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Remarks:

Amended claims in accordance with Rule 137(2) EPC.

(54) **Yarn-feeding apparatus for textile machines, with control of the feeding parameters**

(57) Yarn loops are unwound from a yarn feeder (18) provided with a stationary yarn-winding drum (20) upon request from a textile machine (16). Braking means (28, 128) apply a braking action by friction on the unwinding yarn in such a way as to maintain the yarn tension substantially constant. A yarn consumption sensor (34) con-

tinuously measures the actual yarn consumption and generates a corresponding signal (PS) indicative of the consumption. Processing means (32, 36) calculate a consumption signal (YC) on the basis of the corresponding signal (PS), compare it with a predetermined consumption range, and adjust the stitches as a function of the difference between the two values.

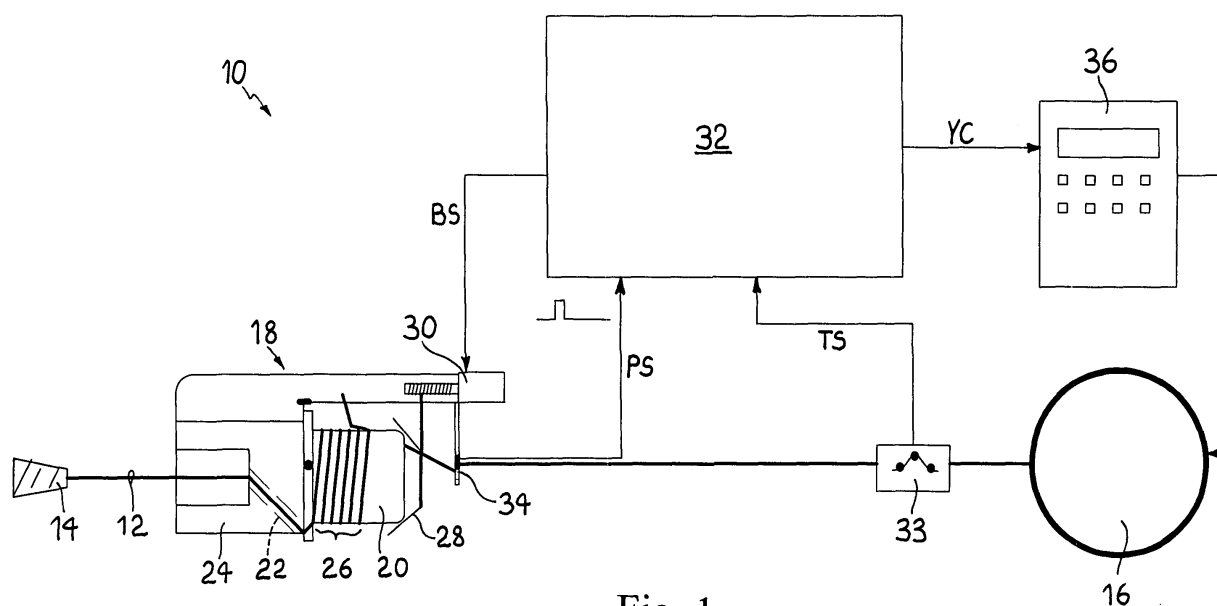


Fig. 1

Description

[0001] The present invention relates to a yarn-feeding apparatus for textile machines, particularly knitting machines, with control of the main feeding parameters.

[0002] As known, in the modern textile lines including knitting machines or the like, tension sensors are used for measuring/controlling the tension of the yarn fed to the machine in order to maintain it substantially constant. In particular, it is desirable to eliminate the fluctuations of tension which may cause defects in the finished products and a lower manufacturing yield.

[0003] An apparatus of this type is described in EP 0 950 742, wherein the yarn is fed to the machine by a yarn feeder provided with a rotating yarn-winding drum, on which the yarn is wound, which draws the yarn from a reel and delivers it to the machine. The tension of the yarn fed by the feeder is controlled by varying the speed of rotation of the drum on the basis of the signal received from the tension sensor, by means of a tension control loop. Accordingly, the variation of tension to be applied is converted into a difference between the yarn-feeding speed and the yarn-drawing speed set on the downstream machine.

[0004] In order to compensate the difference between the yarn-feeding speed, which, as mentioned above, is modulated in relation to the tension control, and the drawing speed set on the machine, a signal indicative of the yarn-feeding speed, which is calculated on the basis of the speed of rotation and of the diameter of the yarn-winding drum, is transmitted to the control unit of the machine; the control unit adjusts the stitches as a function of this speed in such a way as to compensate the difference between the yarn-feeding speed and the yarn-drawing speed.

[0005] The apparatus of EP 950 742 is not satisfactory in terms of accuracy because the yarn-feeding speed calculated as above, which is used both in the tension control loop and in the loop compensating the variations of speed, may considerably differ from the actual speed, because of both the inevitable slipping of the yarn on the yarn-winding drum and the inertia of the yarn.

[0006] Furthermore, the direct influence exerted by the tension control on the yarn-feeding speed, in the apparatus of EP 950 742, causes the loop compensating the variations of speed to activate very frequently, with consequent high wear of the mechanisms which adjust the stitches in the downstream machine.

[0007] Moreover, the variations of speed applied to compensate the tension control loop are subjected to a certain delay because of the inertia of the yarn-winding drum, thereby affecting the quickness of response of the control system.

[0008] Therefore, it is a main object of the invention to provide a yarn-feeding apparatus for textile machines, in which the feeding parameters, in particular the yarn speed and the yarn tension, are controlled more accurately and more quickly than in the known apparatuses.

[0009] It is another object of the invention to provide an apparatus in which the wear of the mechanisms adjusting the stitches in the textile machine is reduced.

[0010] The above objects and other advantages which will better appear below, are achieved by the apparatus 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 diagrammatically shows a yarn-feeding apparatus for textile machines according to the invention;
- Fig. 2 diagrammatically shows a yarn-feeding apparatus for textile machines according to an alternative embodiment of the invention.

[0012] With initial reference to Fig. 1, a yarn feeding apparatus 10 is shown, in which a yarn 12 is drawn from a reel 14 and is fed to a conventional textile machine, preferably a knitting machine 16, via a yarn feeder 18 of a known type provided with a stationary drum.

[0013] A feeder of the above type is described, e.g., in EP 707 102 of Applicant, and comprises a stationary drum 20 on which a flywheel 22 driven by a motor 24 winds a plurality of yarn loops forming a weft stock 26. Upon request from machine 16, the loops are unwound from drum 20 and are fed to the machine.

[0014] Feeder 18 is also provided with braking means comprising a frustoconical, hollow braking member 28 which is coaxially arranged with its larger base in front of stationary drum 20 and is biased with its inner surface against the delivery edge of the drum by actuator means 30. The yarn delivered by feeder 18 is pressed between the delivery edge of drum 20 and braking member 28, whereby it is subjected to a braking action by friction. Actuator means 30 are controlled by a feeder control unit 32 which receives a tension signal TS from a tension sensor 33 arranged along the path of the yarn and, on the basis of it, applies a braking signal BS to actuator means 30, which signal is modulated in such a way as to maintain the yarn tension substantially constant.

[0015] Yarn feeder 18 is also provided with a sensor 34 for continuously measuring the yarn consumption, preferably a piezoelectric sensor connected as described in EP 1 335 054 of Applicant. Alternatively, an optical sensor as described in EP 0 327 973 could be used. In this description, the term "consumption" or "speed" is intended to define the amount of yarn delivered from the drum over time. The signal transmitted by sensor 34, which typically is a pulse signal PS, is processed by control unit 32 in order to calculate the exact number of loops and portions of loop which are unwound from the drum, thereby generating a very accurate consumption signal YC. For a more detailed description of the consumption-

measuring system, reference should be made to the description of EP 1 335 054.

[0016] Consumption signal YC is transmitted to a machine control unit 36 programmed to compare the measured consumption with a predetermined consumption range and to adjust the stitches (not shown) as a function of the difference between these two values.

[0017] In the operation, yarn 12 is fed to machine 16 via feeder 24, with a tension which is maintained substantially constant by the modulated braking action applied by braking member 28. If the braking action applied by braking member 28 causes yarn 12, whose speed is measured by sensor 34, to slow down below the consumption range set on the downstream machine 16, machine control unit 36 adjusts the stitches in such a way as to compensate the difference between these two values.

[0018] As the person skilled in the art will immediately understand, apparatus 10 according to the invention allows the tension of yarn 12 to be controlled, and the stitches to be adjusted, very accurately, by using a yarn feeder 18 of the type provided with a stationary drum and with braking means operated in such a way as to control the tension of the yarn without directly influencing the yarn-feeding speed. This leads to less frequent interventions of the loop compensating the variations of speed and, consequently, to reduced wear of the mechanisms which adjust the stitches.

[0019] Moreover, the apparatus according to the invention is not subjected to the drawbacks deriving from the use of feeders having a rotating drum, with which, as mentioned above, the quickness of response of the system is affected by the inertia of the yarn-winding drum and by the adjusting criterion that is adopted.

[0020] Nevertheless, the apparatus according to the invention makes use of a very accurate consumption-measuring system, which also enhances the accuracy of the loop compensating the variations of speed.

[0021] Fig. 2 shows a second embodiment of the invention, in which the corresponding or similar parts are referred to by the same reference numbers.

[0022] In the apparatus of Fig. 2, yarn 12 is braked downstream of yarn consumption sensor 34, e.g., by a brake 128 of the type described in EP 1 072 707, wherein the yarn is braked by friction between a pressure member operated by a motor and a stationary base. For a more detailed description of this brake, reference should be made to the description of EP 1 072 707.

[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. For instance, although the braking means and the tension sensor of the above embodiments are connected to the control unit of the machine via the control unit of the feeder, they could alternatively be directly connected to, and processed by, the control unit of the machine. To this purpose, the processing means cited in the claims may comprise both feeder control unit

32 and machine control unit 36. Of course, the braking means used in either the first or the second embodiment may be of different types, e.g., in the case of the first embodiment, metal foil brakes, brush brakes, and the like could be used, while, in the case of the second embodiment, swinging arm brakes could be used, as well known to the person skilled in the art.

10 Claims

1. A yarn-feeding apparatus for a textile machine (16) provided with adjustable stitches, **characterized in that** it comprises:

- a yarn feeder (18) provided with a stationary yarn-winding drum (20) from which yarn loops are unwound upon request from a textile machine (16),
- braking means (28, 128) which are controlled to apply a braking action by friction on the unwinding yarn such as to maintain the yarn tension substantially constant,
- a yarn consumption sensor (34) arranged to continuously measure the actual yarn consumption and to generate a corresponding signal (PS) indicative of the consumption, and
- processing means (32, 36) which are programmed to calculate a consumption signal (YC) on the basis of said corresponding signal (PS) and to compare it with a predetermined consumption range, and are connected to adjust said stitches as a function of the difference between the two values.

2. The apparatus of claim 1, **characterized in that** said braking means (28, 128) are controlled on the basis of a tension signal (TS) transmitted by a tension sensor (33) arranged along the path of the yarn.

3. The apparatus of claim 1 or 2, **characterized in that** said braking means (28) are arranged upstream of said yarn consumption sensor (34) in such a way as to press the unwinding yarn against the drum.

4. The apparatus of claim 3, **characterized in that** said braking means comprise a frustoconical, hollow braking member (28) coaxially arranged with its larger base in front of the drum (20) and biased with its inner surface against the delivery edge of the drum.

5. The apparatus of claim 1 or 2, **characterized in that** said braking means (128) are arranged downstream of said yarn consumption sensor (34) in such a way as to press the unwinding yarn between a pressure member operated by a motor and a stationary base.

6. The apparatus of any of claims 1 to 5, **characterized**

in that said yarn consumption sensor (34) is a piezoelectric sensor generating a pulse signal (P), and said processing means (32) are programmed to process said pulse signal (PS) for calculating the exact number of loops and portions of loops unwound from the drum.

7. The apparatus of any of claims 1 to 5, **characterized in that** said yarn consumption sensor (34) is an optic sensor generating a pulse signal (P), and said processing means (32) are programmed to process said pulse signal (PS) for calculating the exact number of loops and portions of loop unwound from the drum.

8. The apparatus of claim 6 or 7, **characterized in that** said processing means comprise a dedicated control unit (32) of the feeder.

Amended claims in accordance with Rule 137(2) EPC.

1. A yarn-feeding apparatus for a textile machine (16) provided with adjustable stitches, **characterized in that** it comprises:

- a yarn feeder (18) provided with a stationary yarn-winding drum (20) from which yarn loops are unwound upon request from a textile machine (16),
- braking means (28, 128) which are controlled to apply a braking action by friction on the unwinding yarn such as to maintain the yarn tension substantially constant,
- a yarn consumption sensor (34) arranged to continuously measure the actual yarn consumption and to generate a corresponding pulse signal (PS) indicative of the consumption, and
- processing means (32, 36) which are programmed to process said pulse signal (PS) for calculating the exact number of loops and portions of loops unwound from the drum and for determining a corresponding consumption signal (YC), to compare said consumption signal (YC) with a predetermined consumption range, and to adjust said stitches as a function of the difference between the two values.

2. The apparatus of claim 1, **characterized in that** said braking means (28, 128) are controlled on the basis of a tension signal (TS) transmitted by a tension sensor (33) arranged along the path of the yarn.

3. The apparatus of claim 1 or 2, **characterized in that** said braking means (28) are arranged upstream of said yarn consumption sensor (34) in such a way as to press the unwinding yarn against the drum.

4. The apparatus of claim 3, **characterized in that** said braking means comprise a frustoconical, hollow braking member (28) coaxially arranged with its larger base in front of the drum (20) and biased with its inner surface against the delivery edge of the drum.

5. The apparatus of claim 1 or 2, **characterized in that** said braking means (128) are arranged downstream of said yarn consumption sensor (34) in such a way as to press the unwinding yarn between a pressure member operated by a motor and a stationary base.

6. The apparatus of any of claims 1 to 5, **characterized in that** said yarn consumption sensor (34) is a piezoelectric sensor.

7. The apparatus of any of claims 1 to 5, **characterized in that** said yarn consumption sensor (34) is an optic sensor.

8. The apparatus of claim 6 or 7, **characterized in that** said processing means comprise a dedicated control unit (32) of the feeder.

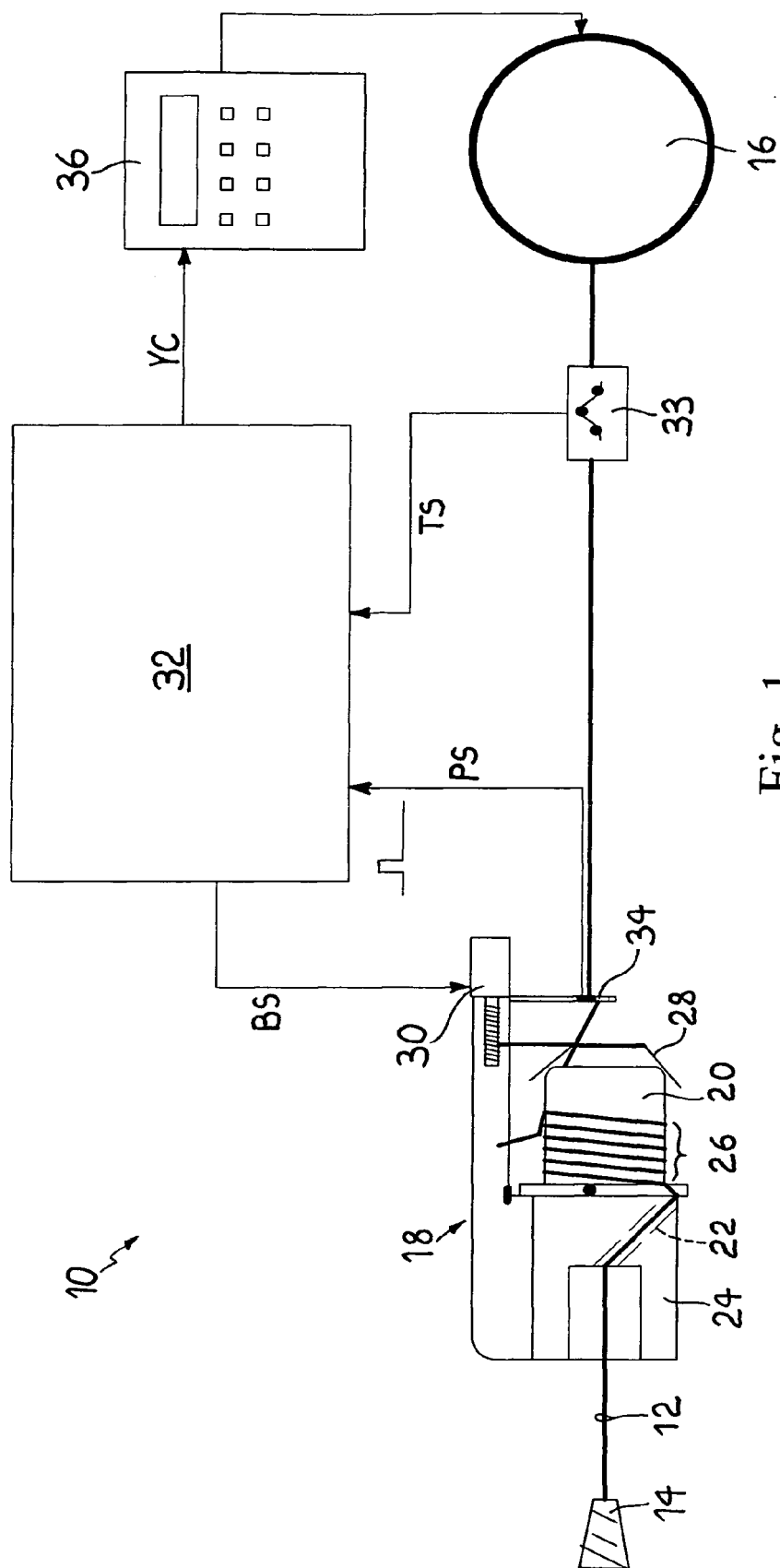


Fig. 1

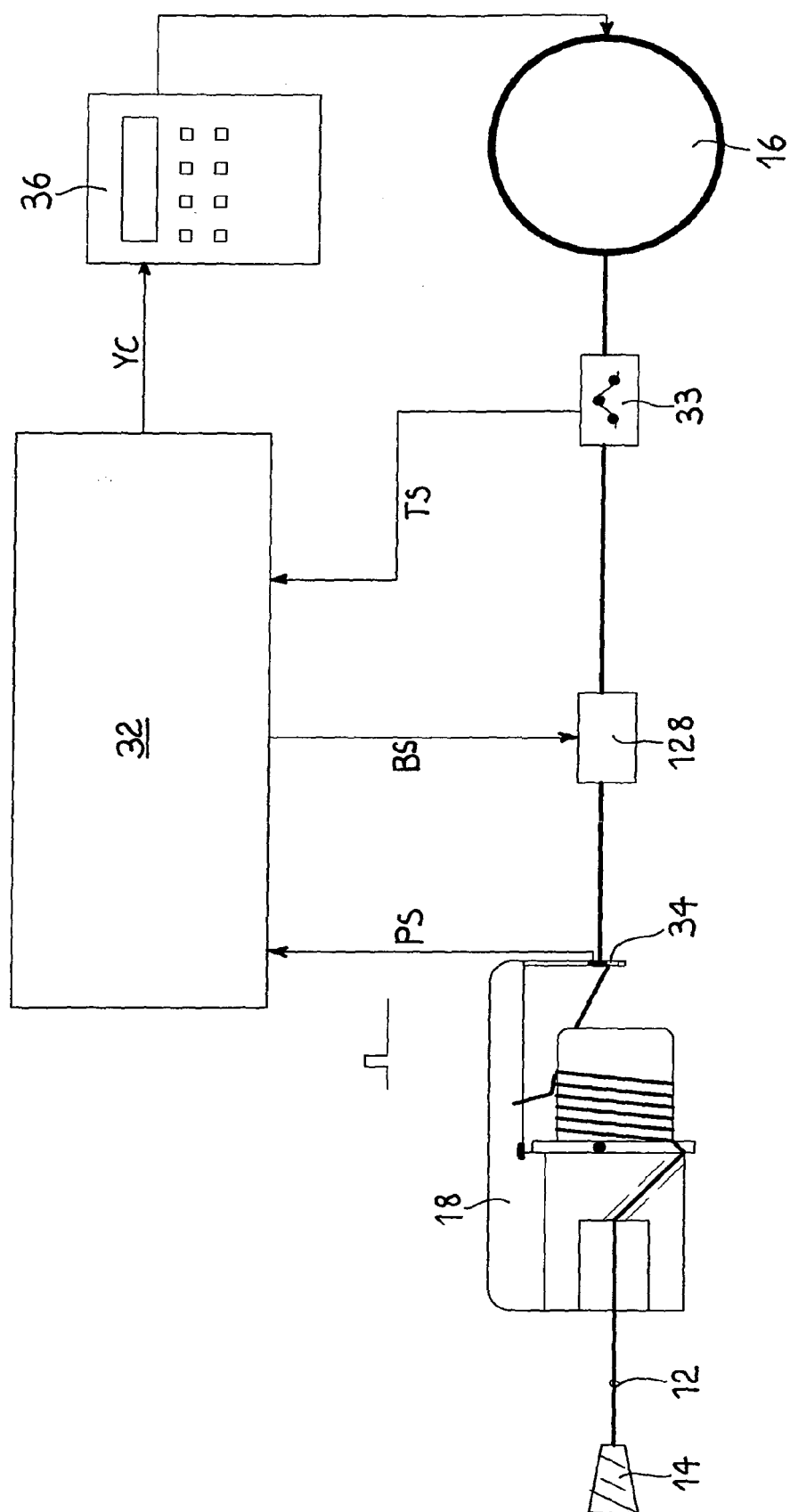


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 08 42 5726

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Place of search Munich		Date of completion of the search 23 April 2009	Examiner Pieracci, Andrea
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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