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(54) METHOD FOR CONTROLLING THE UNWINDING OF YARN FROM A WEFT FEEDER

(57) Method for controlling the unwinding of yarn from a weft feeder wherein detection means (18) generate unwinding pulses (UWP) that indicate the release of a turn or fraction of a turn of yarn from a feeder (10); a continuous count is made of a relative operating position (NPSD_CNT) of a textile machine (16), measured from the last unwinding pulse (UWP); the amount of yarn picked up at each machine revolution (YCPR) is calculated continuously, as well as a threshold operating position (NPSD) as a function of the variation of position corresponding to a machine revolution, of a maximum length of yarn that can be inserted in the machine and can be chosen by the user, and of the amount of yarn picked up at each machine revolution; when the relative operating position (NPSD_CNT) equals or exceeds the threshold operating position (NPSD), a stop signal is generated.

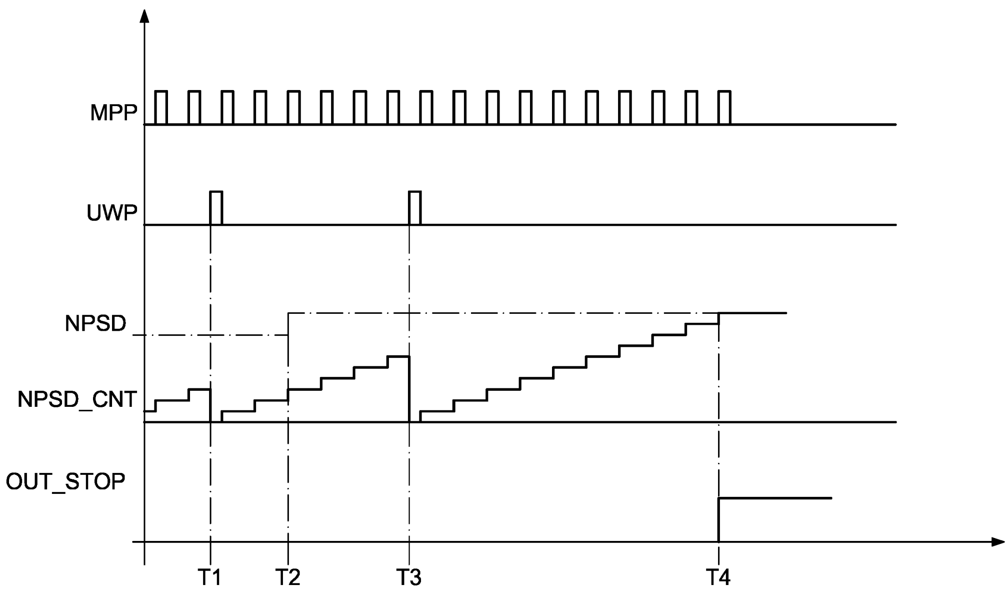

Fig. 2

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Description

[0001] The present invention relates to a method for controlling the unwinding of yarn from a weft feeder.

[0002] As is known, a textile machine, such as a circular knitting machine, can be fed by a plurality of yarns that are unreeled from respective yarn feeders.

[0003] An "accumulator" yarn feeder can generically comprise a drum onto which winding means wind a plurality of yarn turns which form a reserve. Such winding means can consist of a motorized flywheel that winds the yarn on the drum, or the drum itself can be rotated in order to wind the yarn onto it. The yarn is taken from a distaff upstream and passed on to the textile machine downstream on request from the latter.

[0004] Accumulator weft feeders make it possible to maintain the amount of reserve wound on the drum substantially constant, independently of the yarn drawing rate by the downstream machine, while at the same time controlling the output yarn tension.

[0005] In order to achieve the above mentioned objects, the feeder makes use of various sensors connected to a control unit. One such sensor, in particular, generates at least one pulse for each turn executed and can be optical, piezoelectric, or the like.

[0006] "Positive" yarn feeders are also known, in which the yarn originating from a distaff is wound onto a spool which, turned by a motor, feeds it to a textile machine downstream, e.g., a knitting machine.

[0007] In conventional systems, between the feeder and the knitting machine there is also a sensor that is adapted to detect accidental stoppages of the weft, e.g., in the event of breakage of the yarn or of loss of the yarn by the needles of the machine. In such case, the control unit orders the machine to stop so as to prevent defects in the finished garment, or the complete separation of the hose of the garment being made.

[0008] As is known, such yarn breakage sensors can be mechanical or electronic.

[0009] Mechanical sensors have the advantage that they are cheaper, but they do not perform as well in terms of response times. Furthermore, in operation, such sensors brush against the weft with a lever, disturbing the tension of the yarn and as a consequence compromising the precision of the system for controlling the tension.

[0010] Electronic sensors have the advantage that they perform better in terms of response time and in operation they do not interfere with the yarn tension during unwinding, in that they detect the movement of the weft by way of a photoelectric sensor. However, such electronic sensors are relatively expensive and require the installation and wiring of an additional power supply and communication circuit, with further increase of the costs and of the complexity of the detection assembly.

[0011] EP2270269B1 of this same Applicant describes a method of detecting the stoppage of the yarn unwinding from an accumulation weft feeder, which overcomes the drawbacks of the systems that use yarn breakage sensors like the ones mentioned above.

[0012] According to EP2270269B1, a threshold interval is continuously calculated which corresponds to the maximum time interval between two successive pulses beyond which it must be assumed that an accidental stoppage of the weft has occurred. Such threshold interval is updated in real time as a function of the yarn pickup speed. Therefore, the delay since the last pulse received is measured continuously and is compared with the updated threshold interval, so as to stop the machine if the measured delay exceeds the updated threshold interval.

[0013] The above system preferably has an initial calibration step in which an average yarn unwinding time is determined.

[0014] As is well known to the person skilled in the art, such calibration step is not welcome because it keeps personnel occupied and further, in this step, controlling the unwinding of the yarn is disabled since the system needs to acquire the basic data for its subsequent good operation.

[0015] Furthermore, the system in EP2270269B1 requires a speed signal of the machine in order to update the threshold interval in real time, and in some cases this may not be available.

[0016] EP2857567A1 discloses a method that entails monitoring the clock pulses generated by the knitting machine and representing a preset length of weft inserted, and stopping the machine if a preset maximum number of clock impulses elapse since the last turn was unwound.

[0017] The main drawback of this method is that, once the process is set up and begun, both the length of weft representing the inserted length and the maximum number of pulses are fixed, and they do not adapt automatically to the actual consumption of yarn of the various feeder devices involved in the textile process. As is well known to the person skilled in the art, such drawback is particularly relevant in Jacquard applications that use many accumulation feeders, where the consumption of yarn fluctuates greatly between one feeder and the next.

[0018] This method has the further drawback of requiring an interface in order to adapt the origin signal to the consumption signal of the feeder devices.

[0019] Therefore, the main aim of the present invention is to provide a method for controlling the unwinding of yarn from a weft feeder that, while retaining the advantages of the known system described in EP2270269B1, does not require an initial calibration step and does not require the presence of a speed signal of the downstream machine, and further is capable of adapting automatically to the actual consumption of yarn of the various feeder devices involved in the textile process.

[0020] The above aim and other advantages, which will become better apparent hereinafter, are achieved by the method having the characteristics recited in claim 1, while the dependent claims define other characteristics of the invention which are advantageous, although secondary.

[0021] Now the invention will be described in more detail with reference to a preferred but not exclusive embodiment thereof, which is illustrated for the purposes of non-limiting example in the accompanying drawings, wherein:

Figure 1 schematically illustrates a yarn feeder apparatus in which the method according to the invention can be used;
Figure 2 is a diagram showing sequences of signals generated over time with the method according to the invention.

[0022] With reference to Figure 1, a weft feeder 10 comprises a drum 12 onto which a motorized flywheel 14 winds yarn F in the form of turns that constitute a reserve. The yarn F, which originates from a distaff 15, is unwound from the drum 12 on request of a machine 16 downstream, e.g., a knitting machine.

[0023] In a way that is known per se, an unwinding sensor 18, typically an optical sensor, generates an unwinding pulse UWP for each turn or fraction of a turn of yarn unwound from the drum.

[0024] Downstream of the weft feeder 10 is a weft braking device 20, which is controlled by a control unit CU. The control unit CU is programmed to stabilize the yarn tension during unwinding from the drum 12 by retroactively controlling the weft braking device 20 on the basis of the signal generated by a tension sensor 22 associated with the yarn being unwound.

[0025] In a manner that is conventional, the control unit CU of the feeder is connected to the machine 16 by way of a BUS 30 for the mutual exchange of information such as alarms, statuses and setting of parameters.

[0026] In particular, the machine 16 generates an incremental signal that indicates its operating position. In the embodiment described herein for the purposes of example, the operating position of the machine is provided by a sequence of position pulses MPP which are generated during the rotation of the machine (Figure 2) and transmitted on the BUS 30. Once the variation of position of the machine corresponding to a machine revolution is known, in this case given by the number of position pulses generated for each turn NPPR, each position pulse MPP will correspond to an exact operating position.

[0027] The position pulses MPP can be generated by the controller of the machine 16 or obtained directly from the signals of an encoder which, usually, is associated with the machine.

[0028] In order to detect any accidental stoppages of the weft, e.g. caused by the breakage of the yarn or the loss of the yarn by some of the needles of the machine, the apparatus described above adopts a method that, according to the invention, comprises the following steps:

- continuously counting a relative operating position NPSD CNT of the machine 16, measured from the last unwinding pulse UWP generated,
- continuously calculating the amount of yarn picked up at each machine revolution YCPR on the basis of the number of unwinding pulses UWP generated,
- continuously calculating a threshold operating position NPSD on the basis of the formula

$$NPSD = NPPR \times YLME/YCPR,$$

where YLME is a maximum length of yarn that can be inserted in the machine and can be set by the user, and
- generating a stop signal when the relative operating position NPSD_CNT equals or exceeds the threshold operating position NPSD.

[0029] In the example described herein and shown in Figure 2, where the position of the machine is an incremental value derived from a series of impulse signals, the threshold operating position NPSD corresponds to a maximum number of position pulses.

[0030] Figure 2 shows that the relative operating position NPSD_CNT is reset whenever an unwinding pulse UWP is generated, at the times T1 and T3. Furthermore, note that the value of NSPD can change dynamically during the operation, such as at time T2 where it increases from 8 to 10 following a variation in yarn consumption.

[0031] Once a number of pulses equal to NPSD since the last unwinding pulse UWP generated (at time T3) has elapsed, the machine stop signal is generated (at time T4), because the weft has presumably stopped running.

[0032] Obviously, all the above measuring and calculation operations are executed by the control unit CU on the basis of the impulse signals received from the unwinding sensor 18 and from the machine 16. The programming of the control unit comes under the normal knowledge of the person skilled in the art and therefore will not be described further.

[0033] The maximum length of yarn that can be inserted in the machine YLME is a value that can be set according to requirements. In particular, a value can be chosen that balances shorter response time (lower YLME values) with lower risk of false stoppages (higher YLME values). For the purposes of example, values can be chosen comprised between 35 and 40 cm in order to maximize response times, or comprised between 60 and 70 cm in order to reduce the risks of false stoppages.

[0034] It is clear that this method can be applied to "positive" yarn feeders fitted with a motorized weft-winding spool, using as unwinding pulses the pulses originating, e.g., from Hall sensors conventionally provided in order to detect the position of the spool.

[0035] A preferred embodiment of the invention has been described, but obviously the person skilled in the art may make various modifications and variations within the scope of the appended claims.

[0036] In particular, although in the embodiment described the position of the machine is an incremental value derived from a series of impulse signals, such value could be derived differently, e.g. from a resolver.

[0037] The disclosures in Italian Patent Application No. 102016000074062 (UA2016A005219) from which this application claims priority are incorporated herein by reference.

[0038] 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 controlling the unwinding of yarn from a weft feeder, said feeder (10) being provided with detection means (18) adapted to generate unwinding pulses (UWP) that indicate the release of a turn or fraction of a turn of yarn, said machine (16) continuously providing information that indicates its operating position, **characterized in that** it comprises the following steps:

   - continuously counting a relative operating position (NPSD_CNT) of said machine (16), measured from the last unwinding pulse (UWP) generated,
   - continuously calculating the amount of yarn picked up at each machine revolution (YCPR) on the basis of the number of unwinding pulses (UWP) generated,
   - continuously calculating a threshold operating position (NPSD) that can vary dynamically during operation on the basis of the formula

   $$NPSD = NPPR \times YLME/YCPR,$$

   where NPSD is said threshold operating position, NPPR is the variation of position that corresponds to a machine revolution, YLME is a maximum length of yarn that can be inserted in the machine and can be set by the user, and YCPR is the amount of yarn picked up at each machine revolution,
   - generating a stop signal when said relative operating position (NPSD_CNT) equals or exceeds said threshold operating position (NPSD).

2. The method according to claim 1, **characterized in that** said relative operating position (NPSD_CNT) is derived from a sequence of position pulses (MPP) generated during the rotation of the machine, said position variation corresponding to a revolution (NPPR) is equal to the number of position pulses (MPP) generated at each machine revolution, and said threshold operating position (NPSD) corresponds to a maximum number of position pulses.

3. The method according to claim 1 or 2, **characterized in that** said maximum length of yarn that can be inserted in the machine (YLME) is comprised between 15 and 90 cm.

4. The method according to claim 3, **characterized in that** said maximum length of yarn that can be inserted in the machine (YLME) is comprised between 35 and 70 cm.

5. The method according to one of claims 1-4, wherein said feeder (10) is provided with a drum (12) that is adapted to carry a stock of turns of yarn wound thereon which are adapted to be unwound on request of said machine (16), **characterized in that** said detection means comprise at least one sensor (18) that is adapted to generate an unwinding pulse (UWP) at each turn or fraction of a turn unwound from the drum.

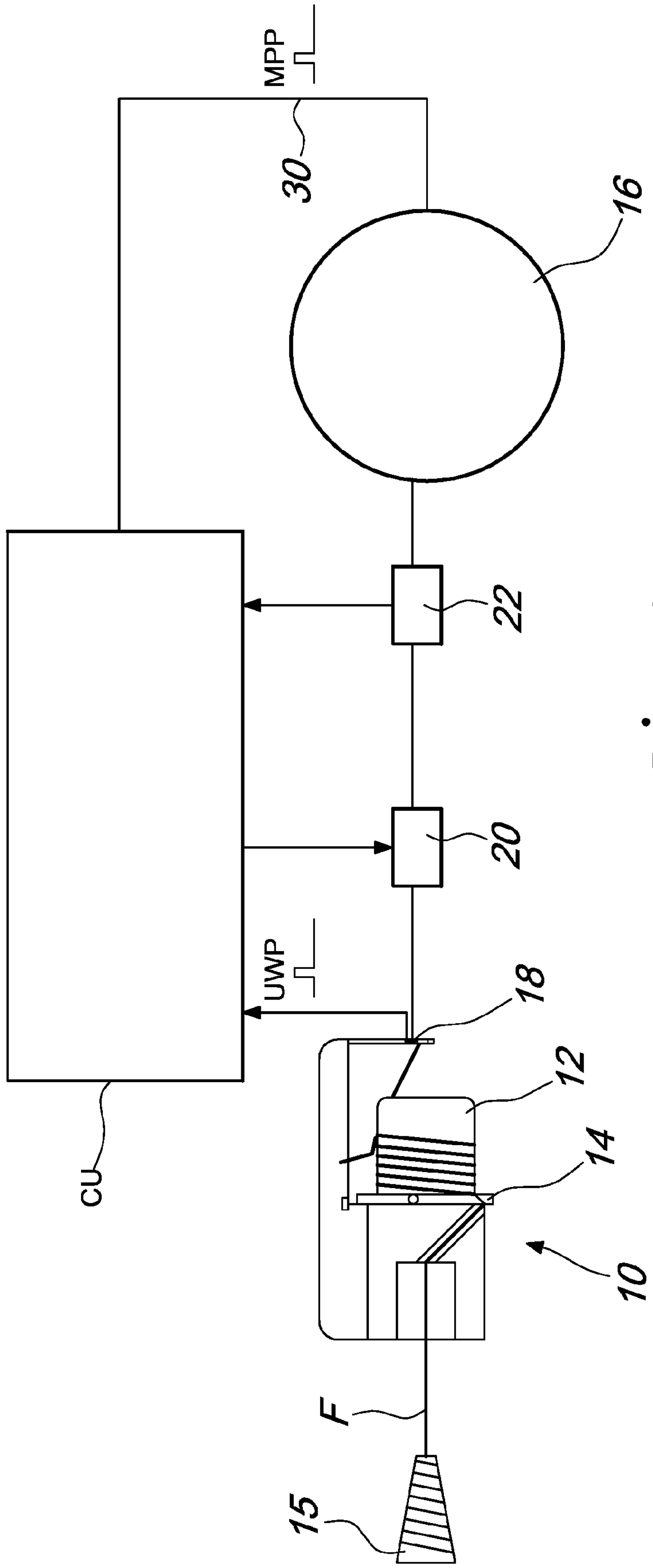

Fig. 1

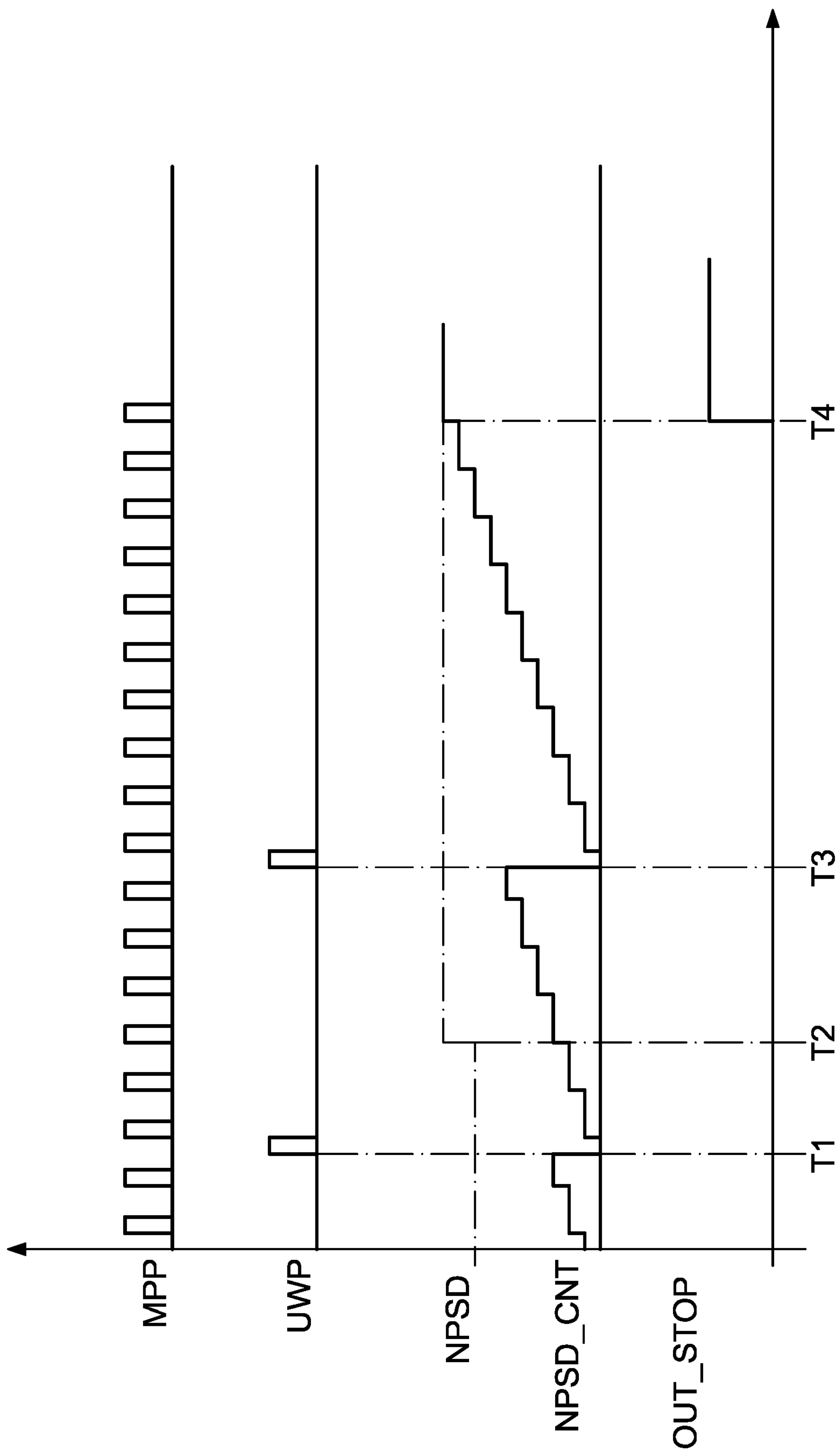

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 17 17 8574

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	30 August 2017	Braun, Stefanie

CATEGORY OF CITED DOCUMENTS

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

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