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(71) Applicant: **Dirk Benoit Elektronika N.V.**
B-8790 Waregem (BE)

(72) Inventor: **Benoit, Dirk**
8790 Waregem (BE)

(74) Representative: **Ostyn, Frans, Ing.**
K.O.B. NV
President Kennedypark 31 C
B-8500 Kortrijk (BE)

(54) Detection system for detecting and avolding knots and/or irregularities in weft yarns in a fabric

(57) The invention relates to a detection system (1) for detecting and avoiding knots and/or irregularities in weft yarns (10) when weaving a fabric on a weaving machine (20), where the knot and/or the irregularity may be manually removed by stopping the weaving machine or may be automatically removed by having a colour selector stop, and the detection system (1) being provided with one or several knot detectors (4) to detect the knots and the irregularities of the weft yams (10) and which is provided, when detecting a knot and/or an irregularity of the weft yarn (10), to determine the length of the weft yarn (L_t) between the knot and/or the irregularity and the weaving machine and provided to activate the weaving machine (20) to continue its weaving operation until the moment that the length of the weft yarn (L_t) between the knot and/or the irregularity and the fabric equals the width of the fabric, and at that moment, to send a signal to the weaving machine (20) in order to stop the weaving machine or the colour selector in order to remove the knot and/or the irregularity manually, respectively automatically.

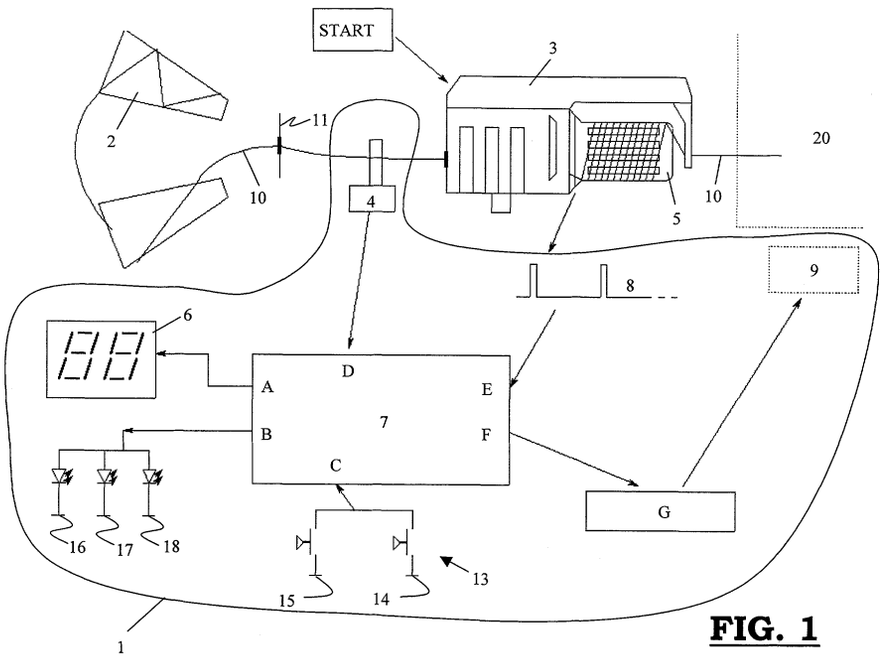

FIG. 1

EP 1 544 339 A1

Description

[0001] The invention relates to a detection system for detecting and avoiding knots and/or irregularities in weft yarns when weaving a fabric on a weaving machine, where the knot and/or the irregularity may be manually removed by stopping the weaving machine or may be automatically removed by having a colour selector stop.

[0002] The problem when weaving fabrics where use is made of textile yarns, is that knots and/or irregularities of the textile yams may cause them to become visible in the fabric. These fabrics then will be of a lesser quality, because of which they will be considered to be second choice fabrics. In order to produce a quality fabric, weft lengths which are free of knots have to be used.

[0003] The problem of knots and/or irregularities is already referred to in BE 1 007 850. In there, a weaving machine is described having a weft yarn supply, of the type where each weft yarn, between successive insertions, stays connected to the weft yarn and where the weft yarn, at the beginning of its insertion, is detached from the weft yarn by means of a weft scissors. The supply consists of at least two supply channels for the weft yarn, comprising a supply of yarn, means of control in order to provide a weft yarn from a specific supply channel and a control unit. The control unit is operating in conjunction with detection means which determine whether there is a knot or an irregularity between the supply of yarn of a supply channel and the weft edge. The control unit is operating in conjunction with control means which, after the detection means have discovered a knot or an irregularity of the weft yarn, will cut off the supply channel concerned and will continue to supply weft yams by providing a weft yarn from one or several of the other supply channels. Furthermore, the control unit is operating in conjunction with switching means, which will determine when the knot or the irregularity of the weft yarn, situated in the disconnected supply channel, is in a position with respect to the weft scissors, such that in case the weft yarn mentioned before is detached from the weft edge by the weft scissors, the knot or irregularity will remain connected to the weft edge. reconnect the disconnected supply channel, after the switching means have determined that the knot or the irregularity is situated in the position mentioned before.

[0004] The problem with such a system is that the weft yam is taken along with the lost selvedge. When a knot and/or an irregularity is for instance situated 10 m away from the fabric, and the weaving machine is weaving 16 wefts per cm, then 16 000 wefts have to be carried out to bridge these 10 m. When the weaving machine is operating at a speed of 600 wefts per minute, then it may take about 30 minutes before the disconnected supply channel will be reconnected again. The result will be a loss of yam and consequently a loss of efficiency.

[0005] The purpose of the invention is to provide a detection system for detecting and avoiding knots and/or irregularities of weft yams when weaving a fabric on a weaving machine which may occur in the weft yams themselves or which my occur when binding up a new bobbin or in case of a break of the weft yam of the bobbin, with a loss of weft yam as reduced as possible.

[0006] The detection system is especially useful with chenille and other coarse yarns.

[0007] The purpose of the invention is solved by providing a detection system for detecting and avoiding knots and/or irregularities of weft yams when weaving a fabric on a weaving machine, where the knot and/or the irregularity may be removed manually by stopping the weaving machine or may be removed automatically by means of a colour detector stop, and the detection system being provided with one or several knot detectors to detect knots and/or irregularities of the weft yams, and which is provided to determine the length of the weft yam between the knot and the weaving machine, when detecting a knot and/or an irregularity, and which is provided to activate the weaving machine to continue its weaving operation until the moment that the length of the weft yam between the knot and/or the irregularity and the fabric equals the width of the fabric, and at that moment to send a signal to the weaving machine, to stop the weaving machine or the colour selector in order to remove the knot and/or the irregularity manually, respectively or automatically.

In such a manner, the weft yarn is still incorporated into the fabric as far as possible, before the knot and/or the irregularity is removed from the fabric, thus reducing the loss of yam and increasing the efficiency.

[0008] In a preferred embodiment of a detection system according to the invention, with the weaving device a prewinder is installed, which is provided with a winding disk for pre-unwinding the weft yams, and the detection system is designed to carry out a learning phase, in which the maximum number of windings (N) which are wound on the winding disk, are counted.

[0009] Preferably, the detection system is thereby provided with a sensor to count the maximum number of windings (N) on the winding disk during the learning phase.

[0010] Preferably, the said sensor, is an existing sensor on the winding disk which normally serves to check whether the motor of the prewinder is running or not.

[0011] This has the advantage that no additional sensor has to be provided in the winding disk, but that the, already existing sensors in the winding disk, are used.

[0012] In a preferred embodiment of a detection system according to the invention, the weaving machine is provided with a colour selector and the detection system is designed to generate a bobbin break signal, that will release the weaving machine when the signal is activated and, that will stop the weaving machine and/or the colour selector when the signal is interrupted.

[0013] Preferably, the learning phase occurs between the starting signal and the activation of the bobbin break signal.

[0014] In a preferred detection system according to the invention, the detection system is designed to briefly interrupt the bobbin break signal in case a knot and/or an irregularity is detected, because of which the prewinder will come to a standstill.
With the detection of a knot and/or an irregularity, preferably the number of windings (Y) being taken off the winding disk (= take-off) is measured between the interruption of the bobbin break signal and the becoming into standstill of the prewinder.

[0015] In a preferred detection system according to the invention, the detection system is provided to measure the maximum number of windings (N) and the take-off (Y) by counting the number of UGN-pulses.

[0016] In an advantageous detection system according to the invention, the detection system is provided for the input of the weft length (G) of the fabric, and is provided to determine the number of windings (K) still remaining on the winding disk of the prewinder between the knot and/or the irregularity and the fabric, this number of windings (K) being converted into a number of UGN-pulses for whole weft lengths (V), that, may be still carried out after the knot and/or the irregularity has been detected before the knot and/or the irregularity is removed, on the basis of the circumference (O) of the winding disk of the prewinder and the weft length (G) entered into the detection system with the following formulas

- N-Y=K;
- G / O = T, T being the number of whole pulses in a weft length (G);
- K / T = P, P being the number of whole lengths;
- T*P=V.

[0017] In a preferred embodiment of a detection system according to the invention, the detection system is provided with a display which is provided to display the length of the weft yam (L_t) between the knot and/or the irregularity and the fabric, this length (L_t) being calculated by:

- calculating the length (L_w) of the number of windings (K) from the number of windings (K) obtained and the circumference (O) of the winding disk of the prewinder by means of the following formula:

$$L_w = \Pi * K * O;$$

- by adding the distance (L_v) between the fabric and the prewinder to this length (L_w) obtained, resulting in the total length between the knot and/or the irregularity and the fabric (L_t).

[0018] In a preferred embodiment of a detection system according to the invention, the detection system is provided with an electric circuit which is responsible for the processing of all input and output signals of the detection system.

[0019] In a preferred embodiment of a detection system according to the invention, the knot detector is provided at the entrance of the prewinder.

[0020] In a preferred detection system according to the invention, the weaving machine is designed to automatically remove the knot and/or the irregularity by means of an automatic selection transition.

[0021] Preferably, such a detection system may be applied with:

- the detection and removal of a knot when binding up a new bobbin;
- the detection and removal of a knot and/or an irregularity when there is a knot and/or an irregularity in the bobbin itself;
- the detection and removal of a knot in case of the breaking and binding up again of a bobbin.

[0022] In order to further clarify the properties of this invention and to mention its additional advantages and particulars, a more detailed description of a detection system for detecting and avoiding knots and/or irregularities in weft yams on a weaving machine will now follow. It may be obvious that nothing in the following description may be interpreted as being a restriction of the protection for the device according to the invention demanded for in the claims.

[0023] In this description, by means of reference numbers, reference is made to the attached drawings in which:

- ***figure 1*** is a schematic block diagram of a detection system for detecting knots and/or irregularities of weft yams in a fabric, that is installed with a weaving machine;
- ***figure 2*** is a flowchart of the software of a knot detector.

[0024] The detection system (1) according to the invention, as represented in figure 1, is designed for detecting and avoiding knots and/or irregularities of weft yams (10) when weaving a fabric on a weaving machine (20). The weaving machine (20) is provided with one or several bobbins (2) to supply the weft yams (10). The bobbins (2) are provided in a bobbin frame. Furthermore one or several prewinders (3) are provided between the bobbins (2) and the weaving machine (20) to pre-unwind the weft yams (10) originating from one or several bobbins (2). The weft yam (10), originating from a bobbin (2) is passing through a yam holder (11) to the prewinder (3).

[0025] The detection system (1) is provided with one or several knot detectors (4) to detect knots and/or irregularities of the weft yams (10). In figure 1, two bobbins (2), one prewinder (3) and one knot detector (4) are represented. The knot detector (4) being installed be-

tween the bobbins (2) and the prewinder (3). However, the knot detector (4) may likewise be installed between the prewinder and the weaving machine (20), or it may be integrated in the prewinder (3). The prewinder (3) is provided with a winding disk (5) for pre-unwinding the weft yarn (10).

[0026] The detection system (1) is provided to determine the length of the weft yam (10) between the knot and/or the irregularity and the weaving machine (20) in case a knot and/or an irregularity of the weft yam (10) is detected and at the same time to activate the weaving machine (20) to continue its weaving operation until the moment that the length of the weft yam (10) becomes shorter than the width of the fabric and, at that moment, to send a signal to the weaving machine (20) to stop the weaving machine in order to remove the knot and/or the irregularity manually or to carry out a colour selector stop in order to remove the knot and/or the irregularity automatically.

[0027] The detection system (1) is provided to carry out a learning phase, during which the maximum number of windings (N) that are wound on the winding disk (5) of the prewinder (3) are counted. As shown in figure 1, a push button is therefore provided, whereby the learning phase is started by pushing it. However, the learning phase may be carried out when switching on the detection system (1). In order to carry out the learning phase, the detection system (1) is provided with a sensor, which, preferably, is a sensor already installed on the winding disk (5) that normally is used to check whether the motor or the prewinder is running or not. The learning phase takes place between the moment the prewinder (3) is switched on and the moment the bobbin break signal is activated. The bobbin break signal is a signal, which, when activated, is responsible for the releasing of the weaving machine (20) and when interrupted is responsible for a general stop of the weaving machine or the colour selector (the colour selector is not represented in the figure).

[0028] When detecting a knot and/or an irregularity, the bobbin break signal is briefly interrupted. At that moment, the number of windings (Y) (see figure 2) being taken of from the winding disk (5), i.e. the take-off, is measured between the interruption of the signal and the coming to a standstill of the prewinder (3).

[0029] The maximum number of windings that are wound on the winding disk (5) of the prewinder (3) and the take-off are measured by counting the UGN-pulses (8).

[0030] As represented in figure 2, in step S101, when switching on the prewinder (3) (= PUD), the starting signal is activated (start = 1) and the learning phase is started (learn = 1). In case those two values are equalling 1, the learning phase is carried out by counting the number of UGN-pulses, until the bobbin break signal is activated (S102). Then, this number of pulses counted, originating from the winding disk (5) of the pre-winding device (3) are entered (S103) in storage location (N). As long as no knot is detected, the loop P 103 is completed.

[0031] In case a knot and/or an irregularity is detected by the knot detector (4) (S104), the bobbin break signal is briefly interrupted, while the take-off is counted. Shortly thereafter, depending on the setting of the machine, either the machine is completely stopped, in case the knot and/or the irregularity will be removed manually or the colour selector is stopped in case the knot and/or the irregularity will be removed automatically (S105).

[0032] Then, in step S106 and S109, it is determined how many wefts there still can be carried out before the knot and/or the irregularity may be removed manually or automatically. To do so, the following steps will be taken:

- N - Y = K (S106), K being the number of windings remaining on the winding disk (5) of the prewinder (3) between the knot and the fabric;
- G / O = T (S107), T being the number of pulses in a weft length (G). The weft length (G) is entered into the detection system (1);
- K / T = P (S108), being the number of whole lengths;
- T * P = V (S109), V being the number of pulses for whole weft lengths.

[0033] The weaving machine (20) will continue to weave until the moment that Y = V, i.e. until the moment that the length of the weft yam (10) between the knot and/or the irregularity and the fabric equals the width of the fabric (S110). At that moment the TF-out signal is activated (TF-out = 1) and the weaving machine (20) or the colour selector is stopped (S111). However, as long as Y is not equal to V, the loop P109 is completed.

[0034] In step (S112), X is calculated by means of the formula (P + 1) x T. When this X equal is to the take-off (Y) (113), then the weaving machine (20) or the colour selector will be started again (S114). However, as long as X is not equal to Y, the loop P112 is completed.

[0035] Then, the knot and/of the irregularity can be removed manually or automatically as already indicated before. To remove the knot and/or the irregularity automatically, preferably use will be made of an automatic selection-transition (= PSO-system) as described in BE 1 007 850.

[0036] As represented in figure 1, there is a display (6), for instance, an LCD-display that is provided to display the length of the weft yarn (L_t) between the knot and/or the irregularity and the fabric, this length (L_t) being calculated by:

- calculating the length (L_w) of the number of windings (K) from the number of windings (K) obtained and the circumference (O) of the winding disk of the prewinder by means of the following formula:

$$L_w = \Pi * K * O;$$

- adding the distance (L_v) between the fabric and the prewinder to this length (L_w) obtained, resulting in the total length between the knot and/or the irregularity and the fabric (L_t).

[0037] In order to process all input and output signals of the detection system (1), an electric circuit (7) has been provided. The following signals are sent to and from this electric circuit (7):

- A: the output signal to the LCD-display (6);
- B: the output signal of the indicator LEDs (16, 17, 18);
- C: the input signal of the input touch (13);
- D: the input signal of the knot detector (4);
- E: the input signal of he UGN-pulses;
- F: the output signal to the weaving machine (20) or to the colour detector.

[0038] Besides the push button (14) to start the learning phase (as described above), there is a second push button (15) for the input of the parameters. These push buttons (14, 15) together are constituting the "input touch".

[0039] Furthermore, there are three indicator LEDs, i. e.:

- a first LED (16) indicating that the voltage has been applied to the detection system (1);
- a second LED (17) indicating an error in the detection system (1), for instance, that there has been an interruption of the bobbin break signal and the prewinder has not come to a standstill;
- a third LED (18) producing an alarm in case a knot is detected.

[0040] In order to stop the weaving machine (20) or the colour selector as indicated in S 110 in figure 1, a stop signal (G) is sent to the control box (9) of the weaving machine.

Claims

1. Detection system (1) for detecting and avoiding knots and/or irregularities in weft yams (10) when weaving a fabric on a weaving machine (20), where the knot and/or the irregularity may be manually removed by stopping the weaving machine or may be automatically removed by having a colour selector stop, **characterized in that** the detection system (1) is provided with one or several knot detectors (4) to detect the knots and/or the irregularities of the weft yams (10), is provided when detecting a knot and/or an irregularity of the weft yam (10), to determine the length of the weft yam (L_t) between the knot and/or the irregularity and the weaving machine, and is provided to activate the weaving machine (20) to continue its weaving operation until the moment that the length of the weft yarn (L_t) between the knot and/or the irregularity and the fabric equals the width of the fabric, and at that moment, to send a signal to the weaving machine (20) in order to stop the weaving machine or the colour selector in order to remove the knot and/or the irregularity manually, respectively automatically.

2. Detection system according to claim 1, **characterized in that** a prewinder (3) is installed, which is provided with a winding disk (5) for pre-unwinding the weft yams (10), and the detection system (1) is designed to carry out a learning phase, in which the maximum number of windings (N) which are wound on the winding disk (5) are counted.

3. Detection system according to claim 2, **characterized in that** the detection system (1) is provided with a sensor to count the maximum number of windings (N) on the winding disk (5) during the learning phase.

4. Detection system according to claim 3, **characterized in that** the said sensor is an existing sensor on the winding disk (5) which normally serves to check whether the motor of the prewinder is running or not.

5. Detection system according to any one of the claims 1 up to and including 4, **characterized in that** the weaving machine (20) is provided with a colour selector and the detection system (1) is designed to generate a bobbin break signal that will release the weaving machine (20) when the signal is activated, and that will stop the weaving machine (20) and/or the colour selector when the signal is interrupted.

6. Detection system according to claim 5, **characterized in that** the learning phase occurs between the starting signal and the activation of the bobbin break signal.

7. Detection system according to claim 5 or 6, **characterized in that** the detection system (1) is provided to briefly interrupt the bobbin break signal in case a knot or an irregularity is detected, because of which the prewinder (3) will come to a standstill.

8. Detection system according to claim 7, **characterized in that** with the detection of a knot and/or an irregularity, the number of windings (Y) being taken off the winding disk (5) (= take-off) is measured between the interruption of the bobbin break signal and the becoming into standstill of the prewinder (3).

9. Detection system according to any one of the claims

1 up to and including 8, **characterized in that** the detection system is provided to measure the maximum number of windings (N) and the take-off (Y) by counting the number of UGN-pulses.

10. Detection system according to claim 9, **characterized in that** the detection system (1) is provided for the input of the weft length (G) of the fabric, and is provided to determine the number of windings (K) still remaining on the winding disk (5) of the prewinder between the knot and/or the irregularity and the fabric, this number of windings (K) being converted into a number of UGN-pulses (8) for whole weft lengths (V) that may be still carried out after the knot and/or the irregularity having been detected, before the knot and/or the irregularity is removed, on the basis of the circumference (O) of the winding disk (5) of the prewinder (3) and the weft length (G) entered into the detection system (1) by means of the following formulas:

- N-Y=K;
- G / O = T, T being the number of whole pulses in a weft length (G);
- K / T = P, P being the number of whole lengths;
- T * P = V.

11. Detection system according to claim 9, **characterized in that** the detection system (1) is provided with a display (6), which is provided to display the length of the weft yam (L_t) between the knot and/or the irregularity and the fabric; this length (L_t) being calculated by:

- calculating the length (L_w) of the number of windings (K) from the number of windings (K) obtained and the circumference (O) of the winding disk (5) of the prewinder by means of the following formula:

- $L_w = \Pi * K * O$;
- adding the distance (L_v) between the fabric and the prewinder (3) to the length (L_w) obtained, resulting in the total length between the knot and/or the irregularity and the fabric (L_t).

12. Detection system according to any one of the preceding claims, **characterized in that** the detection system (1) is provided with an electric circuit (7) which is responsible for the processing of all input and output signals of the detection system.

13. Detection system according to any one of the claims 1 up to and including 12, **characterized in that** the one or several knot detectors (4) are provided at the entrance of the prewinder (3).

14. Detection system according to any one of the claims 1 up to and including 13, **characterized in that** the weaving machine (20) is designed to automatically remove the knot and/or the irregularity by means of an automatic selection transition.

15. Detection system according to any one of the claims 1 up to and including 14, **characterized in that** the detection system (1) is applied for the detection and removal of a knot when binding up a new bobbin (2).

16. Detection system according to any one of the claims 1 up to and including 14, **characterized in that** the detection system (1) is applied for the detection and removal of a knot and/or an irregularity when there is a knot and/or an irregularity in the bobbin (2) itself.

17. Detection system according to any one of the claims 1 up to and including 14, **characterized in that** the detection system (1) is applied for the detection and removal of a knot in case of the breaking and binding up again of a bobbin (2).

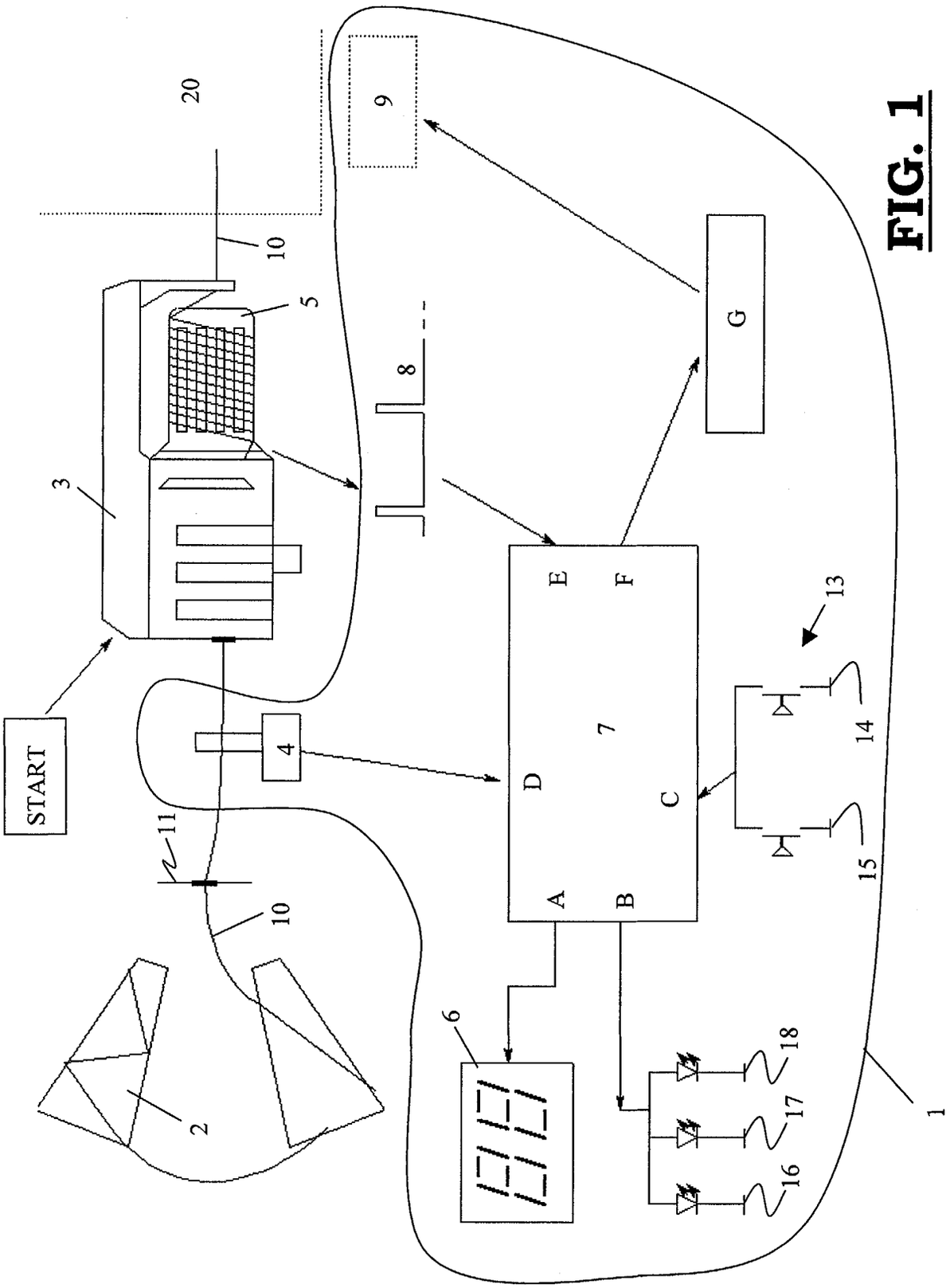

FIG. 1

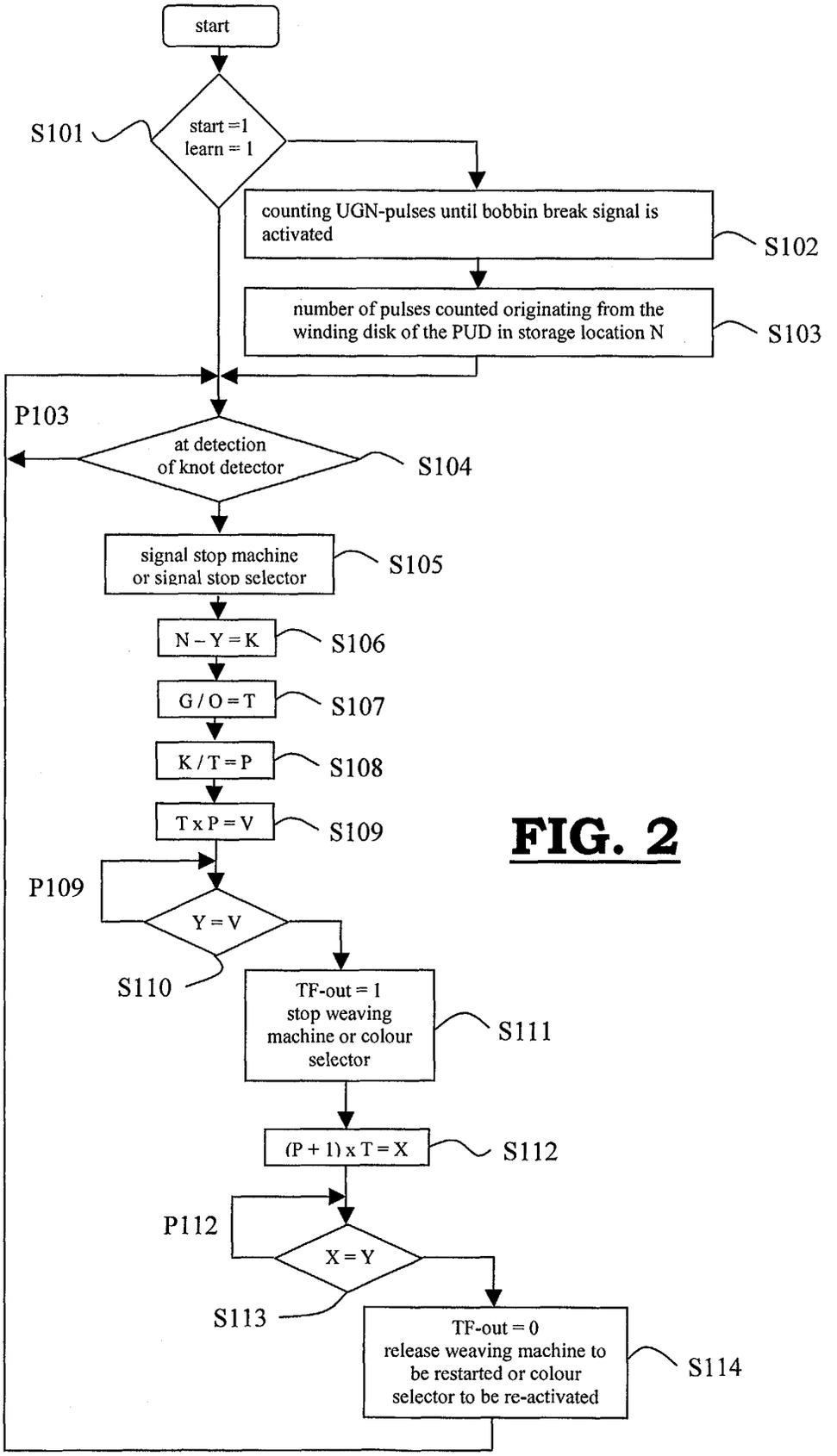
start
start =1
learn = 1
S101
counting UGN-pulses until bobbin break signal is activated
S102
number of pulses counted originating from the winding disk of the PUD in storage location N
S103
P103
at detection of knot detector
S104
signal stop machine or signal stop selector
S105
N – Y = K
S106
G / O = T
S107
K / T = P
S108
T x P = V
S109
P109
Y = V
S110
TF-out = 1
stop weaving machine or colour selector
S111
(P + 1) x T = X
S112
P112
X = Y
S113
TF-out = 0
release weaving machine to be restarted or colour selector to be re-activated
S114

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 07 8403

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 332 007 A (WAHHOUD ADNAN) 26 July 1994 (1994-07-26) * column 2, line 23 - line 64; claim 1; figure 1 * -----	1	D03D51/34 D03D47/34
A,D	BE 1 007 850 A (PICANOL NV) 7 November 1995 (1995-11-07) -----		
A	US 4 559 976 A (KODAMA IKUO ET AL) 24 December 1985 (1985-12-24) -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
D03D D03J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 March 2005	Van Gelder, P

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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29-03-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5332007 A	26-07-1994	DE 4209686 A1	30-09-1993
		DE 59302416 D1	05-06-1996
		EP 0562230 A1	29-09-1993
		JP 2815771 B2	27-10-1998
		JP 6002247 A	11-01-1994
BE 1007850 A	07-11-1995	BE 1007850 A3	07-11-1995
		DE 59402743 D1	19-06-1997
		EP 0656437 A1	07-06-1995
		US 5544679 A	13-08-1996
US 4559976 A	24-12-1985	JP 59066540 A	16-04-1984
		KR 8601411 B1	23-09-1986

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