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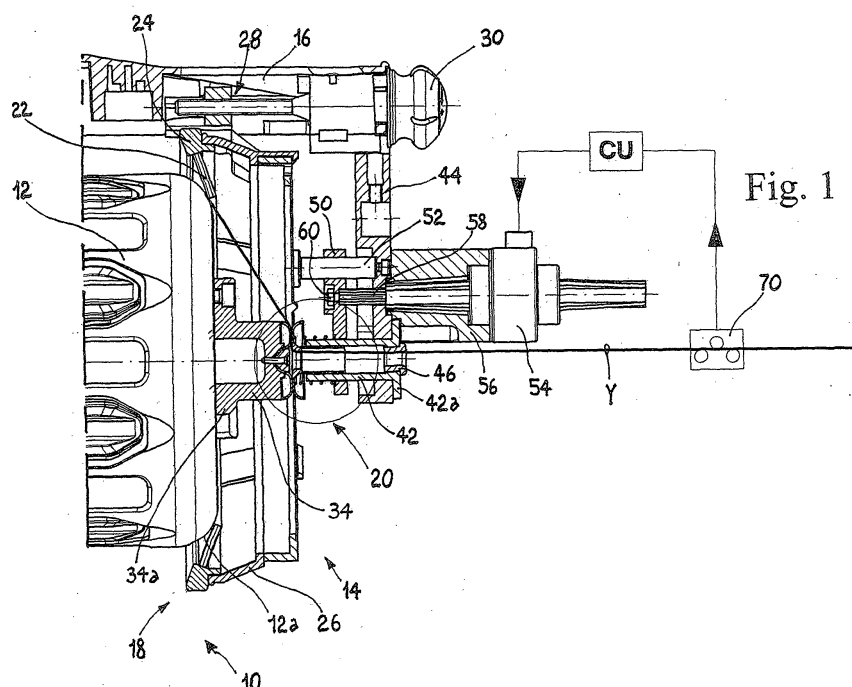
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(54) Yarn-braking device for storage yarn feeders

(57) A first braking plate (32) is adapted to be coaxially fixed to a delivery end of a drum (12). A second braking plate (40) is coaxially biased against the first one by elastic means (48) operatively engaged between the second braking plate (40) and an abutment (50). The yarn (Y) runs between the braking plates (36, 44), thereby receiving a braking action by friction depending on the pre-load of the elastic means. The abutment (50, 150) is operatively connected to a motor (54, 154), via rotary-to-trans-

latory motion conversion means (58a, 64a, 150a, 151), for shifting in a direction such as the pre-load is varied. The motor (54, 154) is driven by a control unit (CU, CU') which modulates the pre-load in such a way as to maintain the tension of the yarn (Y) substantially constant on a desired level, on the basis of a signal generated by a tension sensor (70, 170) interacting with the yarn unwinding from the feeder.

**Fig. 1****EP 2 924 156 A1**

Description

[0001] The present invention relates to a yarn-braking device for storage yarn feeders.

[0002] As known, a storage yarn feeder for a textile apparatus typically comprises a drum on which a motorized flywheel winds a plurality of yarn loops forming a stock. The yarn, which is drawn from a reel upstream of the yarn feeder, is unwound from the drum upon request from a downstream machine, e.g., a loom, and passes through a braking unit comprising one or more weft-braking devices adapted to maintain the unwinding yarn under tension.

[0003] WO91/14032 discloses a weft-braking device in which the yarn unwinding from the drum runs in a radial direction between two counterposed annular plates which are arranged coaxially in front of the drum and are biased against each other for braking the yarn by friction. The drum-side plate is fixed, while the opposite plate is biased against the fixed plate by either a spring or an electromagnetic actuator controlled in such a way as to adjust the braking action applied to the yarn.

[0004] Also in WO02/22483 the unwinding yarn runs radially between two counterposed annular plates arranged coaxially in front of the drum. The drum-side plate is made of a magnetic material and is axially slidable on a pin. The opposite plate is stationary and has an electromagnet arranged behind it which may be energized to attract the movable plate against the fixed plate, thereby applying a braking action upon the yarn which depends on the current across the electromagnet.

[0005] Both the above solutions have the advantage that they do not require frequent cleaning operations, as the dust and the paraffins generated by the yarn rubbing between the braking surfaces are swept away by the rotary motion of the yarn unwinding from the drum.

[0006] However, these solutions have the drawback that they do not allow the average tension of the yarn to be adjusted over time, as required for certain applications in order to preserve the quality and the absence of defects on the finished item. For example, the yarn tension is liable to rise as the reel upstream of the yarn feeder is emptied. In this case, it would be desirable that the brake automatically adjusts its braking action, in order to compensate for this variation and maintain the feeding tension substantially constant.

[0007] Furthermore, the electromagnetic actuators, which are well known for their high consumption of current, must always be supplied for generating the required braking force, with consequent high energy consumption, especially in view of the fact that a conventional weaving/knitting apparatus is often provided with several tens of yarn feeders serving a single downstream machine.

[0008] Other known braking devices are provided with a hollow, frustoconical braking member which is elastically biased against the delivery end of the drum. There are known applications of this type which also allow the

braking force exerted by the frustoconical member to be adjusted based on the feeding tension of the yarn. As disclosed, e.g., in EP0707102, these solutions are not suited to certain applications due to the high inertia and deformability of the frustoconical braking member.

[0009] Therefore, it is a main object of the present invention to provide a weft-braking device for storage yarn feeders which allows the average tension of the yarn to be adjusted over time without being subject to the above-mentioned drawbacks of the known systems, particularly in relation to the power consumption of the electromagnetically controlled systems and to the mechanical limitations of the systems which make use of a hollow, frustoconical braking member.

[0010] The above objects and other advantages, which will become apparent from the following description, are achieved by the weft-braking device having the features recited in claim 1, while the dependent claims state other advantageous, though secondary features of the invention.

[0011] 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 view in axial cross-section showing the end portion of a storage yarn feeder having a weft-braking device according to a first embodiment of the invention installed thereon;
- Fig. 2 shows a detail of Fig. 1 to an enlarged scale;
- Fig. 3 is a perspective, broken-away view of a portion of the weft-braking device of Fig. 1;
- Fig. 4 is a view in axial cross-section of a component of the weft-braking device of Fig. 3;
- Fig. 5 is a view similar to Fig. 1, which shows an alternative embodiment of the invention;
- Fig. 6 is a view in axial cross-section of the weft-braking device of Fig. 5;
- Fig. 7 a perspective, broken-away view of a portion of the weft-braking device of Fig. 6;
- Fig. 8 is a perspective view of a component of the weft-braking device of Fig. 7.

[0012] Fig. 1 shows the end portion of a storage yarn feeder. Yarn feeder 10 comprises a drum 12, which is adapted to have a plurality of yarn loops Y wound thereon to form a stock. Yarn Y is unwound from drum 12 upon request of a downstream machine, e.g., a loom (not shown), and passes through a braking unit 14 supported on an arm 16 which protrudes from the body (not shown) of the feeder. Braking unit 14 comprises a passive weft-

braking device 18 of a conventional type, which is adapted to exert a static braking action upon the unwinding yarn at a delivery edge 12a of drum 12, as well as an active weft-braking device 20 which is adapted to exert a modulated braking action upon the yarn downstream of passive weft-braking device 18, in order to substantially stabilize the tension on a desired level.

[0013] In a way known per se, passive weft-braking device 18 comprises a frustoconical member 22 which is biased with its inner surface against delivery edge 12a of drum 12. Frustoconical member 22 is coaxially supported, at its outer edge, by a ring 24 which is coaxially fixed to a rim 26. Rim 26 is supported by arm 16 in such a manner as to axially move upon control of a screw mechanism 28 incorporated in arm 16. Screw mechanism 28 is manually operable via a knob 30 for adjusting the pressure exerted by frustoconical member 22 against drum 12 and, consequently, the static braking action applied to the yarn by friction.

[0014] With particular reference to Fig. 2, active weft-braking device 20 comprises a pair of counterposed braking plates having a circular profile, which are coaxially supported in front of the delivery end of drum 12. A first braking plate 32 is mounted on a cylindrical support 34 provided with a flanged end 34a, via which it is coaxially fixed to the delivery end of drum 12. The opposite end of cylindrical support 34 has a hemispherical seat 36, in which a central portion 34a of first plate 34, which has a matching hemispherical profile, is received. Central portion 34a is axially sandwiched between hemispherical seat 36 and a counter-shaped locking member 38, which is axially screwed to the end of cylindrical support 34. A spherical coupling is thereby provided, which allows first plate 34 to swing about a point lying on the axis of drum 12. An outer edge 34b of first braking plate 34 is curved toward drum 12. A flat annular portion 34c is defined between central portion 34a and outer edge 34b.

[0015] A second braking plate 40 is coaxially arranged in front of first braking plate 34. Second braking plate 40 has an inner edge 40a and an outer edge 40b both curved away from the drum, as well as a flat annular portion 40c defined between them, which faces flat annular portion 34c of first braking plate 34. A tubular projection 40d coaxially protrudes from inner edge 40a of the second plate, and is slidably inserted in a sleeve 42 fixed to arm 16 via a support 44 (Fig. 1). The end of sleeve 42 facing away from second braking plate 40 is flanged in 42a for anchoring to support 44, and has a yarn-guide eyelet 46 inserted therein.

[0016] Second plate 40 is elastically biased against first plate 34 by a helical compression spring 48. Spring 48 is engaged between second plate 40 and an abutment which, in this embodiment, consists of a slide 50 sliding on a pin 52 parallel to sleeve 42 and fixed to support 44. Slide 50 can shift upon control of a linear stepper actuator 54. Linear actuator 54 is fixed to support 44 via a spacer 56, and is provided with a stem 58 having a threaded end fixed to slide 50 by a nut 60.

[0017] Fig. 4 is a diagrammatical view in axial cross-section of actuator 54. Actuator 54 comprises a housing 61 having an annular stator 62 housed therein. A hollow rotor 64 inserted in stator 62 is supported by housing 61 via two bearings 66, 68. Stem 58 is received in hollow rotor 64 and is threaded at 58a. Hollow rotor 64 is internally threaded at 64a and engages the threading of stem 58. Accordingly, the rotary motion of hollow rotor 64 is converted into a translational motion of stem 58.

[0018] Actuator 54 is driven by a control unit CU (Fig. 1) which is programmed to modulate the braking action exerted by active weft-braking device 20 depending on the signal generated by a tension sensor 70, which is arranged downstream of weft feeder 10 for measuring the tension of the yarn unwinding from the drum, in such a way as to maintain the yarn tension substantially constant on a desired level.

[0019] In operation, feeder 10 draws yarn Y from a reel (not shown) and winds it on drum 12 in the form of loops, e.g., by means of a weft-winding swivel arm (not shown), in a manner conventional per se. Yarn Y, which is unwound from drum 12 upon request of the loom, first passes through passive weft-braking device 18, which applies a static braking action upon the yarn, and then through active weft-braking device 20. In an example of application, as the reel upstream of feeder is emptied, the yarn tension is liable to rise. Control unit CU detects this increase of tension by tension sensor 70, and varies the position of slide 50, which acts on second braking plate 40 via spring 48, in such a manner as to modulate (in this case, to reduce progressively) the pre-load of spring 48 and, consequently, the braking action applied to the yarn running between the plates, thereby compensating for the tension variation.

[0020] Figs. 5-8 show an alternative embodiment of the invention, which differs from the previous embodiment in the spring-preloading mechanism of active yarn-braking device 120. In this embodiment, an abutment consisting of an annular cursor 150 is slidably fitted to sleeve 142 and acts on spring 148. A portion of the outer surface of cursor 150 is rack-shaped in 150a and is engaged by a worm screw 151 keyed to the shaft of a stepper motor 154. Stepper motor 154 is fixed to support 144 via a junction 156 which integrally extends from the end of sleeve 142 facing away from second braking plate 140. The whole mechanism is enclosed in a casing 159. Cursor 150 is prevented from rotating with respect to sleeve 142 by a pin 157 which is integral with cursor 150 and slidably engages a slot 159a formed in case 159.

[0021] Stepper motor 154 is driven by a control unit CU' connected to a tension sensor 170 in a manner similar to the previous embodiment.

[0022] A few preferred embodiments of the invention have been described herein, but of course many changes may be made by person skilled in the art within the scope of the claims. For example, in lieu of stepper linear actuators or stepper motors, brushless drive systems may be used.

Claims

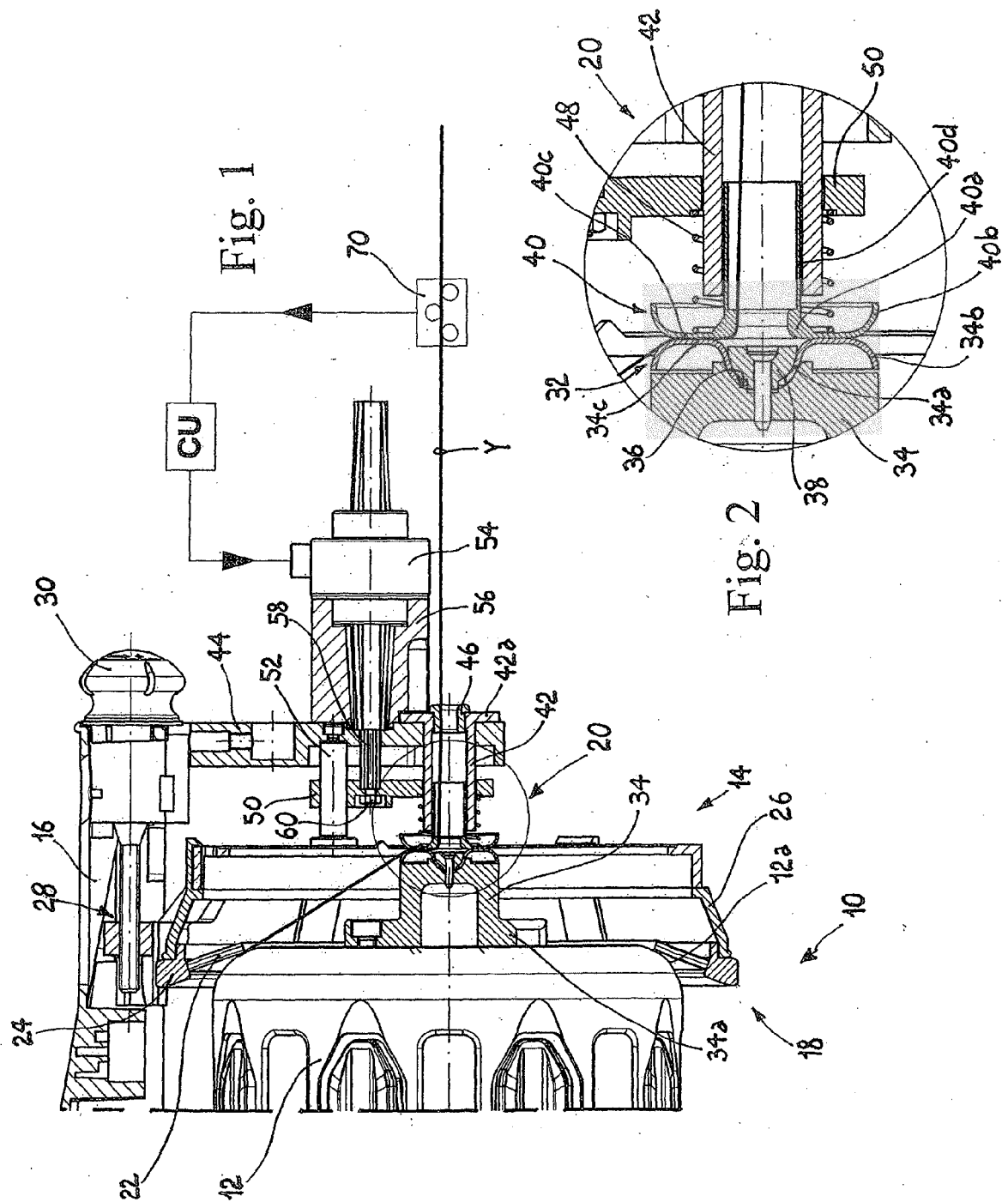
1. A yarn-braking device for installation on a storage yarn feeder (10) provided with a drum (12) having a plurality of yarn loops (Y) wound thereon, which are adapted to be unwound upon request from a downstream machine, comprising:
 - a first braking plate (32), which is adapted to be coaxially fixed to a delivery end of the drum (12), and
 - a second braking plate (40), which is coaxially biased against said first braking plate (32) by elastic means (48) operatively engaged between said second braking plate (40) and an abutment (50),

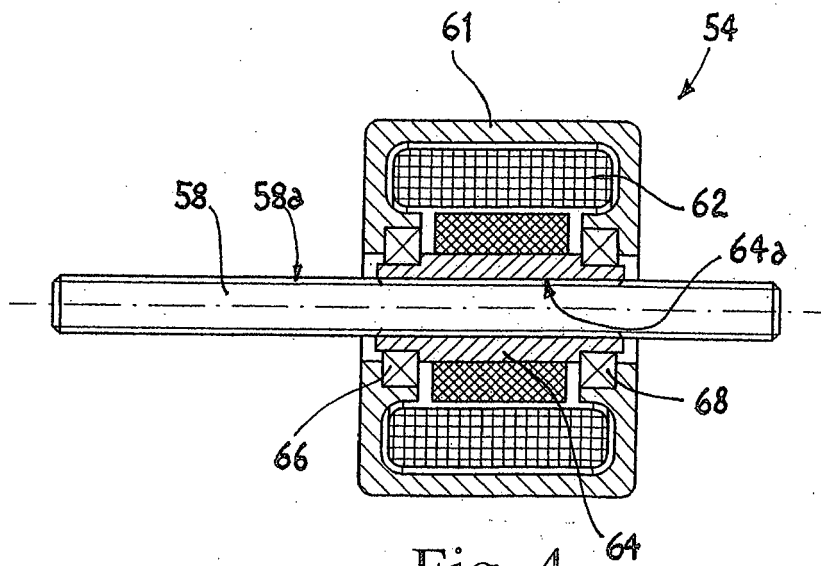
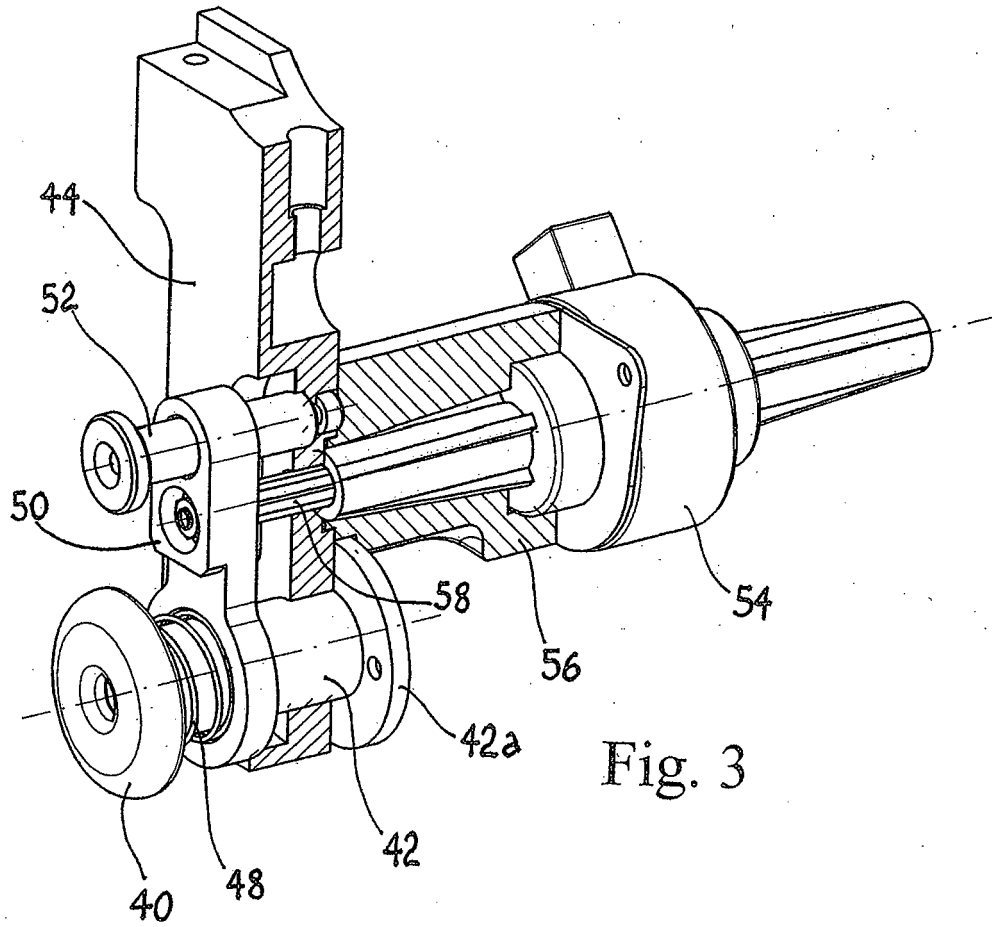
said yarn (Y) being adapted to run between said braking plates (36, 44) to receive a braking action by friction depending on the pre-load of said elastic means,

characterized in that said abutment (50, 150) is operatively connected to a motor (54, 154) via rotary-to-translatory motion conversion means (58a, 64a, 150a, 151) for shifting in such a direction as to vary said pre-load, said motor (54, 154) being driven by a control unit (CU, CU') programmed to modulate said pre-load in such a way as to maintain the tension of the yarn (Y) substantially constant at a desired level, on the basis of a signal generated by a tension sensor (70, 170) interacting with the yarn unwinding from the feeder.
2. The yarn-braking device of claim 1, **characterized in that** said second braking plate (40, 140) is guided to slide axially by a tubular projection (40d) which extends coaxially from its inner edge (40a) and slidably engages a guide sleeve (42, 142) integral with the drum.
3. The yarn-braking device of claim 2, **characterized in that** said elastic means comprise a compression helical spring (48, 148) surrounding said guide sleeve (42, 142).
4. The yarn-braking device of claim 2 or 3, **characterized in that** said abutment comprises a slide (50) which surrounds said guide sleeve (42, 142) and is slidable on guide means (52) spaced from, and parallel to, the guide sleeve (42).
5. The yarn-braking device of any of claims 1 to 4, **characterized in that** said motor (54) and said rotary-to-translatory motion conversion means (58a, 64a) are integrated in an electric linear actuator provided with a driving rod anchored to said abutment (50).
6. The yarn-braking device of claim 5, **characterized**

in that said linear electric actuator is a stepper linear actuator.

7. The yarn-braking device of claim 2 or 3, **characterized in that** said abutment comprises an annular cursor (150) slidably fitted to said guide sleeve (142), and **in that** said rotary-to-translatory motion conversion means comprise a rack (150a) integral with said cursor and operatively engaged by a worm screw (151) keyed to a driving shaft of said motor (154).
8. The yarn-braking device of claim 7, **characterized in that** said motor is a stepper motor (154).





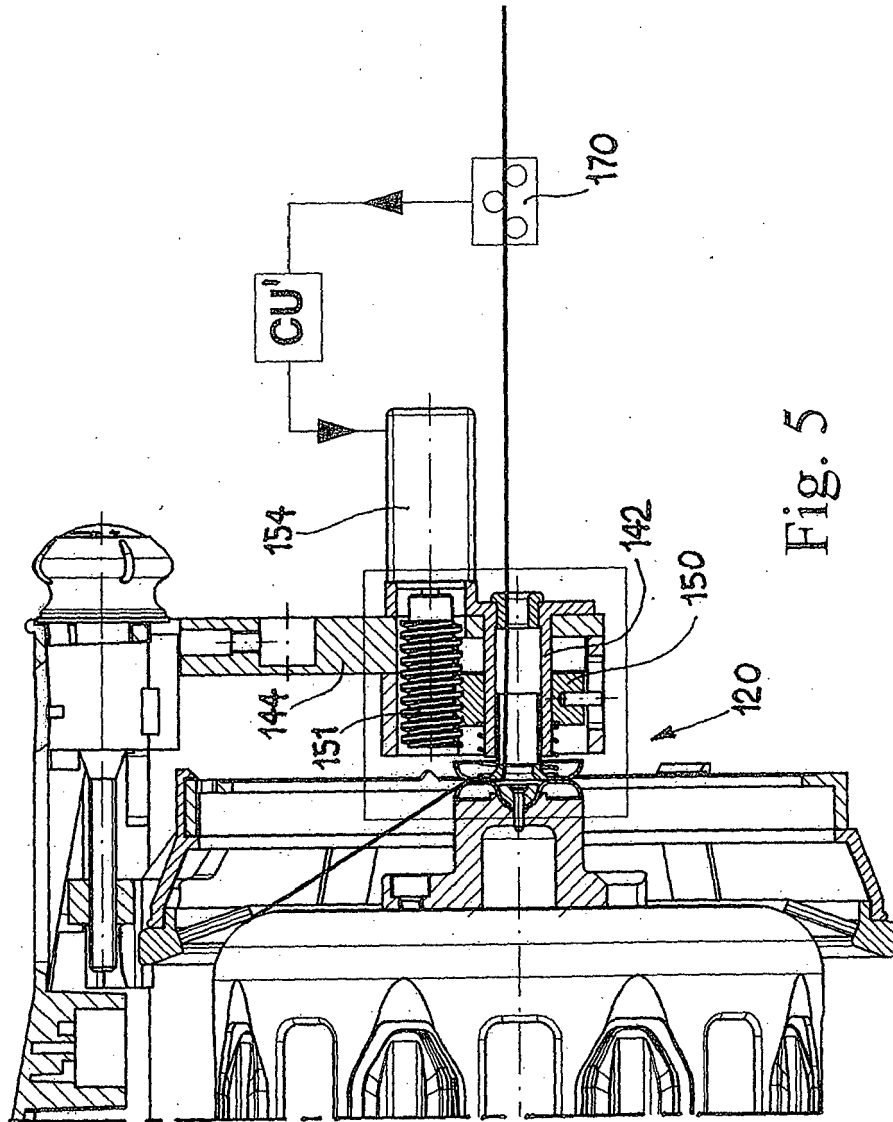


Fig. 5

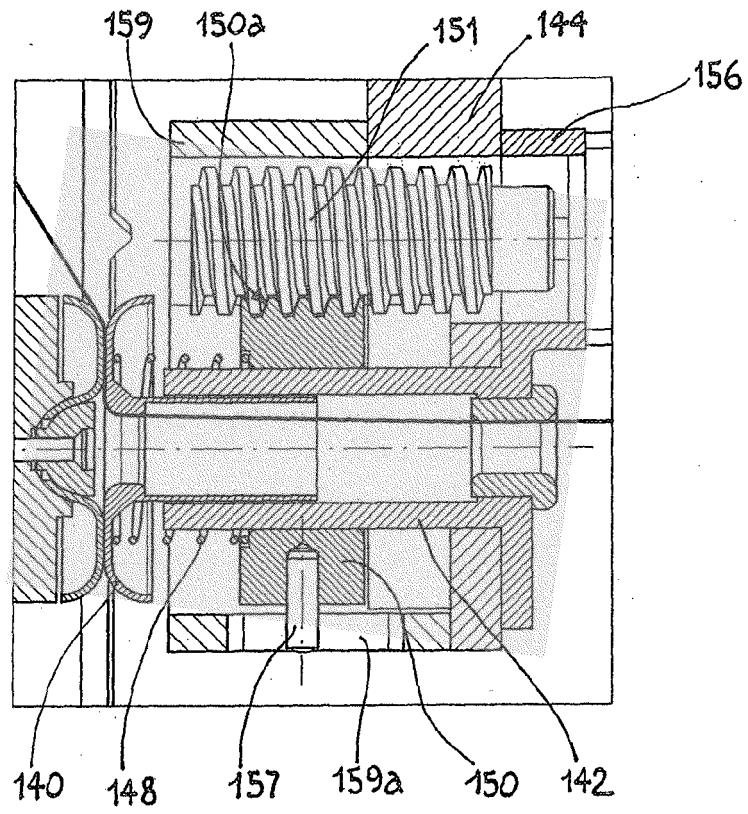


Fig. 6

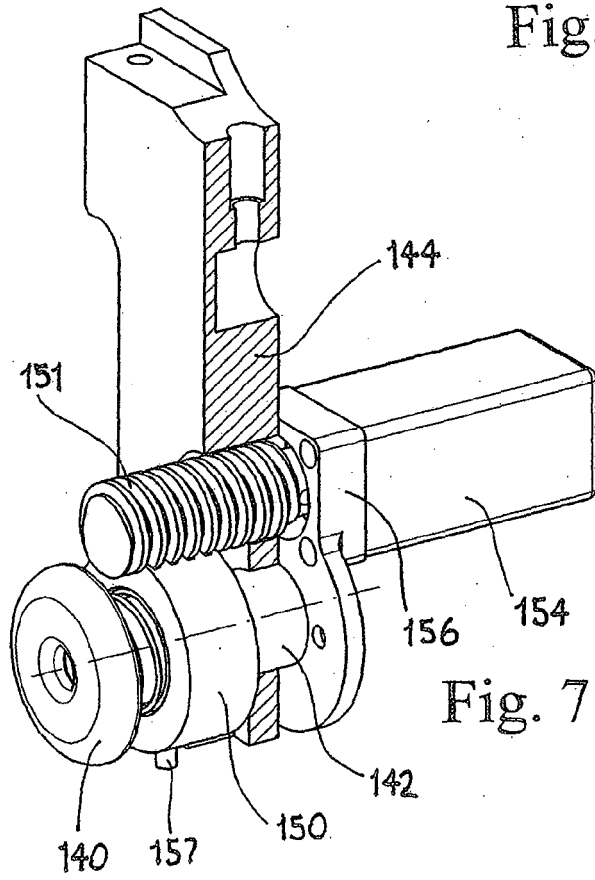


Fig. 7

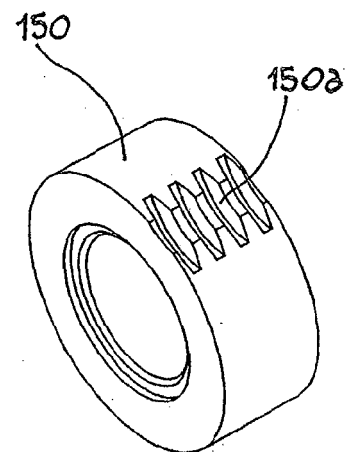


Fig. 8



EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 343 899 A (JACOBSSON KURT A G [SE] ET AL) 6 September 1994 (1994-09-06) * column 4, lines 14-33 * * column 15, lines 7-68 * * column 27, line 6 - column 35, line 61 * * figures 1-38 *	1-8	INV. D03D47/36 D04B15/48
A	US 6 095 449 A (GALLO MARIO [IT] ET AL) 1 August 2000 (2000-08-01) * abstract; figures 17-29 *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			D03D D04B B65H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 July 2015	Examiner Louter, Petrus
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 00 0072

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21-07-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5343899 A	06-09-1994	NONE	
US 6095449 A	01-08-2000	CN 1270567 A	18-10-2000
		DE 69612989 D1	28-06-2001
		DE 69612989 T2	06-09-2001
		EP 0851833 A1	08-07-1998
		IT VC950006 A1	20-03-1997
		US 6095449 A	01-08-2000
		WO 9711016 A2	27-03-1997

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 9114032 A [0003]
- WO 0222483 A [0004]
- EP 0707102 A [0008]