(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 613 884 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.02.2020 Bulletin 2020/09

(51) Int Cl.:
D04B 15/48 *(2006.01)*

(21) Application number: **19183859.8**

(22) Date of filing: **02.07.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **07.08.2018 IT 201800007909**

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(54) METHOD FOR MEASURING THE CONSUMPTION OF YARN FOR ACCUMULATION WEFT FEEDERS

(57) A method for measuring the consumption of yarn for accumulation weft feeders wherein a control unit (CU) of an accumulation weft feeder (10) calculates the amount of consumed yarn Cm in a time interval comprised between an instant t1 and an instant t2 on the basis of the following formula:

$$Cm = (ERQ1 - ERQ2) + IPC * C$$

where ERQ1 is the estimated reserve amount on the drum (12) of the feeder at the instant t1, ERQ2 is an estimated reserve amount that is present on the drum (12) at the instant t2, IPC is the number of winding pulses (WP) counted in the time interval between the instant t1 and the instant t2, and C is the length of the loop or fraction of loop wound on the drum. The estimated reserve amounts at the instants t1 and t2 are calculated on the basis of the number of winding pulses (WP) and of unwinding pulses (UWP), the latter being counted by an unwinding sensor (S3) and being generated from the instant when the weft reserve sensor (S2) switches its own state.

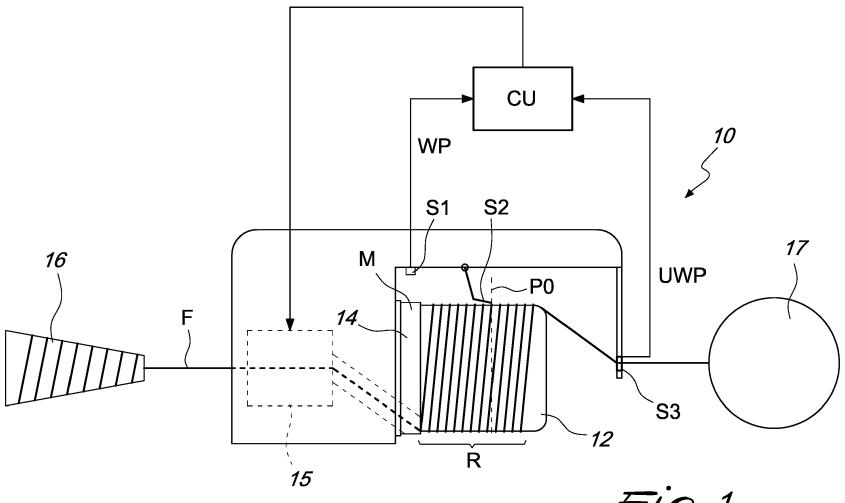

Fig. 1

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Description

[0001] The present invention relates to a method for measuring the consumption of yarn for accumulation weft feeders.

[0002] As is known, a generic textile machine can be fed with a plurality of yarns unwinding from respective weft feeders known as "accumulation weft feeders".

[0003] In general, an accumulation weft feeder comprises a drum adapted to carry a plurality of yarn loops that form a reserve and are wound thereon. The yarn, which is picked up from an upstream spool, can be wound on the drum by a motorized flywheel, or the drum itself is rotated in order to wind the yarn thereon.

[0004] For some applications, especially in the knitting sector, it can be useful to measure the consumption of yarn that the textile machine picks up from the weft feeder over a preset period of time. The period of time taken into consideration can be, for example, the one necessary for the production of the entire item in the case of machines for manufacturing hosiery items, in which the time for completing an item is on the order of one minute, or the one that corresponds to a few dozen machine rotations in the case of large-diameter machines, which are designed for productions that require longer times.

[0005] The purposes of the measurement can be different according to the applications.

[0006] In particular, on hosiery knitting machines it is necessary to verify that the amount of yarn used for each item does not deviate excessively from a nominal amount determined on a sample item. In fact, excessive deviation is a symptom of a problem in the textile machine or in the weft feeders (for example, too low or too high yarn tension, incorrect adjustment of the knitting triangles, broken needles, etc.), which can compromise the quality of the production.

[0007] On large-diameter machines, instead, yarn consumption is measured most of all to estimate the cost of the yarn for manufacturing a given article.

[0008] A known method for measuring yarn consumption provides for counting the loops that unwind from the drum in a specific period of time, based on the signal received by an unwinding sensor provided on some feeders. This unwinding sensor generates a pulse for each unwound loop or, if there are multiple sensors arranged equidistantly around the drum for a more precise measurement, for each loop fraction. By multiplying the number of pulses generated by the length of the loop (which corresponds to the circumference of the drum) or of the loop fraction, the amount of yarn picked up is obtained.

[0009] Furthermore, the system described above is not error-prone since common photocell-based unwinding sensors, as is known, sometimes can fail to detect the passage of a loop, especially when the yarn unwinds relatively slowly.

[0010] Another known method for measuring the consumption of yarn entails the counting of the loops that are wound on the drum in a given period of time on the basis of the signal received from a winding sensor, which is instead present on all accumulation weft feeders.

[0011] Winding sensors are more reliable than unwinding sensors because they do not provide for an interaction with the yarn but calculate the turns performed by the flywheel or by the drum in the winding step.

[0012] However, this method, which is based on the hypothesis that the amount of yarn wound on the drum corresponds to the amount of yarn unwound from it during the measurement interval, is inevitably less precise than the previous one, especially when the time interval considered is relatively short. In fact, if in the long term the difference between the amount of yarn wound on the drum and the unwound amount can be considered negligible, in the short term it is not so, taking into consideration also the variability of the rate of consumption of the yarn.

[0013] In this regard, as is known, the weft feeder adjusts the unwinding speed of the yarn so as to keep the reserve present on the drum as constant as possible. Therefore, if the measurement is performed while the rate of absorption of the yarn is substantially constant, it is fair to assume that the amount of weft wound on the drum is approximately equal to the amount of weft that is unwound. Conversely, in particularly critical operating conditions, with the yarn consumption rate that varies continuously during the production of the item and frequent stops/restarts of the feeder, the measurement of consumption by means of said method is anything but realistic.

[0014] The aim of the present invention is to provide a method for measuring the consumption of yarn for accumulation weft feeders that is more reliable and precise than known systems, even in particularly critical operating conditions, and can be applied also to feeders lacking a yarn unwinding sensor.

[0015] This aim and other objects which will become better apparent from the description that follows are achieved by the method having the characteristics described in claim 1, while the dependent claims define other advantageous, albeit secondary, characteristics of the invention.

[0016] The invention will be now described in greater detail, with reference to a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in Figure 1, which shows schematically an accumulation weft feeder to which the method according to the invention is applied.

[0017] With reference to Figure 1, a generic accumulation weft feeder 10 for textile machines is provided with a drum 12 and with winding means which, in the embodiment described herein, comprise a flywheel 14 turned about the axis of the drum 12 by a motor 15 in order to pick up yarn F from a spool 16 and wind it onto the drum 12 so as to form a reserve R. The yarn F unwinds from the drum 12 upon request from a generic downstream textile machine, such as a circular knitting machine 17.

[0018] The feeder 10 is conventionally provided with at least one winding sensor S1, preferably a Hall sensor, arranged to detect the passage of magnets such as M which are integral with the flywheel 14 and to generate corresponding winding pulses WP for each loop or loop fraction (depending on the number of winding sensors) that is wound onto the drum 12; with a weft reserve sensor S2, preferably a mechanical sensor, which provides a binary information regarding the presence or not of a minimum amount of reserve at an intermediate point P0 of the drum 12, switching its state when the reserve ends at said intermediate point; and with at least one unwinding sensor S3, preferably an optical sensor, which generates an unwinding pulse UWP per each loop or fraction of a loop (depending on the number of unwinding sensors) that unwinds from the drum 12.

[0019] In a per se known manner, the weft feeder 10 is provided with a control unit CU which is programmed to adjust the winding speed of the flywheel 14 on the basis of the signal received from the weft reserve sensor S2, so as to keep the amount of reserve present on the drum 12 substantially constant on a desired value.

[0020] According to the invention, the control unit CU is programmed to calculate the amount of consumed yarn Cm in a time interval comprised between an instant t1 and an instant t2 on the basis of the following formula:

$$Cm = (ERQ1 - ERQ2) + IPC * C$$

where ERQ1 is an estimated reserve amount that is present on the drum 12 at the instant t1, ERQ2 is an estimated reserve amount that is present on the drum 12 at the instant t2, IPC is the number of winding pulses WP counted in the time interval between the instant t1 and the instant t2, and C is the length of the loop wound onto the drum, or fractions of a loop where multiple winding sensors S1 are present; the estimated reserve amounts at the instants t1 and t2 being calculated on the basis of the number of winding pulses WP and of unwinding pulses UWP generated, respectively, by the winding sensor S1 and by the unwinding sensor S3 from the instant in which the weft reserve sensor S2 switches its state (i.e., when the yarn reserve that is present on the drum 12 ends at the weft reserve sensor S2 at the point P0).

[0021] For example, if a value equal to zero is assigned to the estimated reserve amount when the reserve ends exactly at the weft reserve sensor S2, it will be increased by a value equal to +1*C if a pulse is received from the winding sensor S1, +2*C if two pulses are received from the winding sensor S1, etc.. Likewise, the estimated reserve amount will be reduced by a value equal to -1*C if a pulse is received from the unwinding sensor S3, -2*C if two pulses are received from the unwinding sensor S3, etc..

[0022] Therefore, the estimated reserve amount is continuously updated during operation while the control unit CU, in a per se known manner, adjusts in real time the speed of the flywheel 14 so that the estimated reserve amount remains always close to the zero value. In practice, if at a certain moment the amount of estimated reserve has a negative value, for example, -1*C, the winding speed will be increased, whereas if it has a positive value, for example, +2*C, it will be reduced.

[0023] A preferred embodiment of the invention has been described, but obviously the person skilled in the art may provide various modifications and variations within the scope of the claims.

[0024] For example, although in the embodiment described here by way of example the yarn is wound on the drum by a rotating flywheel, obviously the solution according to the invention would be equally applicable to the case in which the drum itself is turned in order to wind the yarn thereon.

[0025] Furthermore, in the described example it has been assumed that the amount of yarn that corresponds to a winding pulse is equal to the amount of yarn that corresponds to an unwinding pulse, but of course the two amounts might be different. For example, if there is only one winding sensor and there are two unwinding sensors, each winding pulse would correspond to the passage of a complete loop, while each unwinding pulse would correspond to the passage of half of a loop.

[0026] The disclosures in Italian Patent Application No. 102018000007909 from which this application claims priority are incorporated herein by reference.

[0027] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method for measuring the consumption of yarn for an accumulation weft feeder (10), said weft feeder (10) being provided with a drum (12), with motorized winding means (14) adapted to pick up yarn (F) from a spool (16) and wind it onto the drum (12) so as to form a reserve (R), with at least one winding sensor (S1) adapted to generate a winding pulse (WP) per each loop or fraction of loop that is wound onto the drum (12), with a weft reserve sensor (S2) adapted to provide a binary information regarding the presence/absence of a minimum amount of reserve at an intermediate point (P0) of the drum (12), its state being switched when the reserve ends at said intermediate point (P0), with at least one unwinding sensor (S3) adapted to generate an unwinding pulse (UWP) per each loop or fraction of a loop that is unwound from the drum (12) upon request from a downstream textile machine (17), and with a control unit

(CU) programmed to adjust the winding speed of said winding means (14) on the basis of the signal received by said weft reserve sensor (S2), so as to keep the amount of reserve on the drum (12) substantially constant on a desired value,
characterized in that said control unit (CU) is programmed to calculate the amount of consumed yarn Cm in a time interval comprised between an instant t1 and an instant t2 on the basis of the following formula:

$$Cm = (ERQ1 - ERQ2) + IPC * C$$

where ERQ1 is an estimated reserve amount that is present on the drum (12) at the instant t1, ERQ2 is an estimated reserve amount that is present on the drum (12) at the instant t2, IPC is the number of winding pulses (WP) counted in the time interval between said instant t1 and said instant t2, and C is the length of the loop or fraction of loop wound on the drum,
said estimated reserve amounts at the instants t1 and t2 being calculated on the basis of the number of winding pulses (WP) and of unwinding pulses (UWP) generated from the instant when said weft reserve sensor (S2) switches its own state.

2. The method according to claim 1, **characterized in that** said winding means comprise a flywheel (14).

3. The method according to claim 1, **characterized in that** said winding means consist of said drum, said drum being motorized in order to rotate and wind the yarn onto itself.

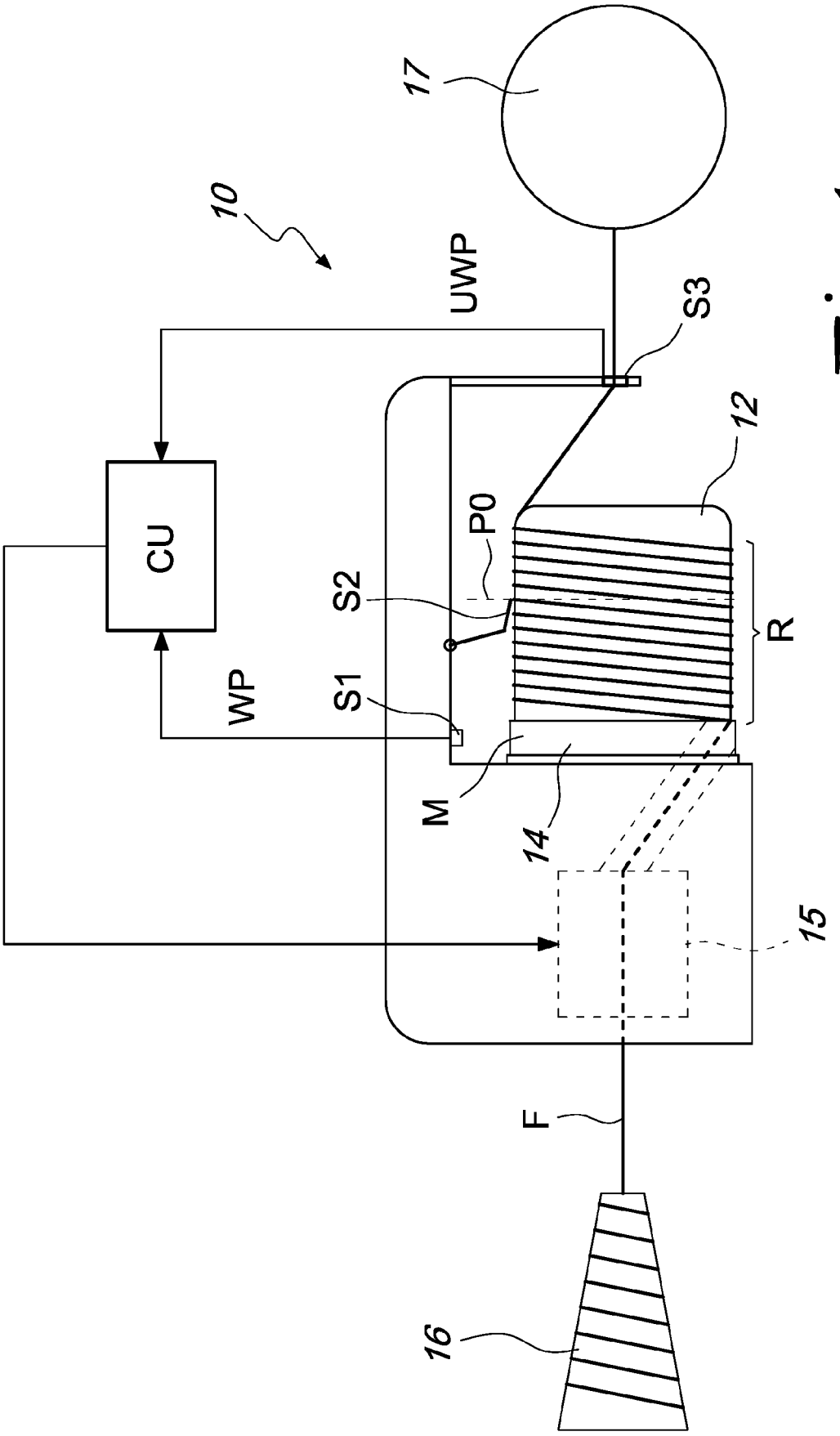

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 19 18 3859

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	EP 2 907 906 A1 (LGL ELECTRONICS SPA [IT]) 19 August 2015 (2015-08-19) * paragraphs [0011], [0015] - [0022]; claims 1, 6; figures 1-2 *	1-3	INV. D04B15/48
A	EP 2 592 032 A1 (BTSR INT SPA [IT]) 15 May 2013 (2013-05-15) * paragraphs [0010] - [0013], [0017] - [0035]; claims 1, 11; figures 1-2 *	1-3	

TECHNICAL FIELDS SEARCHED (IPC)

D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 January 2020	Sterle, Dieter

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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15-01-2020

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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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