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(54) **Method for monitoring weft insertion in feeders of jet looms with fed thread pre-measuring unit**

Verfahren zur Funktionsüberwachung von Schussfadeneintrag in Fadenliefervorrichtungen von
Düsenwebmaschinen mit Fadenmesseinheit

Procédé pour la surveillance de l'insertion de la trame dans les fournisseurs de métiers à tisser à jet
avec unité de mesure de fil

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Description

[0001] The present invention relates to a method for monitoring weft insertion in feeders of jet looms with fed thread pre-measuring unit.

[0002] Weft pre-measuring units are known and widely used in the field of jet weaving (air- or water-jet looms) which, inserted between the spool and the loom, have the specific task of feeding a preset length of thread, for each weft insertion, by releasing it from a weft reserve accumulated on the drum of the unit in the form of turns wound onto the drum and to also replace the released weft by winding onto the drum a corresponding amount of thread, so as to keep the weft reserve substantially unchanged (see e.g. WO-A 87 04151).

[0003] As it will become better apparent from the detailed description that follows, a conventional system for feeding jet looms with a unit for pre-measuring the fed thread at each weft insertion uses a weft feeder and pre-measuring unit which comprises: a fixed drum, on which a windmilling arm winds the turns of thread that form the weft reserve; a weft retention finger for stopping the thread, which is associated with the fixed drum and is actuated electromagnetically in order to release the thread, allowing it to unwind from the drum, and to stop its unwinding when the pre-measured amount is reached; means for counting the turns of thread released at each weft insertion; means for counting the turns wound back onto the drum of the unit in order to restore the weft reserve; and a control microprocessor which receives a weft release signal from the loom and supervises the actuation of the weft retention finger, the counting of the unwound turns and the actuation of the motor that drives the windmilling arm that winds back the turns, restoring the weft reserve.

[0004] In particular, in order to keep the weft reserve substantially invariant over time, the microprocessor processes the pulsed signals generated by a first optical sensor which detects the passage of the turns that unwind from the drum and, respectively, by a second magnetic sensor which provides one pulse at each turn of the windmilling arm that winds a corresponding turn onto the drum of the unit. For this purpose, the microprocessor compares the number of pulses of the signals generated by the first and second sensors and actuates accordingly the motor of the windmilling arm, making the number of pulses match so as to keep unchanged the weft reserve that is present on the drum of the feeder and pre-measuring unit.

[0005] Correct control of the reserve by the above specified conventional system is ensured so long as the first and second sensors both provide the microprocessor with corresponding correct signals, but there are particular operating conditions in which this does not occur. In such cases, the conventional system is no longer capable of ensuring correct replenishment of the weft reserve.

[0006] A typical condition in which the conventional

system loses control of weft reserve replenishment occurs when, for any reason, one or more turns are unwound from the drum of the feeder and pre-measuring unit at an excessively low travel speed, hereinafter termed insertion speed. In this case, the circuit for detecting and amplifying the signal of the optical sensor designed to detect the turns that unwind from the drum (which is also described in detail hereinafter) can in fact eliminate the signal by interpreting it as noise and accordingly filtering it out by means of a high-pass filter. The filter is provided in order to eliminate light variations that are much slower than those caused by the rapid passage of the thread and are noise-related, such as for example variations in external light, the passage of grains of dust, vibrations of light reflected on the sensor caused by the operation of the unit, and the like.

[0007] Many circumstances can make the insertion speed too low: for example, during normal insertion the weft can become entangled in the warp, or in the comb of the loom (if it is too dirty), and thus undergo sudden deceleration although the carrier fluid is fed at the maximum flow-rate. Likewise, during manual release of the weft the thread retained in the nozzle of the loom is propelled by a reduced flow, known as holding flow, at a pressure which is much lower than the normal weft release pressure: in this case also, the speed of the thread is reduced considerably.

[0008] It is therefore evident that when one or more turns are unwound at an excessively low insertion speed, since the corresponding pulses produced by the optical sensor are no longer provided because the sensor does not effectively detect the passage of the turns, the feeder and measuring unit is depleted by a corresponding amount of reserve without restoring it, and can thus reach a condition in which it is completely empty, or at least a condition in which the presence of reserve is insufficient, forcing to stop the weaving process at least temporarily in order to manually start the reserve replenishment procedure.

[0009] The aim of the present invention is to eliminate this severe drawback.

[0010] Within this aim, an object of the present invention is to provide a method for monitoring weft insertion which is adapted to eliminate, or at least minimize, the possibility of depleting the weft reserve on the drum of the feeder and pre-measuring unit in any of the circumstances that can cause suppression of the signal of the sensor designed to detect the passage of the turns being unwound.

[0011] Another important object of the present invention is to provide a monitoring method which is highly reliable and in particular is independent of the variation of several parameters of the weaving process, such as in particular the nature and count of the weft thread, the structure and operating speed of the loom, and the length of the thread required for each weft insertion.

[0012] According to the present invention, this aim, these important objects and others which will become

apparent from the following detailed description are achieved with a weft insertion monitoring method which has the specific characteristics stated in the appended claims.

[0013] Substantially, the method according to the invention is based on the statistical prediction that every insertion request that arrives at the control and supervisor microprocessor is usually performed correctly regardless of whether the unwinding turn detection sensor has seen and reported or not the passage of all the turns to be inserted. In this manner, if the passage of a turn is not detected after a preset interval of time since the last pulse generated by the passage of a turn, or since the last insertion request, this failed detection is taken to mean that the requested turns have been inserted.

[0014] In practice, the method according to the invention, based on this prediction, consists in programming the microprocessor so that it generates, upon an external command, respective interrupts upon variation in the signals produced by the turn winding and unwinding sensors and upon variation in the weft request signal produced by the loom; in assigning the routines of the interrupts of the signals of said sensors the task of decreasing and, respectively, incrementing the counters of the number of turns wound onto, and respectively unwound from, the drum of the unit, and of setting a timer to a value which is equal to the maximum time that elapses between the passage of one turn and the next; and in giving the routine of the weft request signal the task of ascertaining that the number of turns inserted as a consequence of the directly preceding request exceeds a preset minimum threshold and the task of compensating for any missing turns by subtracting them from the turns that are present on the feeder drum; said microprocessor being also adapted to generate a periodic internal interrupt whose routine has the task of checking whether the setting of the timer has expired or not in the interval between two turns, in order to compensate for said turns and set the number of released turns equal to the number of turns to be released, thereby indicating the end of the insertion.

[0015] The characteristics, purposes and advantages of the weft insertion monitoring method according to the present invention will become apparent from the following detailed description and with reference to the accompanying drawings, given by way of non-limitative example, wherein:

Figure 1 is a block diagram of a conventional system for feeding and pre-measuring the weft for jet looms;

Figure 2 is a circuit diagram of the circuit associated with the optical sensor for detecting the turns being unwound;

Figures 3a-3b-3c-3d are flowcharts of the routines of the various interrupts generated by the supervisor microprocessor;

Figures 4 and 5 are time charts of the signals that

reach the supervisor microprocessor in case of correct and, respectively, irregular operation.

[0016] With reference to Figure 1, SI generally designates a conventional system for feeding a weft thread F to a jet loom TE with pre-measurement of the thread fed at each insertion and unwound from a spool RO.

[0017] The system SI uses, for this purpose, a weft feeder and pre-measuring unit, generally designated by the reference letter P, which comprises a fixed drum TA on which a windmilling arm BR, associated with a flywheel VO and actuated by a motor MO, winds a plurality of turns of thread which form a weft reserve RT. A weft retention finger DI for stopping the thread F is associated with the drum TA of the feeder and is actuated by an electromagnetic actuator AE in order to release the thread, allowing it to unwind from the drum TA, and to stop its unwinding when the pre-measured amount or length is reached. A microprocessor μP , designed to supervise the entire system SI, generates an output CE for controlling the electromagnet of the weft retention finger DI and another set of three outputs a, b, c for controlling the motor MO by means of a power interface (driver) MPD.

[0018] A first optical sensor UWP, located at the output of the drum TA, is provided in order to count the turns that unwind from the drum and sends to the microprocessor μP its pulsed signals UWSP, processed beforehand in an amplification and filtration circuit CAF.

[0019] A second magnetic sensor H provides the microprocessor μP with a pulse WSP at each rotation of the windmilling arm BR that winds a corresponding turn onto the drum TA, said magnetic sensor detecting the passage of a magnet M which is carried by the flywheel VO associated with the arm BR.

[0020] The circuit CAF for amplifying and filtering the signal produced by the optical sensor UWP is now described with reference to Figure 2.

[0021] Said sensor comprises an emitter diode LE and a receiver phototransistor FT, which produces, across its terminals, a weak current IR which is proportional to the amount of light received by reflection from a mirror, or the like, located on the drum TA of the unit P and which is struck by the light emitted by the diode LE. The current fed to the emitter diode is adjusted by an appropriate control circuit CRC which is designed to keep the current substantially constant. The weft thread F that unwinds from the drum intersects the beam of light that is incident on the mirror and reflected by it, causing an instantaneous decrease in the current IR emitted by the phototransistor. The current signal IR is amplified in an amplifier A1 at the output of which there is a corresponding signal S2 which is amplified in terms of voltage. In order to make the signal independent of noise caused by external light and/or other accidental factors which cause much slower variations than those produced by the passage of the turns of thread, the signal S2 is filtered in a high-pass filter A2 and the signal S3

that is present at the output of said filter is applied to a comparator A3, so that when signal S3 exceeds the reference threshold RF the positive pulse of the signal UWSP is produced. Otherwise, i.e., when $S3 < RF$, the pulse of the signal UWSP is suppressed.

[0022] The microprocessor μP also receives the weft release request signal TR generated by the loom TE. When the microprocessor receives the request signal TR, it immediately energizes the actuator AE, which lifts the weft retention finger DI, allowing the unwinding of the turns of the weft reserve RT. At the same time, the loom TE, for example of the air-jet type, actuates the jets of the main nozzles and of the relay nozzles and inserts the weft in the shed. During weft insertion, the microprocessor, by means of the signals UWSP, is kept informed on the number of turns unwound from the drum TA of the pre-measuring unit P and when the requested number of turns has been reached it actuates the actuator AE with reversed polarity, causing the lowering of the weft retention finger DI and stopping the unwinding of the thread.

[0023] At the same time, the microprocessor μP actuates the motor MO in order to replenish the turns of thread taken from the weft reserve RT, and at each wound turn it receives from the sensor H a corresponding signal WSP. In order to keep the weft reserve RT substantially invariant over time, the microprocessor compares the number of pulses of the signal UWSP with the number of pulses of the signal WSP and makes the number of the pulses substantially match. However, if one or more pulses of the signal UWSP are suppressed because $S3 < RF$ due to one of the above noted reasons, the microprocessor loses control of reserve replenishment, and the reserve can become fully depleted, stopping the weaving process.

[0024] In order to avoid this drawback, the present invention provides an insertion monitoring method which is independent of any checking of the match between the pulses of the signals WSP and UWSP and introduces the concept of the resetting, or lack thereof, of a counter within a preset time limit (timeout) elapsing from the passage of the last turn or from the actuation of the weft release request signal.

[0025] In practice, with the method according to the present invention the microprocessor μP is programmed so as to generate (Figures 4 and 5), upon a command which originates externally, respective interrupts upon a variation (a negative one in the example of Figures 4 and 5) of the signals UWSP and WSP produced by the turn unwinding and rewinding sensors and upon a variation (a positive one in the example) of the weft request signal TR generated by the loom TE, and so as to internally generate a periodic control interrupt.

[0026] With reference now to the flowcharts of Figures 3a, 3b, 3c and 3d, the parameters used in the various routines that the microprocessor performs for the various interrupts are defined hereafter:

- NS = number of turns present and wound on the drum TA of the feeder and pre-measuring unit P;
- NSI = number of turns required for the current insertion;
- 5 -- NSP = number of turns released during the current insertion;
- TMRO = setting of a timer which corresponds to a preset time (timeout) elapsing from the passage of the last turn or from the actuation front of the weft release signal TR;
- 10 -- FI = coefficient ($1 \leq FI \leq 0$) for evaluating whether the turns that are missing to complete the current insertion for should be compensated for or not.

15 **[0027]** Using the above notations, the following interrupts are detected:

- interrupt in the signal UWSP (Figure 3a): the microprocessor starts a routine which has the following tasks:

- a) decrease the counter of the number of turns wound on the drum TA, setting $NS = NS - 1$, and correspondingly increment the counter of the number of turns released by the drum, setting $NSP = NSP + 1$;
- b) setting the timer TMRO to the value equal to the maximum time that elapses between the passage of one turn and the passage of the next, said time being chosen greater than 2-3 times the average turn unwinding time (in the illustrated example, $TMRO = 30$ ms);

- interrupt of the signal WSP (Figure 3b): the microprocessor performs a routine whose sole purpose is to increment by one unit the number NS of the turns present on the drum; said signal in fact means that one turn has been wound onto the drum, and therefore the microprocessor sets $NS = NS + 1$;
- 40 -- interrupt of the weft release signal RA (Figure 3c): the microprocessor performs a routine which has the following tasks:

- a) check whether the turns inserted in the directly preceding insertion exceed the maximum required threshold, verifying the inequality $NSP \geq NSI.FI$;
- b) if the result is positive, compensate for the turns that are missing for completion of insertion ($NSI - NSP$), subtracting said missing turns from the number of turns NS that are present on the drum TA;
- c) reset the counter for the turns NSP being released;
- d) set the timer TMRO;

- periodic interrupt (Figure 3d): the microprocessor performs a routine by means of which:

a) it first of all checks the turn timeout condition, verifying the equality $TMRO = 0$. If this equality holds:

b) the thread compensation condition expressed by the inequality $NSP \geq NSP.FI$ is verified;

c) if this inequality also holds, the microprocessor compensates for the turns by setting NSP equal to NSI and this indicates the end of insertion.

[0028] If instead $TMRO \neq 0$, it is decreased.

[0029] The above described periodic interrupt is executed with a preset and constant frequency, for example equal to 1 ms.

[0030] The chart of Figure 4 plots the behavior over time of the variables involved in the monitoring method according to the present invention. Said chart is self-explanatory for the technician in the field and relates to an insertion of five turns $NSI = 5$ which occurs correctly without suppression of pulses of the sensor UWP. The chart of Figure 5, similar to the chart of Figure 4, instead illustrates an incorrect insertion in which although for example $NSI = 5$ and $FI = 0.6$, the pulses produced by the sensor UWP are only four. In this case, after the fourth pulse the timeout condition occurs, i.e., $TMRO=0$, so that the periodic interrupt, by positively verifying the condition

$$NSP(=4) > NSI(=5) \cdot FI(=0.6)(=3),$$

compensates for NS and NSP .

[0031] Without altering the principle of the invention, the details of execution and the embodiments may of course be varied extensively, with respect to what has been described and illustrated by way of non-limitative example, without thereby abandoning the scope of the invention.

[0032] 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 scope of each element identified by way of example by such reference signs.

Claims

1. A weft insertion monitoring method in systems (SI) for feeding looms (TE) of the jet type with a thread pre-measuring unit (P) which comprises a drum (TA) for accommodating a weft reserve (RT), a weft retention finger (DI), a windmilling arm (BR) for winding turns for replenishing the weft reserve, a first optical sensor (UWP) for detecting the turns of thread that unwind from the drum, a second mag-

netic sensor (H) for detecting the number of turns of the windmilling arm and a supervisor microprocessor (μP) which controls the weft retention finger (DI) and the motor (MO) of the windmilling arm (BR) and receives in input a weft request signal (TR) generated by the loom (TE) and first and second pulsed signals (UWSP-WSP) generated by said first and second sensors, which it compares, actuating the windmilling arm (BR) so as to make the number of pulses of said first and second signals match in order to keep the weft reserve (RT) substantially invariant; **characterized in that** it comprises the steps of determining, when said first signal (UWSP) is missing one or more pulses with respect to the number of turns of the weft request (TR), a maximum time (TMRO) after which the microprocessor (μP), if no further pulses (UWSP) from said first optical sensor (UWP) occur, completes the release of the turns to be inserted ($NSI-NSP$) and/or the compensation of the turns (NS) that are present on said drum (TA) of the pre-measurer (P).

2. The monitoring method according to claim 1, **characterized in that** said maximum time (TMRO) is measured starting from the last pulse of the signal (UWSP) of said second optical sensor (UWP) or from the actuation front of the weft request signal (TR).

3. The monitoring method according to claim 1, **characterized in that** said maximum time (TMRO) is 2-3 times longer than the average turn unwinding time.

4. The monitoring method according to claim 1, **characterized in that** it comprises the steps of:

- programming said microprocessor (μP) so that it generates, under the external control of the signals (UWSP-WSP) of said first and second sensors (UWP-H) and of the weft request signal (TR) of the loom (TE), respective interrupts which occur upon a preselected variation of said signals; said microprocessor being also adapted to generate, by virtue of an internal command, an additional periodic interrupt;
- assigning to the routines of the signals of said first sensor (UWP) the task of decreasing ($NS-1$) the counter of the number of turns (NS) wound onto the drum of the feeder (P) and respectively of incrementing ($NSP+1$) the counter of the number of turns (NSP) unwound from said drum, and of setting a timer to said maximum time (TMRO) that is assumed to elapse between the passage of one turn and the passage of the next;
- assigning the routines of the weft request interrupt (TR) the task of checking whether the number of turns (NSP) inserted as a conse-

quence of the directly preceding request exceeds or not a preset minimum threshold ($NSP \geq NSI.FI$) and the task of compensating for any missing turns, subtracting them from the ones present on the drum ($NS - (NSI-NSP)$), starting the insertion of the turns ($NSP=0$), setting the timer to said maximum time (TMRO);

- assigning the routine of said periodic interrupt the task of verifying whether the setting (TMRO) of the timer has expired or not during the interval between two turns in order to compensate for said turns and set the number of released turns equal to the number of turns to be released ($NSP=NSI$), thus indicating the end of the insertion.

5. The monitoring method according to claim 4, **characterized in that** the coefficient (FI) that determines said minimum preset threshold ($NSI.FI$) is changed automatically by the microprocessor (μP) according to the type of insertion requested.

6. The monitoring method according to claim 4, wherein the interrupts generated by said first and second signals (UWSP-UWP) are produced at the negative variation of the pulses of said signals.

7. The monitoring method according to the preceding claims, wherein said internal interrupt is executed with a perfectly periodic frequency.

8. The monitoring method according to claim 6, **characterized in that** said periodic frequency is chosen equal to 1 ms.

Patentansprüche

1. Verfahren zur Funktionsüberwachung des Schussfadeneintrags bei Systemen (SI) für die Fadenzuführung bei Webstühlen (TE) in Düsenbauweise mit einer Einheit (P) zur Vorabmessung des Fadens, welche eine Trommel (TA) zur Aufnahme einer Schussfadenreserve (RT), einen Schussfaden-Haltefinger (DI), einen sich in der Luftströmung drehenden Arm (BR) zum Aufwinden von Wicklungen zum Auffüllen der Schussfadenreserve, einen ersten optischen Sensor (UWP) zum Erfassen der Fadenwicklungen, die von der Trommel ablaufen, einen zweiten magnetischen Sensor (H) zum Erfassen der Anzahl von Wicklungen auf dem sich in der Luftströmung drehenden Arm und einen Mikroprozessor (μP) zur Überwachung aufweist, welcher den Schussfaden-Haltefinger (DI) und den Motor (MO) des sich in der Luftströmung drehenden Arms (BR) steuert und als Eingang ein Schussfaden-Anforderungssignal (TR) erhält, das vom Webstuhl (TE) erzeugt wird, sowie erste und zweite impuls-

förmige Signale (UWSP-WSP), die von dem ersten und dem zweiten Sensor erzeugt werden, welche sie vergleicht, wobei der sich in der Luftströmung drehende Arm (BR) so betätigt wird, dass die Anzahl der Impulse des ersten Signals auf die des zweiten Signals abgestimmt wird, um so die Schussfadenreserve (RT) im Wesentlichen unveränderlich zu halten, **dadurch gekennzeichnet, dass** es die folgenden Schritte umfasst: dann, wenn bei dem ersten Signal (UWSP) ein oder mehrere Impulse bezüglich der Anzahl der Wicklungen bei der Schussfadenanforderung (TR) fehlen, Festlegen einer maximalen Zeit (TMRO), nach welcher der Mikroprozessor (μP) die Freigabe der einzufügenden Wicklungen ($NSI-NSP$) und/oder den Ausgleich der Wicklungen (NS), die auf der Trommel (TA) vorhanden sind, bei der Vorabmesseinrichtung (P) vornimmt, sofern keine weiteren Impulse (UWSP) von dem ersten optischen Sensor (UWP) vorliegen.

2. Überwachungsverfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die maximale Zeit (TMRO) ab Beginn des letzten Impulses des Signals (UWSP) des zweiten optischen Sensors (UWP) oder ab der Betätigungsflanke des Schussfaden-Anforderungssignals (TR) gemessen wird.

3. Überwachungsverfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die maximale Zeit (TMRO) zwei- bis dreimal länger als die mittlere Zeit zum Abwickeln von Wicklungen ist.

4. Überwachungsverfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** es die folgenden Schritte umfasst:

- Programmieren des Mikroprozessors (μP) in der Weise, dass er unter der Ansteuerung von außen mit den Signalen (UWSP-WSP) von dem ersten und zweiten Sensor (UWP-H) und mit dem Schussfaden-Anforderungssignal (TR) des Webstuhls (TE) jeweilige Unterbrechungen erzeugt, die nach einer zuvor ausgewählten Veränderung der Signale auftreten, wobei der Mikroprozessor auch so ausgelegt ist, dass er aufgrund eines internen Befehls eine zusätzliche periodische Unterbrechung erzeugt;
- Zuweisung der Aufgabe, den Zählerstand für die Anzahl der auf die Trommel der Zuführvorrichtung (P) aufgewundenen Wicklungen zu verringern ($NS-1$) bzw. den Zählerstand für die Anzahl der von der Trommel abgewickelten Wicklungen (NSP) zu erhöhen ($NSP+1$) und eine Zeitschaltung auf die maximale Zeit (TMRO) einzustellen, die voraussichtlich zwischen dem

- Durchlauf mit einer Wicklung und dem Durchlauf der nächsten verstreicht, zu den Routinen für die Signale des ersten Sensors (UWP);
- Zuweisung der Aufgabe, zu überprüfen, ob die Anzahl der infolge einer direkt vorangegangenen Anforderung eingefügten Wicklungen (NSP) einen voreingestellten kleinsten Grenzwert überschreitet oder nicht ($NSP \geq NSI.FI$), sowie der Aufgabe, alle fehlenden Wicklungen dadurch auszugleichen, dass sie von den auf der Trommel vorhandenen Wicklungen subtrahiert werden ($NS - (NSI-NSP)$), ferner mit der Einfügung der Wicklungen zu beginnen ($NSP=0$) und die Zeitschaltung auf die maximale Zeit (TMRO) einzustellen, zu den Routinen für das Schussfadenanforderungs-Interrupt (TR);
 - Zuweisen der Aufgabe, zu überprüfen, ob die Einstellung (TMRO) der Zeitschaltung während des Zeitabschnitts zwischen zwei Wicklungen abgelaufen ist oder nicht, um die Wicklungen auszugleichen und die Anzahl der freigegebenen Wicklungen gleich der Anzahl der freizugebenden Wicklungen einzustellen ($NSP=NSI$), wodurch der Abschluss der Einfügung angezeigt wird, zu der Routine für das periodische Interrupt.
5. Überwachungsverfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** der Koeffizient (FI), welcher den voreingestellten kleinsten Schwellwert ($NSI.FI$) bestimmt, von dem Mikroprozessor (μP) in Entsprechung zu der Art der angeforderten Einfügung automatisch verändert wird.
 6. Überwachungsverfahren nach Anspruch 4, bei welchem die von dem ersten und dem zweiten Signal (UWSP-UWP) erzeugten Interrupts bei der Veränderung der Impulse der Signale ins Negative gebildet werden.
 7. Überwachungsverfahren nach den vorhergehenden Ansprüchen, bei welchem das interne Interrupt mit absolut periodischer Frequenz ausgeführt wird.
 8. Überwachungsverfahren nach Anspruch 6, **dadurch gekennzeichnet, dass** die periodische Frequenz so gewählt wird, dass sie gleich 1 ms ist.

Revendications

1. Procédé de contrôle d'insertion de fil de trame dans des systèmes (SI) d'approvisionnement de métiers à tisser (TE) du type à injection avec une unité de prémesure (P) de fil qui comprend un tambour (TA) pour accueillir une réserve de fil de trame (RT), un doigt (DI) de retenue de fil de trame, un bras d'en-

roulement à moulinet (BR) pour enrouler des spires pour remplir la réserve de fil de trame, un premier capteur optique (UWP) pour détecter les spires de fil qui se déroulent à partir du tambour, un second capteur magnétique (H) pour détecter le nombre de tours du bras d'enroulement à moulinet et un microprocesseur superviseur (μP) qui commande le doigt de retenue du fil de trame (DI) et le moteur (MO) du bras d'enroulement à moulinet (BR) et reçoit en entrée un signal de requête de fil de trame (TR) engendré par le métier à tisser (TE) et des premier et second signaux d'impulsions (UWSP-WSP) engendrés par lesdits premier et second capteurs, qu'il compare, actionnant le bras d'enroulement à moulinet (BR) de façon à faire correspondre le nombre d'impulsions desdits premier et second signaux afin de maintenir la réserve de fil de trame (RT) sensiblement invariante,

caractérisé en ce qu'il comprend les étapes consistant à déterminer, lorsque ledit premier signal (UWSP) présente un manque d'une ou de plusieurs impulsions par rapport au nombre de spires de la requête de fil de trame (TR), un intervalle de temps maximum (TMRO) après lequel le microprocesseur (μP), si aucune autres impulsions (UWSP) n'apparaissent en provenance dudit premier capteur optique (UWP), complète la libération des spires destinées à être insérées ($NSI-NSP$) et/ou la compensation des spires (NS) qui sont présentes sur ledit tambour (TA) du prémesureur (P).

2. Procédé de contrôle selon la revendication 1, **caractérisé en ce que** ledit intervalle de temps maximum (TMRO) est mesuré en partant de la dernière impulsion du signal (UWSP) dudit second capteur optique (UWP) ou à partir du front d'activation du signal de requête de fil de trame (TR).
3. Procédé de contrôle selon la revendication 1, **caractérisé en ce que** ledit intervalle de temps maximum (TMRO) est 2-3 fois supérieur au temps moyen de déroulement de spire.
4. Procédé de contrôle selon la revendication 1, **caractérisé en ce qu'il** comprend les étapes consistant à :
 - programmer ledit microprocesseur (μP) de façon à ce qu'il engendre, sous le contrôle externe des signaux (UWSP-WSP) desdits premier et second capteurs (UWP-H) et du signal de requête de fil de trame (TR) du métier à tisser (TE), des interruptions respectives qui se déclenchent d'après une variation prédéterminée desdits signaux, ledit microprocesseur étant aussi apte à engendrer, grâce à une commande interne, une interruption périodique additionnelle ;

- attribuer aux routines desdits signaux dudit premier capteur (UWP) la fonction de diminuer (NS-1) le compteur du nombre de spires (NS) enroulées sur le tambour du fournisseur (P) et respectivement d'incrémenter (NSP + 1) le compteur du nombre de spires (NSP) déroulées à partir dudit tambour, et de régler un temporisateur sur ledit intervalle de temps maximum (TMRO) qui est supposé s'écouler entre le passage d'une spire et le passage de la suivante ; 5
 - attribuer aux routines d'interruption de requête de fil de trame (TR) la fonction de vérifier si le nombre de spires (NSP) insérées suite à la requête qui précède directement, excède ou non un seuil minimum prédéterminé ($NSP \geq NSI.FI$) et la fonction de compenser toutes spires manquantes, les soustraire de celles présentes sur le tambour ($NS - (NSI-NSP)$), commencer l'insertion des spires ($NSP = 0$), régler le temporisateur sur ledit intervalle de temps maximum (TMRO) ; 10 15 20
 - attribuer la routine correspondant à ladite interruption périodique, la fonction de vérifier si le réglage (TMRO) du temporisateur s'est écoulé ou non pendant l'intervalle entre deux spires de façon à compenser lesdites spires et mettre le nombre des spires libérées égal au nombre de spires à libérer ($NSP=NSI$), de façon à indiquer la fin de l'insertion. 25 30
5. Procédé de contrôle selon la revendication 4, **caractérisé en ce que** le coefficient (FI) qui détermine ledit seuil minimum prédéterminé ($NSI.FI$) est changé automatiquement par le microprocesseur (μp) selon le type d'insertion requis. 35
6. Procédé de contrôle selon la revendication 4, dans lequel les interruptions engendrées par lesdits premier et second signaux (UWSP-UWP) se produisent à la transition négative des impulsions desdits signaux. 40
7. Procédé de contrôle selon les revendications précédentes, dans lequel ladite interruption interne est exécutée avec une fréquence parfaitement périodique. 45
8. Procédé de contrôle selon la revendication 6, **caractérisé en ce que** ladite fréquence périodique est choisie égale à 1 ms. 50

55

Fig. 1

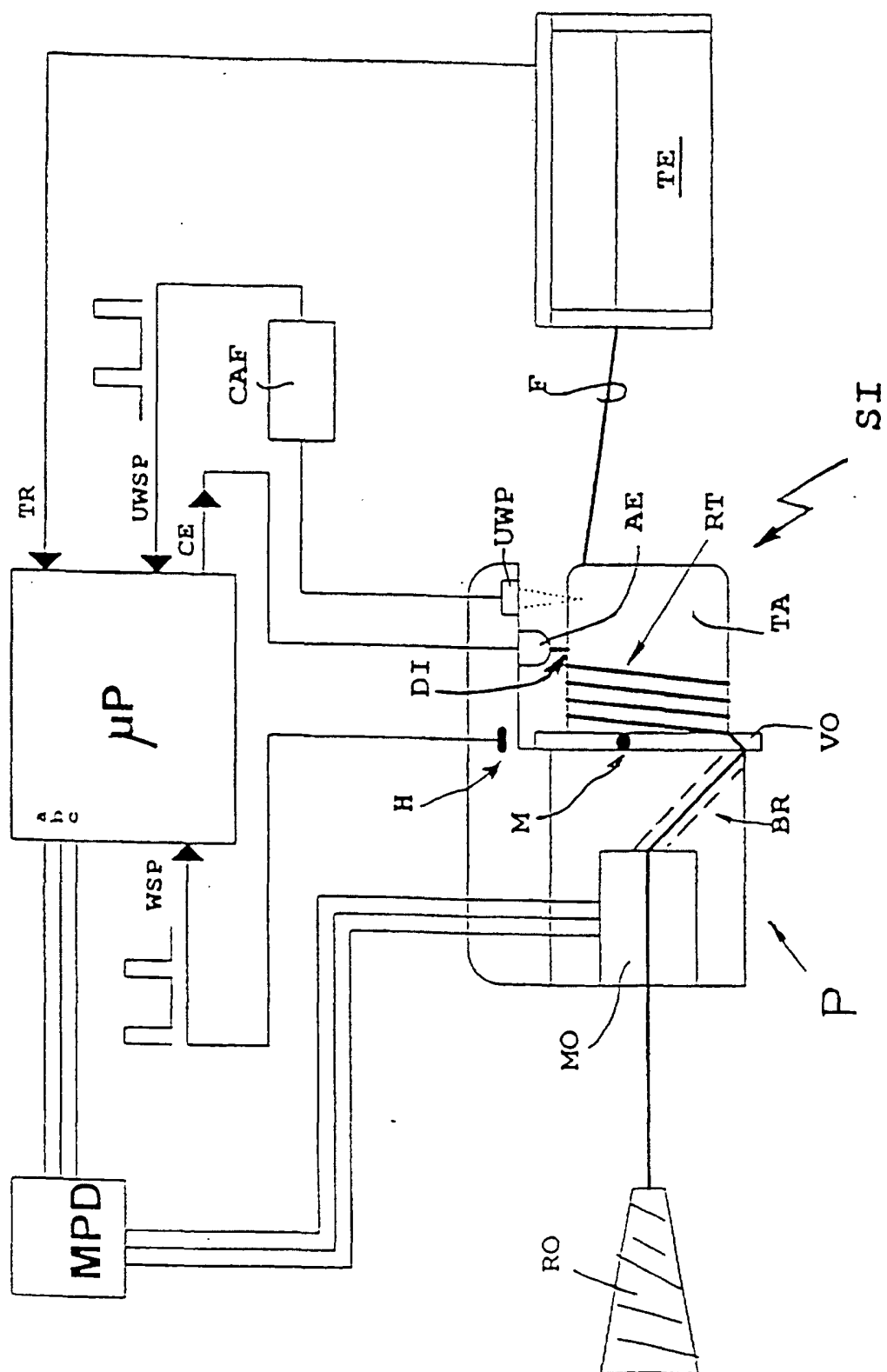
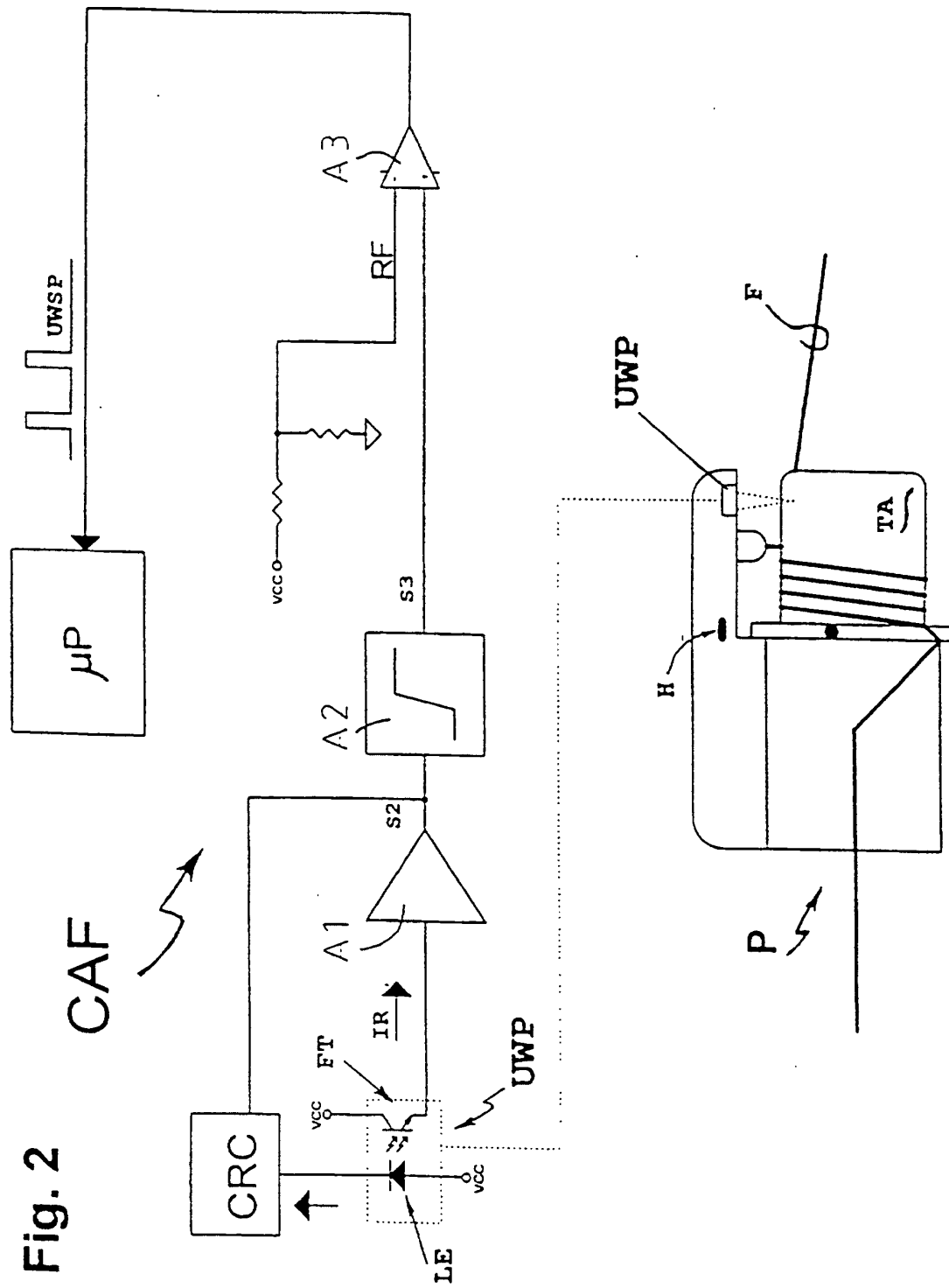


Fig. 2



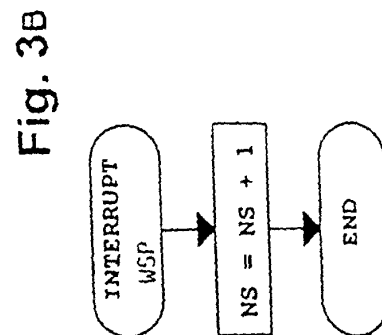
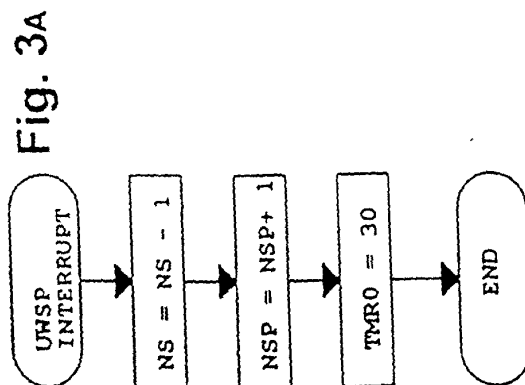
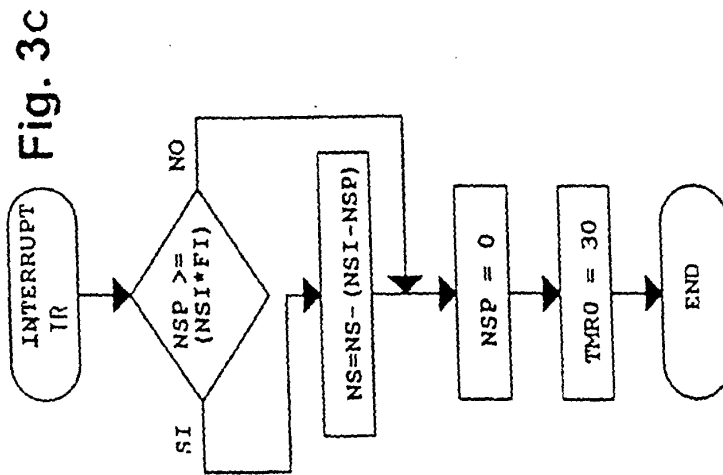
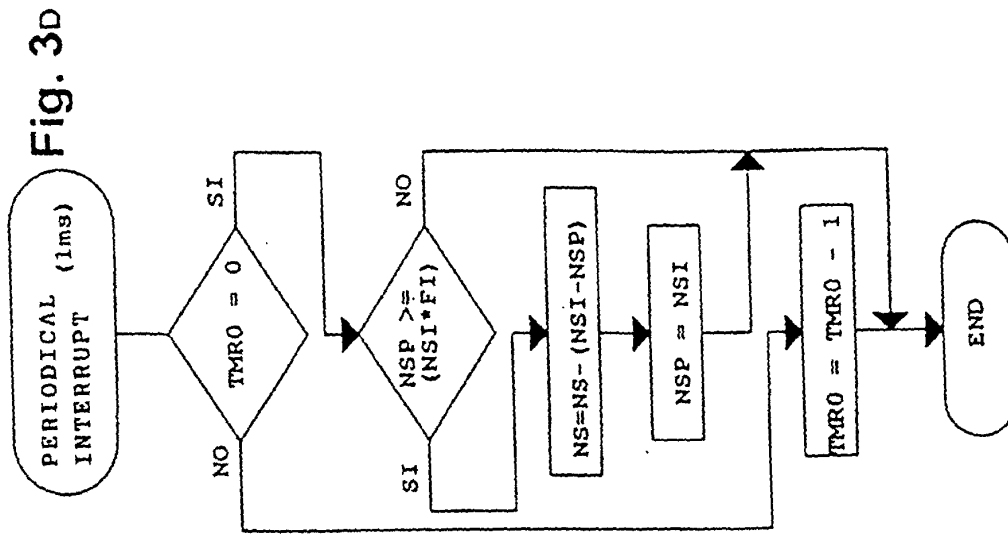


Fig. 4

NSI = 5
FI = 0,6

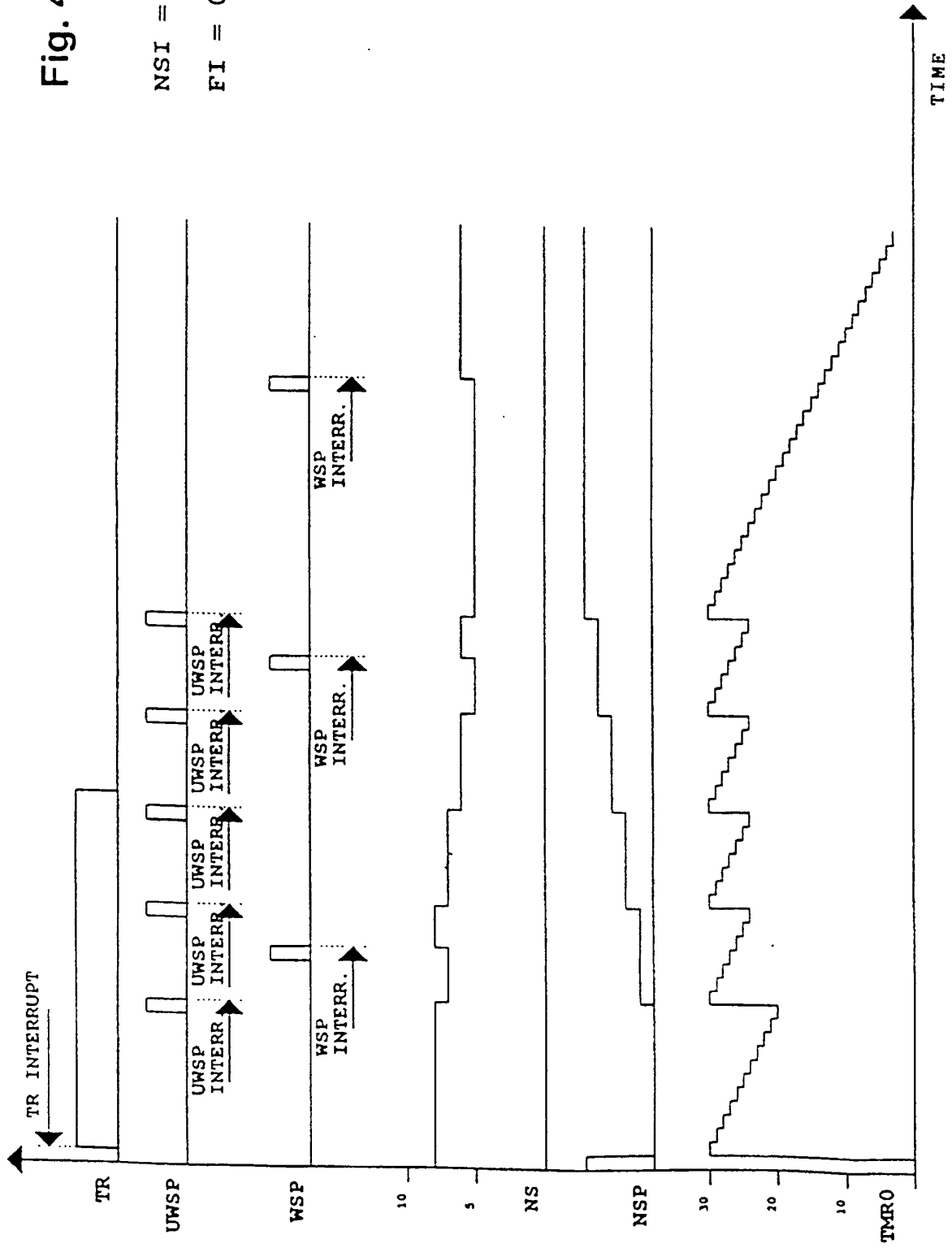


Fig. 5

NSI = 5

FI = 0,6

