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(54) Yarn-feeding assembly for textile machines

(57) A first yarn feeder (14) is provided with a drum (16) which has a plurality of yarn loops (Y) wound thereon and is driven to rotate by a respective motor (20). The motor (20) is electronically connected to a textile machine (12) for rotating at a speed proportional to the yarn-drawing speed of the textile machine and delivering the yarn wound on the drum (16) to the latter. A second feeder (22) is arranged to draw the yarn from a reel (18) and to deliver it to the first feeder (14), with a delivery action which is modulated by a control loop (24). The latter is programmed to stabilize the tension of the yarn unwinding from the second feeder on a predetermined value on the basis of a signal received from a tension sensor (26) operatively coupled to the yarn.

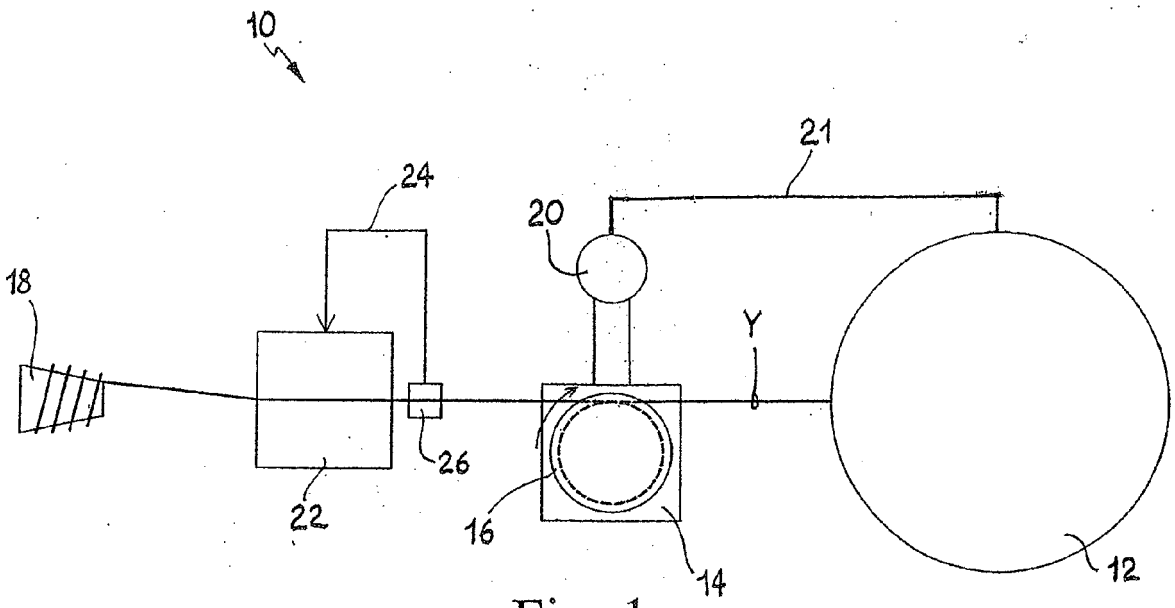

Fig. 1

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Description

[0001] The present invention relates to a yarn-feeding assembly for textile machine, particularly for circular knitting machines.

[0002] As known, a general circular knitting machine is designed to receive a plurality of yarns unwinding from respective feeders arranged about it, which feeders draw the yarns from respective reels.

[0003] In a relatively inexpensive type of feeder, the yarn is wound on a rotary drum which is driven by the motor of the textile machine via a belt drive, with a gear ratio which is mechanically determined on the basis of the diameters of the pulleys which form the belt drive (connection in axis).

[0004] A more sophisticated version of this type of feeder is also known, as shown, e.g., in US 6,145,347, which allows a selection of the yarns to be fed in order to create striped patterns, by so-called "striper" circular knitting machines. In this case, the feeder is provided with a plurality of drums, e.g., four drums keyed to the same shaft which, similarly to the previous case, is driven to rotate by the textile machine via a belt drive. Each drum has one of the yarns under processing coupled thereto, and also in this case the drums always rotate along with the machine; however, the yarns are not entirely wound on their respective drums but, with the feeder at rest, they engage their drums only partially, whereby they do not adhere to them. For the selection of a yarn, each drum has a lever associated thereto, which may be operated to deviate the yarn in such a way as to engage a larger portion of the respective drum and to adhere to it, so that it is fed to the machine.

[0005] Other known yarn feeders are provided with respective motors, which drive the drum at a speed proportional to the speed of the downstream textile machine on the basis of a programmable constant of proportionality, thereby replicating the operation in axis electronically.

[0006] The above feeders operating in axis have the advantage that they always deliver the exact amount of yarn required by the textile machine, but they also have the drawback that the tension of the yarn delivered by the feeder to the textile machine is very variable, because of the fluctuations of tension to which the yarn is subject upstream of the feeder, which circumstance causes anomalies and flaws in the finished garment. The fluctuations of tension to which the yarn is subject upstream of the feeder may be determined by various factors, e.g., the change in diameter of the reel while it progressively empties, deviations in the path of the yarn upstream of the feeder, etc. As known, these fluctuations of tension upstream of the feeder are passed downstream of it, because the yarn loops wound on the drum will be more tense or less tense depending on whether the input yarn is more tense or less tense; accordingly, the yarn unwinding from the drum and feeding the textile machine will also have a variable tension.

[0007] Therefore, it is a main object of the present invention to provide a yarn-feeding assembly for textile machine which, while operating in axis similarly to known systems in order to deliver a guaranteed amount of yarn corresponding to the amount of yarn required by the machine, is not subject to the drawbacks of the known systems in relation to the fluctuations of tension of the yarn, thereby improving the quality of production.

[0008] The above object and other advantages, which will better appear from the following description, are achieved by the yarn-feeding assembly having the features recited in claim 1, while the dependent claims state other advantageous, though secondary features, of the invention.

[0009] 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 diagrammatically shows a yarn-feeding assembly according to the invention;

Fig. 2 is a perspective view of the yarn-feeding assembly, in a first specific embodiment of the invention;

Fig. 3 is a front view of the yarn-feeding assembly, in a second specific embodiment of the invention;

Fig. 4 is a view in side elevation of the yarn-feeding assembly, in a third embodiment of the invention.

[0010] Fig. 1 diagrammatically illustrates a yarn-feeding apparatus 10 according to the invention for a textile machine, for instance, a circular knitting machine 12. All the specific embodiments shown in Figs. 2 to 4 and disclosed in more detail below are covered by the embodiment of Fig. 1 which, therefore, finds general application.

[0011] Yarn-feeding assembly 10 comprises a first feeder 14, which is provided with a rotary drum 16 having a plurality of yarn Y loops coming from a reel 18 wound thereon. Drum 16 of first feeder 14 is driven to rotate by a motor 20, which is electronically connected, e.g., via a CAN-bus line 21, to the motor of the downstream textile machine, for rotating at a speed proportional to the yarn-drawing speed of the textile machine, according to a programmable constant of proportionality, thereby replicating an operation in axis by electronic means.

[0012] According to the invention, a second feeder 22 is arranged upstream of first feeder 14, which draws yarn Y from reel 18 and delivers it to first feeder 14 with a delivery action which is modulated by a control loop 24 which is programmed to stabilize the tension of the yarn unwinding from the second feeder on a predetermined level, on the basis of a signal received from a tension sensor 26 which is operatively coupled to the yarn. Since, as known, the tension of the yarn upstream of first feeder 14 reflects the tension of the yarn downstream of it, the

tension of the yarn delivered by first feeder 14 to machine 12 will be substantially stable and equal to the desired value, although first feeder 14 operates in axis with machine 12 and, therefore, it does not provide any control on the yarn tension.

[0013] Tension sensor 26 is preferably arranged between first feeder 14 and second feeder 22.

[0014] In other words, the yarn-feeding assembly according to this invention allows both the amount of yarn fed to the textile machine (which is proportional to the number of revolutions of first feeder 14) and the yarn-feeding tension, which is stabilized by second feeder 22 before the yarn is delivered to first feeder 14, to be controlled.

[0015] In a specific embodiment of the invention, as shown in Fig. 2, the two feeders 114 and 122 of the yarn-feeding assembly are provided with respective rotary drums 116, 128, which are supported side-by-side and with parallel axes by a single housing 130 and are driven to rotate by respective motors (not shown) housed within housing 130. Tension sensor 126 is mounted to housing 130 between drums 116, 128. The feeders both have the yarn wound between their drums 116, 128 and respective rods 117, 129 slanting towards the axis of the drums, in order to maintain the yarn loops separated from each other in the axial direction.

[0016] The motor of first feeder 114 is electronically connected in axis to the motor of the textile machine, as shown in Fig. 1, in such a way as to rotate at a speed proportional to the yarn-drawing speed of the textile machine.

[0017] With second feeder 122, the control loop (not shown in Fig. 2) modulates the speed of rotation of drum 128 on the basis of the signal received by tension sensor 126, in such a way as to maintain the tension of the delivered yarn (which depends on the difference between the speed at which the yarn is drawn by first feeder 114 and the speed at which the yarn is delivered by second feeder 122) substantially constant on the desired level.

[0018] With this embodiment, the electronics which controls feeders 114, 122 can be integrated in a single circuit (not shown) received within housing 130.

[0019] Fig. 3 illustrates another specific embodiment of the invention, which differs from the previous one in that the two feeders 214, 222 do not form a single body and do not share the same control circuit, but they are separated and provided with respective control circuits (not shown). Of course, in this case tension sensor 226 is mounted to second feeder 222.

[0020] In the embodiment of Fig. 4, first feeder 314 is similar to the first feeder of the previous embodiment, i.e., it is provided with a rotary drum 314 driven by a motor (not shown) which is electronically connected in axis to the motor of the downstream textile machine.

[0021] The second feeder, on the contrary, is a so-called storage feeder 322 of a conventional type. Storage feeder 322 comprises a stationary drum 328 on which a motorized, swivel flywheel 322 winds a plurality of yarn loops forming a stock S.

[0022] Feeder 322 is provided with braking means 334 (which are only diagrammatically shown in Fig. 4) which apply a controlled braking action upon the delivered yarn. In the embodiment described herein, braking means 334 conventionally comprise a hollow, frustoconical braking member 336, which is biased by driving means 340 to abut with its inner surface against the delivery edge 328a of drum 328. In this embodiment, the control loop (not shown in Fig. 4) controls driving means 340 in such a way as to modulate the braking action as a function of the signal received by tension sensor 326, which is supported, together with braking means 334, on an arm 342 projecting from a motor housing 344 of the feeder, in such a way as to maintain the tension of the unwinding yarn substantially constant on the desired level.

[0023] A few preferred embodiments of the invention have been described herein, but of course many changes may be made by a person skilled in the art within the scope of the claims. In particular, when the second feeder is a storage drum, such as in the last-described embodiment, the braking means acting upon the yarn may differ from those illustrated, and they could also be separated from the feeder; e.g., a plate-based brake, in which the yarn is pressed between a stationary plate and a movable plate connected to an actuator, may be used, as well as other conventional brakes. The tension sensor could also be separated from the second feeder, rather than incorporated in it. Furthermore, the constant of proportionality which links the speed of rotation of the drum of the first feeder to the yarn-drawing speed of the textile machine could also be adjusted during processing, e.g., by signals sent from the textile machine to the feeder, which change the constant of proportionality, e.g., as a function of the pattern to be obtained.

Claims

1. A yarn-feeding assembly (10), comprising a first yarn feeder (14) provided with a drum (16) which has a plurality of yarn loops (Y) wound thereon and is driven to rotate by a respective motor (20), said motor (20) being electronically connected to a textile machine (12) for rotating at a speed proportional to the yarn-drawing speed of said textile machine and delivering the yarn wound on the drum (16) to the textile machine, **characterized in that** it comprises a second feeder (22), which is arranged to draw the yarn from a reel (18) and to deliver it to said first feeder (14), with a delivery action which is modulated by a control loop (24) which is programmed to stabilize the tension of the yarn unwinding from said second feeder on a predetermined value on the basis of a signal received from a tension sensor (26) operatively coupled to the yarn.

2. The yarn-feeding assembly (10) of claim 1, **charac-**

terized in that said tension sensor (26) is arranged between said first feeder (14) and said second feeder (22).

3. The yarn-feeding assembly of claim 1 or 2, **characterized in that** said second feeder (122, 222) is provided with a drum (128, 228) driven to rotate by a respective motor, and said control loop is programmed to modulate the speed of rotation of said drum (128, 228) of the second feeder (122, 222) in such a way as to maintain the tension of the unwinding yarn substantially constant on said predetermined value.

4. The yarn-feeding assembly of claim 3, **characterized in that** said first feeder (114) and said second feeder (122) are integrated in a single housing (130) and their respective motors share the same control circuit.

5. The yarn-feeding assembly of claim 1 or 2, **characterized in that** said second feeder is provided with a stationary drum (328) having a plurality of loops of yarn coming from said reel (18) wound thereon, and with braking means (334) controlled by said control loop for applying a modulated braking action to the unwinding yarn in such a way as to maintain the yarn tension substantially constant on said predetermined value.

6. The yarn-feeding assembly (10) of claim 5, **characterized in that** said braking means (334) comprise a hollow, frustoconical braking member (336) which is biased with its inner surface against the delivery edge (328a) of said stationary drum (328) by driving means (340) operatively connected to said control loop.

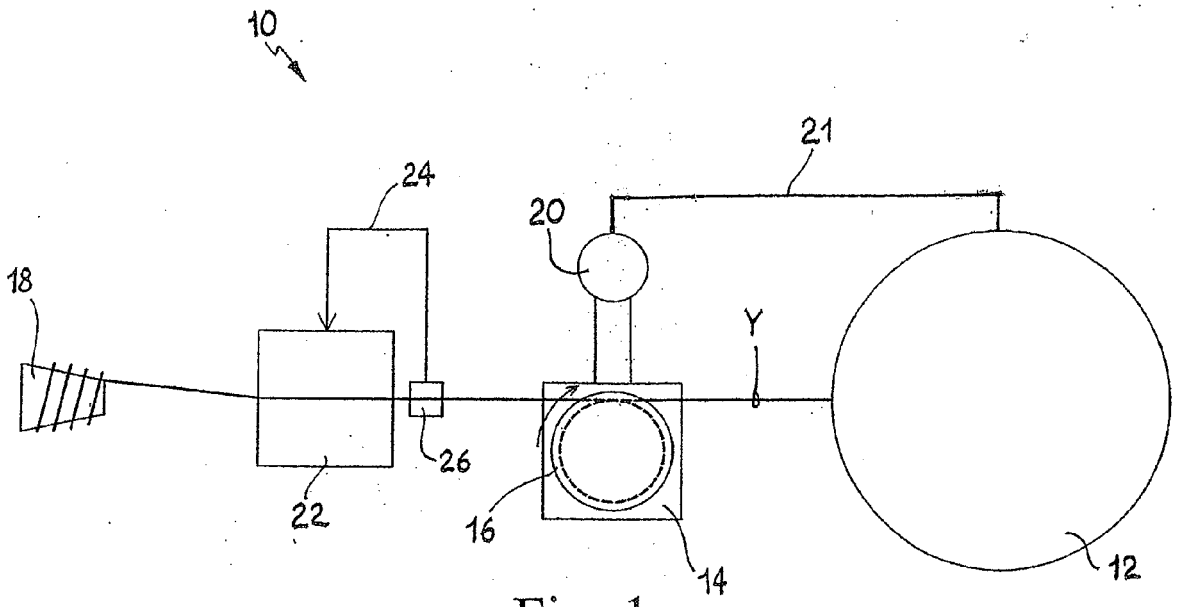

Fig. 1

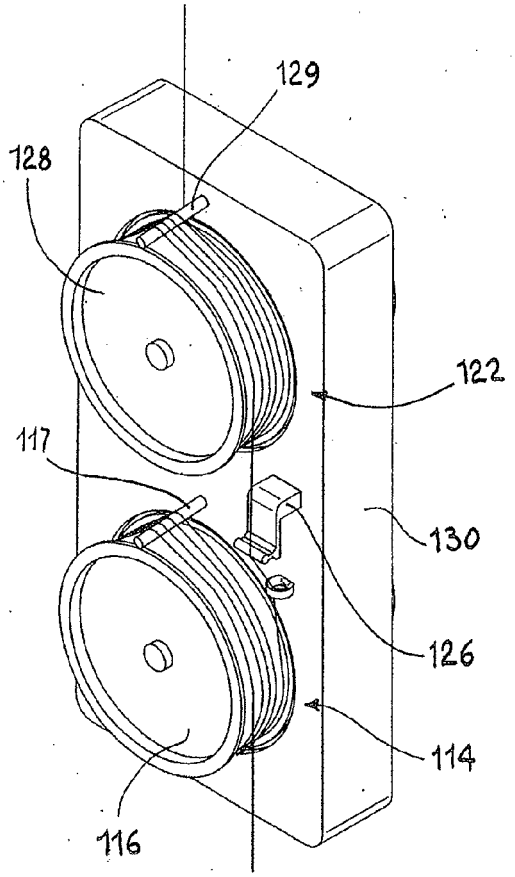

Fig. 2

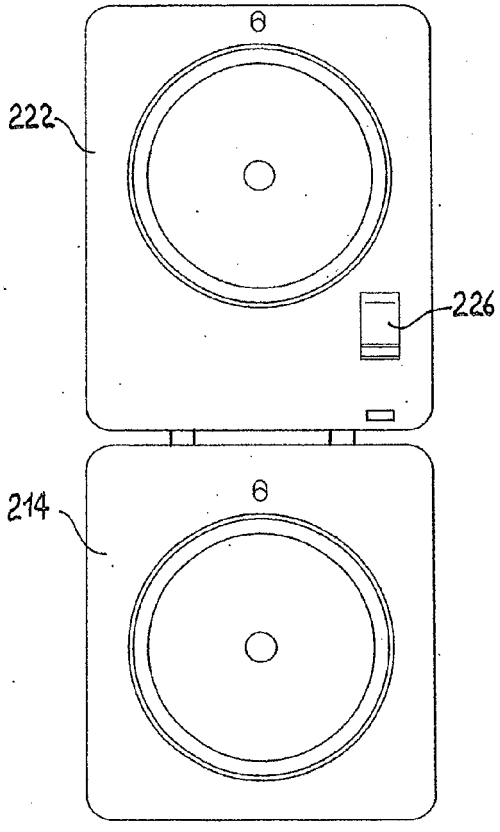

Fig. 3

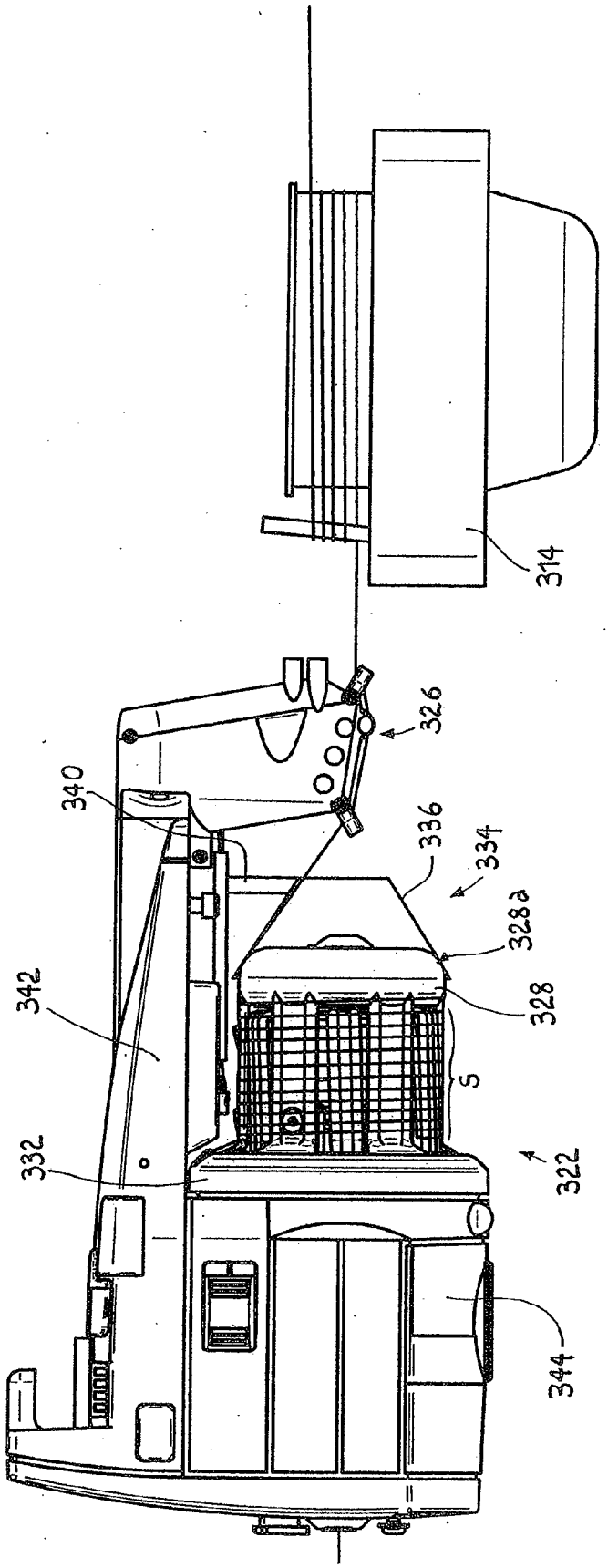

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 13 00 5357

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 5 927 639 A (PAEPKE HORST [DE] ET AL) 27 July 1999 (1999-07-27) * column 1, lines 26-39; figure 1 * * column 1, line 50 - column 2, line 9 * * column 3, line 52 - column 5, line 30 *	1-6	INV. D04B15/48
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A	WO 2011/144987 A2 (BTSR INT SPA [IT]; BAREA TIZIANO [IT]) 24 November 2011 (2011-11-24) * page 5, line 9 - page 6, line 3; figures 1,2 *	1-6	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 March 2014	Wendl, Helen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 00 5357

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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