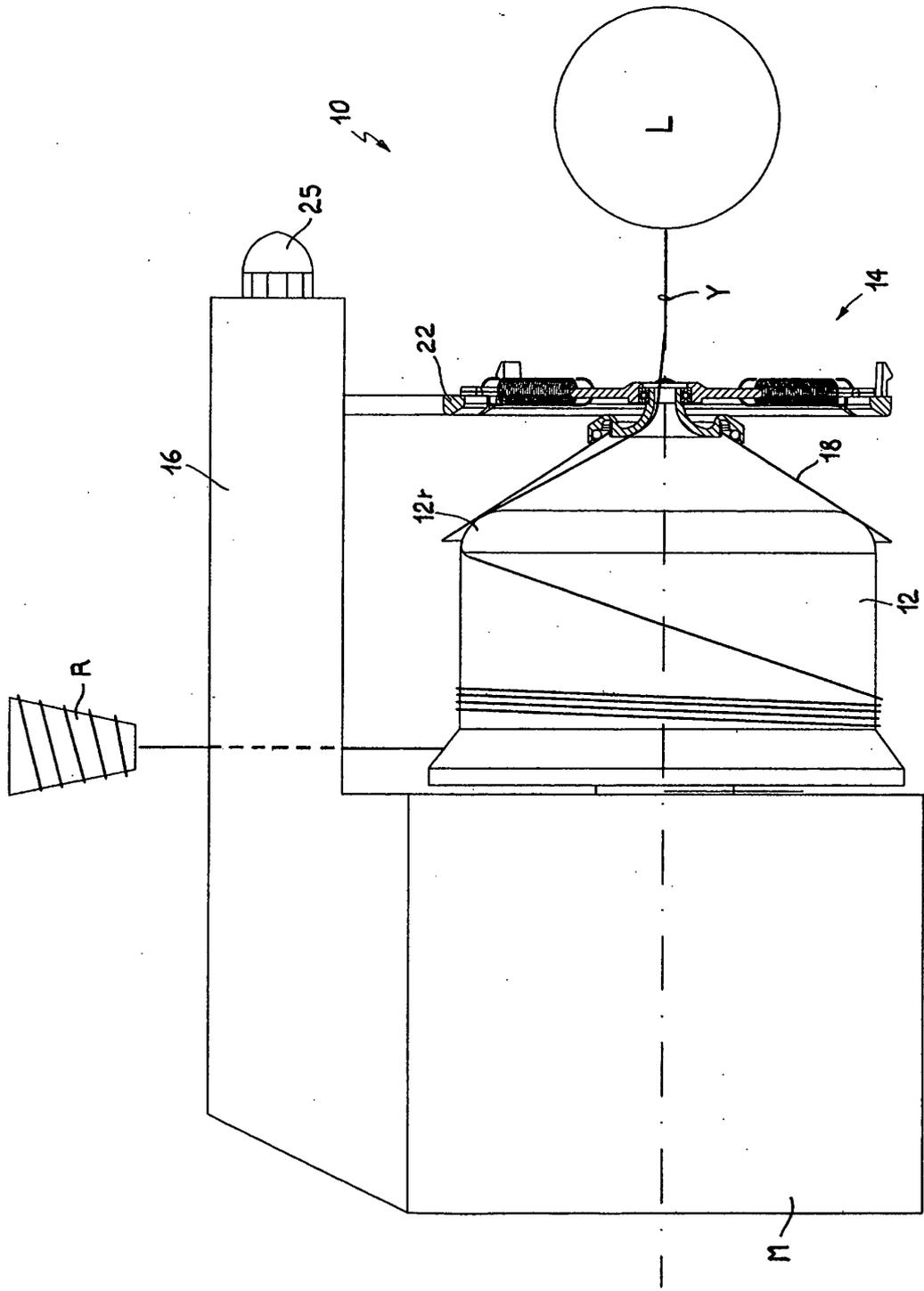


Fig. 1

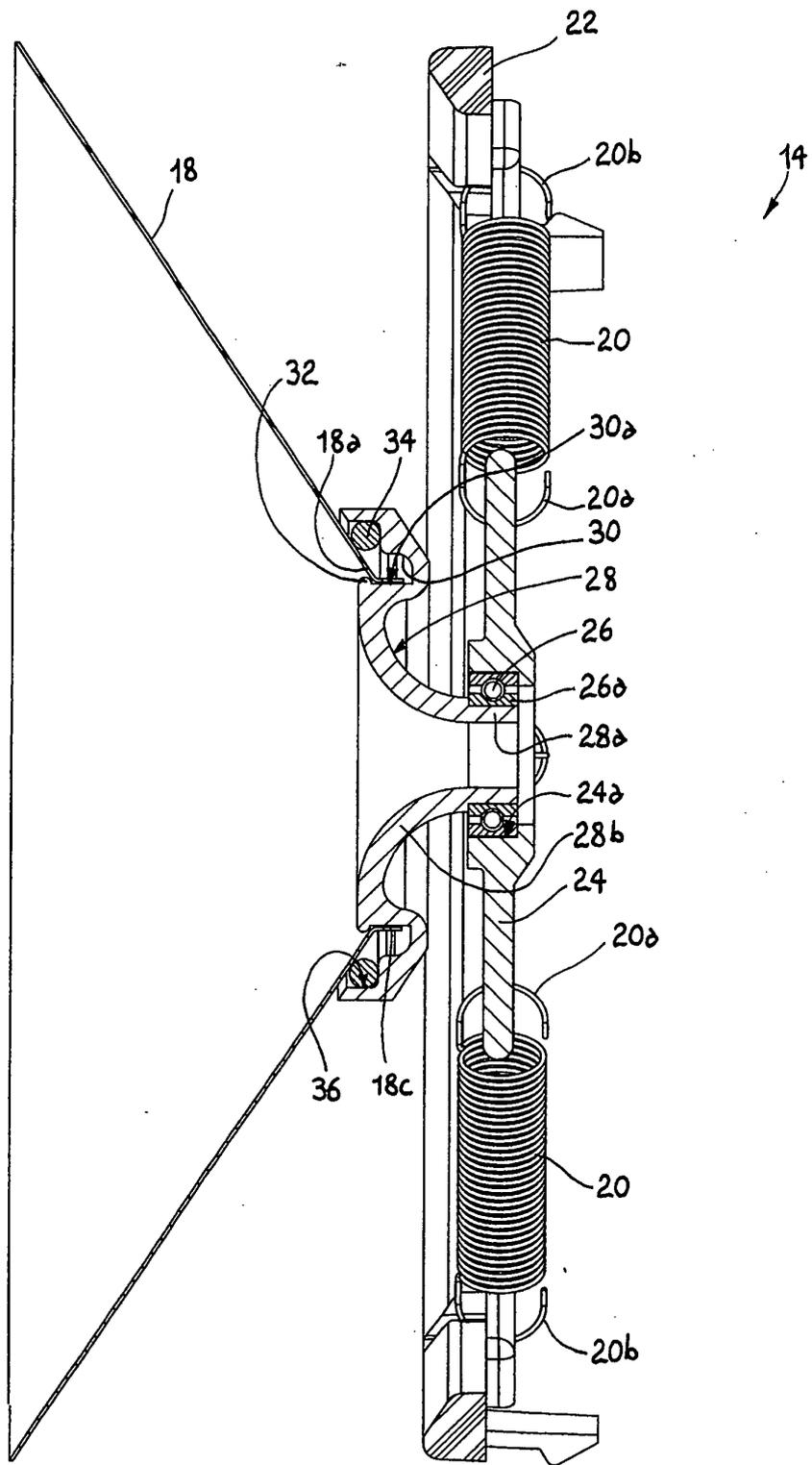


Fig. 2

Fig. 3

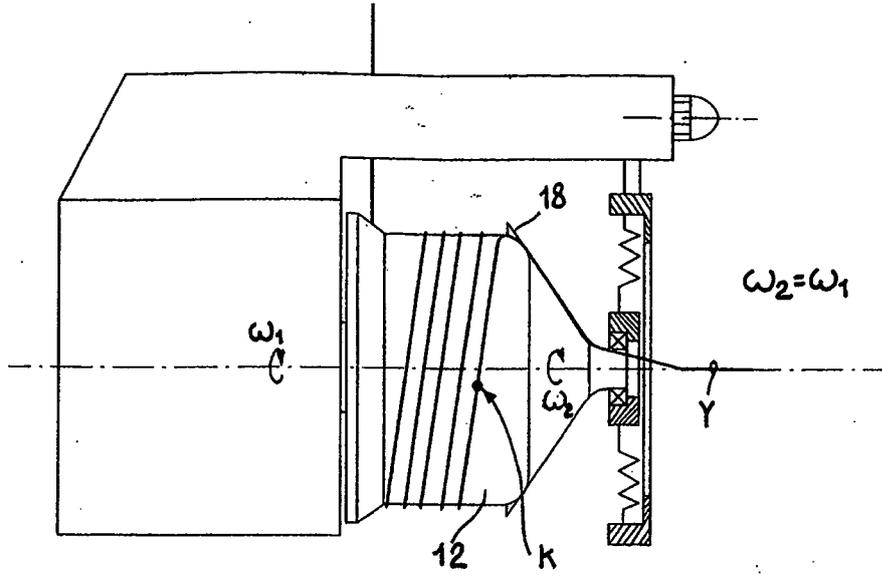


Fig. 4

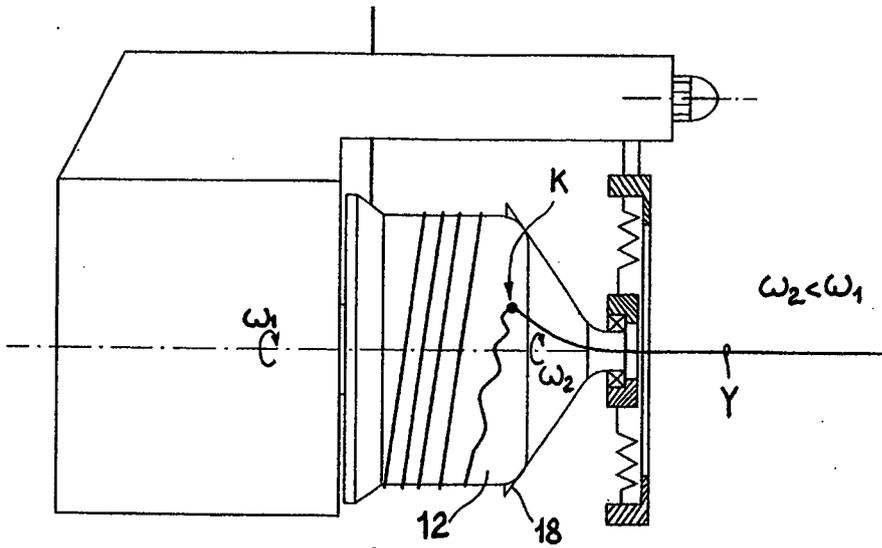
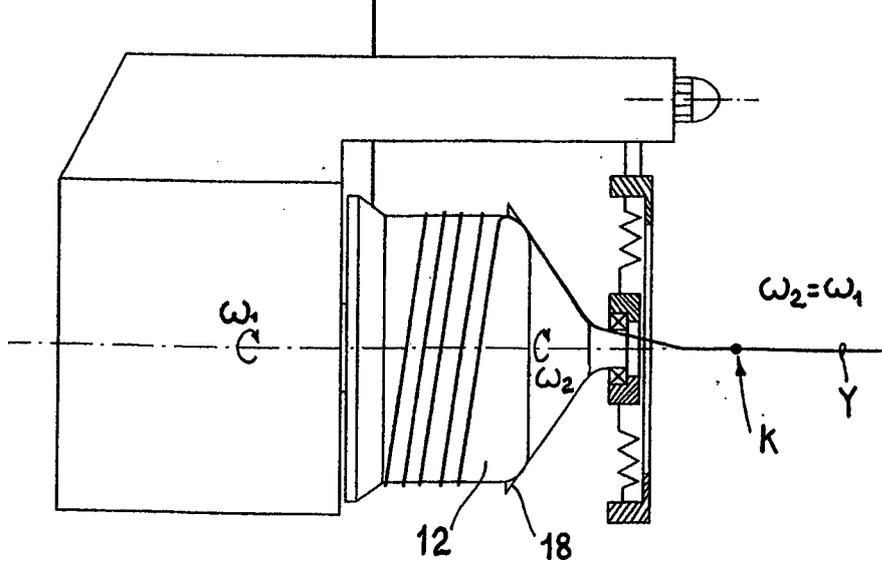


Fig. 5





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