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(54) **A DEVICE AND A METHOD FOR SENSING END OF WARP YARN OR TAPE ON A FABRIC WEAVING LOOM**

VORRICHTUNG UND VERFAHREN ZUM ERFASSEN DES ENDES EINES KETTFADENS ODER EINES BANDES AUF EINER TEXTILWEBMASCHINE

DISPOSITIF ET PROCÉDÉ DE DÉTECTION D'EXTRÉMITÉ D'UN FIL DE CHAÎNE OU D'UN RUBAN SUR UN MÉTIER À TISSER UN TISSU

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(56) References cited:
EP-A1- 2 570 530

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Description

FIELD OF THE INVENTION

5 [0001] Device of the invention relates to weaving machines, containing warp and weft yarns/tapes for fabric weaving on circular weaving machines, more precisely, sensing end of warp yarn/tape during fabric production.

BACKGROUND INFORMATION

10 [0002] The circular weaving loom or machine (CWM) is designed to weave endless tubular or flat fabric using PP, HDPE, LLDPE yarn/tape or other blends of polyolefin (Figure1).

[0003] The warp yarns/tapes are fed to the weaving machine-from more than one creel via rollers. This ensures uniform warp tension, excellent fabric quality, and trouble-free handling (Figures 2 & 3).

15 [0004] In conventional looms, six or more shuttles running on a reed ring are provided for carrying the weft bobbins. During the fabric production, warp bobbins can be changed easily and quickly without shutting down the CWM. This is done by tying into a knot the two ends - one end being that of the exhausted bobbin and the other being that of the fresh yarn. Therefore, when yarn/tape on a bobbin is coming to end, the bobbin needs replacement with a new bobbin. If this is not done within stipulated time, the warp yarn/tape on the bobbin becomes loose as tension drops due to continuity break. As this is done under observation of the operator, this whole operation is dependent on operator skill and prone to operator error. Furthermore, the loose yarn/tape may possibly entangle with other nearby yarns/tapes coming from adjacent bobbins thereby damaging section of the running fabric. Thus, one of the drawbacks of the existing systems is its requirement to regularly monitor bobbin exhaustion by operator. Similarly, another drawback of the existing systems is that when the ends of the warp are noticed, the machine needs to be stopped immediately such that the ends of the warp tapes are not allowed to reach reed ring section of the weaving machine.

25 [0005] One of the popular methods to sense yarn ends incorporates the use of a drop wire (Figures 4A and 4B). Drop wire systems consist of a gravity-controlled 'drop wire' made of metals such as stainless steel through which the tape used for fabric making passes. When warp yarn/tape ends, yarn/tape loses its tension which causes it to sag causing drop wire to fall down. In this case, operator observes sag in yarn/tape and stops the machine to change the empty or semi filled tube with new bobbin.

30 [0006] There are certain limitations of this system which are of practical significance. First, in running machine operator would require to keep monitoring for any warp end, which is very difficult when number of machines operated by operator is more than one or operator loses his attention in between. Second, when number of warp bobbins getting empty is higher, in that case observing all of them is difficult, meanwhile running machine produces waste fabric which cannot be used further.

35 [0007] Nowadays, there is growing trend of filler addition to polyolefin tapes. The filler content tends to generate powdery dust particulates during fabric weaving operation. These dust particles settle on any available surface in the vicinity of the loom. The settled dust has the potential to disrupt the electronic/electrical sensor functioning, hampering the loom operations. There are yarn end detection systems that are automated and use electric circuits. However, it has been found that these systems are susceptible to frequent malfunctioning, especially in the dusty environs.

40 [0008] There is therefore a need to provide an improved drop wire and a system to detect yarn end and provide a notification of it to the operator, which will work unhampered even in dusty environment.

OBJECTS OF THE INVENTION

45 [0009] Accordingly, one of the objects of the present invention is to provide an automated system for sensing warp end.

[0010] Another object of the invention is to provide an automated system for detecting warp end which will work robustly in dusty environment.

[0011] A further object of the invention is to provide an improved drop wire for the purpose of detection of warp end.

50 [0012] Another object of the present invention is to provide a system that reduces the wastage of weaved fabric and machine downtime.

SUMMARY OF THE INVENTION

[0013] The invention discloses a device for sensing an end of a warp yarn or tape on a fabric weaving loom according to claim 1.

55 [0014] The device is so designed that upon detection of a yarn end (due to yarn breakage or due to the yarn package running out of yarn) by a yarn detection means that is also a part of the device, an electric circuit is completed and a notification is sent to the loom operator. The invention is particularly suitable in dusty environment in which CWMs

typically operate.

[0015] The invention utilizes an improved drop wire (6) which maintains its normal operating position by hanging by the running yarn that passes through a loop provided at one end of the drop wire. The drop wire is provided with an electrically conducting first element having a spatially curved external surface. Breakage of the running yarn causes loss of tension in the yarn, causing the drop wire to lose its elevation rapidly. The device of the invention also incorporates a set of electrically conducting second elements having a curved internal surface. Upon the loss of elevation, the first and second elements come in electrical contact with each other, thereby completing an electric circuit and consequently causing a signal to be sent to the operator of the loom indicating yarn breakage. Drop wires (6) are provided on every individual warp yarn/tape which is fed to the central reed ring section.

BRIEF DESCRIPTION OF THE FIGURES

[0016]

Figure 1 shows a schematic of loom used to manufacture woven fabric
 Figure 2 shows a schematic of warp yarn/tape travel path in a loom
 Figure 3 shows woven fabric and a tube form of it
 Figure 4A and 4B show the open circuit and closed circuit positions, respectively, of the typical drop-wire type device of the prior art
 Figures 5A and 5B show the configuration of second elements
 Figure 6A shows the drop wire with first element
 Figures 6B, 6C, and 6D show second elements along with configuration of inner surfaces
 Figure 7 shows details of the inner surfaces of a second element

List of parts:

Creel Bracket (1)	Outer Surface (6C)
Inlet Motor (2)	Second elements (7)
Roller (3)	Physical gap (7A)
Woven fabric (4)	Inner Curved shaped surface (7B)
Bobbin (5)	Single surface (7C)
Drop wire (6)	Sub-surface (7D)
Loop (6A)	Point (7E)
First element (6B)	Edge (7F)
Electronic Circuit (8)	Yarn (9)

DETAILED DESCRIPTION OF THE INVENTION

[0017] Woven fabric for use in making bags for storing materials such as grains, cement, etc. is made from yarn/tape of PP, HDPE, LLDPE or other blends of polyolefin. As shown in Figure 1, a circular weaving machine/loom (CWMs) that makes tubular fabric for making such bags deploys a number of bobbins. Figure 2 shows the typical yarn travel path in a CWM. As discussed earlier, for a number of reasons, yarn gets broken during the loom operation. The device disclosed in the invention allows detection of ends of a broken yarn/tape so that the CWM may be stopped in order and a signal is sent to the operator on duty to avoid entanglement of the broken yarn/tape with other yarns/tapes operational on the CWM.

[0018] As disclosed in the summary section, the key purpose of the device of the invention is to detect the breakage or end of a running yarn and inform the loom operator of its occurrence. This is achieved by providing the following three key elements in the device: a means to detect the yarn breakage, an electric circuit, and a notification means.

[0019] It also should be noted that the CWMs operate in an environment where a substantial amount of particulate matter (dust) is generated as a result of loom operation. These particles settle on any available surface in the vicinity of the loom. The settled dust which is electrically non-conductive has the potential to hamper the loom operations. In the case of systems to detect yarn ends, where electric circuits are employed, the smooth working of such circuits may be hampered by such dust. One of the key aspects of the device of the invention is that it works effectively regardless of the dusty environments within which they are deployed.

[0020] The present invention discloses a device for sensing end of warp yarn or tapes on an automated fabric weaving loom and notifying the instance of yarn breakage to the operator. It comprises a yarn end detection means to detect the

breakage of or a slack in running yarn, an electric circuit, and a notification means to notify breakage of or slack in yarn.

[0021] In one aspect of the invention, the yarn end detection means comprises an improved weighted drop wire (6) (Figures 4A and 6A) with an eye (6A) at its one end through which the running warp yarn/tape (9) passes, and which is held in substantially upheld position by the tension in the running yarn (9). An electrically conducting first element (6B) is attached fixedly to the drop at a predetermined distance 'h' (Figure 4A) from the eye (6A).

[0022] During the operation of the loom, if a yarn (9) breaks, the specific drop wire (6) that was supported by the yarn (9), before its breaking, drops (Figure 4B) from its previously upheld position. It should be noted that during the normal operations of a loom, the drop wire (6) moves vertically, in small amounts, from its normal operating position. This is due to irregularity in the package's winding quality, leading to variation in the yarn tension. However, such vertical positional variation is normal and not unexpected. Whenever there's such accepted type of positional variation, the drop wire (6) regains its normal working position in a matter of fraction of seconds.

[0023] In the instance of an actual breakage (or indeed when a package comes to an end, thereby running out of yarn), the drop of the drop wire (6) from its normal operating position is substantial and irrecoverable. The drop wire (6) drops vertically by a substantial distance from its normal operating position on substantial loss of tension in the running yarn (6) - sensing of the irrecoverable drop of the drop wire (6) represents yarn end detection. A pair of electrically conducting second elements (7) (see Figures 5A/5B) is provided as a part of the electric circuit that is referred to earlier. Upon the detection of a yarn breakage, as the specific drop wire (6) drops (Figure 4B), it brings the first element (6B) in electrical contact with corresponding second elements (7), thereby closing the electric switch/loop and consequently completing the electric circuit (Figure 5B).

[0024] As also shown in Figures 5A and 5B, in another aspect of the invention, the components of the electric circuit are the first elements (6B), second elements (7), an electronic circuit (8) that electrically connects two second elements (7) of any pair of the second elements (7) at one end of the second elements (7), and a source of electric power. It further comprises an **electric switch** or a loop that is yarn-dust-proof. During the normal working operation of the loom, the electric switch/loop remains 'open'. The device is so designed that upon detection of a yarn breakage or a yarn end, the electric switch/loop closes effectively thereby completing the electric circuit - regardless of the presence of dusty environment. Upon closure of the electric circuit, an alarm is raised and a signal is sent to the operator indicating the yarn breakage.

[0025] As discussed earlier, the drop wire (6) supports a first element that has an electrically conducting outer surface (6C). The outer surface (6C) of the first element (6B) is spatially curved (Figure 6A), preferably substantially in the form of a cone of any type. The outer surface (6C) may have serrations that run substantially longitudinally. The yarn-dust-proof electric switch/loop comprises a pair of electrically conducting second elements (7). As shown in Figures 6B and 6C, the second elements (7) are provided with inner curved shaped surfaces (also termed as inner surfaces or inner shaped surfaces) (7B) with a shape that corresponds to the outer surface (6C) of the first elements (6B).

[0026] The term 'corresponds' mentioned above refers to the correspondence between the outer surface (6C) of the first element (6B) and the shaped inner surface (7B) of the second element (7), and is to be understood in the context of electrical connection. The outer surface (6C) of the first element (6B) and the corresponding inner surface (7B or 7C) on the second element do not have to be 'exactly matching' - that is they do not need to be in full contact with each other. By correspondence it is meant that there simply needs to be sufficient contact so that the electric switch/loop is closed effectively.

[0027] It is known that the dust tends to settle on surfaces that are, among other characteristics, devoid of geometric features such as points and sharp edges. In the view of this, in one aspect of the invention, the inner surfaces (7B) of the second elements (7) are provided with points and/or sharp edges. Some of these are illustrated in Figure 7.

[0028] As shown in Figures 5A and 5B, in one embodiment of the invention, the second elements (7) are in the form of a strip or a plate on which are provided the inner curved shaped surfaces (7B). When positioned across from each other, these plates, with the inner curved shaped surfaces (7B) facing the inner curved shaped surfaces (7B) of the other second element (7) from the pair of second elements, they form receptors into which the first elements (6B) fall when the drop wire (6) loses its elevation substantially. As can be seen from Figure 5, there is a physical gap (7A) between the two shaped edges that face each other. It is this gap (7A) that keeps the electric switch/loop in an open state during the normal working condition of the loom. At the same time, the gap (7A) is so designed that the drop wire (6) passes through it in its normal working position without closing the electric loop.

[0029] The curve of the outer surface (6C) of the first element (6B) may of any shape, however it should be such that when the drop wire (6) drops from its normal working position, the first element (6B)-----owing to the curvature of its outer surface (6C)-----goes into the gap (7A) between the inner shaped curved surfaces (7B) of the two parts of the second elements (7) easily. The curvature of the outer surface (6C) should be of such shape that upon resumption of the tension in the yarn, when the drop wire (6) is pulled up back to its own normal working position due to the tension in the yarn, this upward movement of the drop wire (6) is carried out unhindered.

[0030] The inner curved shaped surfaces (7B) of the second elements (7) may be made of a single surface (7C) (Figure 6D) or multiple sub-surfaces (7D) (Figures 6B/6C). In the case there are multiple sub-surfaces (7D), the junctions

between any two sub-surfaces (7D) are preferably in the form of a point (7E) or an edge (7F) (see Figure 7) that is preferably sharp.

[0031] Formation of points or sharp edges (7E and/or 7F) is important in order to not allow dust to settle on at least some part of the curved shaped inner surfaces (7B).

[0032] This is of crucial importance as it allows an effective electric contact to be established with ease between at least some parts of the curved outer surface (6C) of the first element (6B) and the inner curved shaped surface (7B) of the second elements (7) at any time when the drop wire (6) has fallen from its normal operating position.

[0033] The vertical distance 'h' (Figure 4A) at which the first element (6B) is located from the running yarn (9) that supports a particular drop wire (6) depends on the overall configuration of the system of yarns. The distance should be such that upon yarn breakage detection, the circuit is closed within a reasonably short time period. The distance should also be such that there is no false alarm raised in situations where there is temporary loss of tension. However, there may be exceptional circumstances, where the loss of tension is due to abnormal or unexpected slack in an unbroken running yarn, where the drop wire (6) may drop sufficiently so that the circuit closes.

[0034] One feature of the present invention is its ability to distinguish between temporary slack in the warp and permanent breakage in the yarn/tape (9). In the experience of the inventor, in the situations where such exceptional situations occur, the yarn (9) resumes its normal operation once the slack is eliminated by the ongoing movement of the yarn (9). This may take a duration as small as 0.1 seconds and up to 2 seconds. Under such circumstances, it would be undesirable if the CWM shuts down simply because there was a circuit closure (which is typically indicative of yarn end detection).

[0035] In order to overcome such exceptional but potentially real problems, the device is provided with time monitoring facility. Time from any given closure of circuit is monitored and noted. In the case where there's no opening up of the circuit following from a circuit closure event within a predetermined period, it is indicative of a situation involving a yarn end or other undesirable event that suggests that it would be potentially harmful to allow the CWM to continue operation without intervention. In such situation the CWM is made to shut down and a notification signal is sent. The signal may be sent to a monitor. In the case where there's opening of the circuit within the predetermined period, no notification would be sent, however, the CWM will be permitted to continue operation.

[0036] In this manner, the inbuilt intelligent module eliminates possibility of any faulty alarm generation for temporary loosening in yarn/tape (9), and more importantly the consequent shutting down of the CWM. Temporary slack of warp yarn/tape (9) is very common in weaving machines which on account of false alarms consumes significant amount of resources in terms of time and manpower utilization as machine get down for this time period, which is always desirable to avoid under any circumstances.

[0037] It is evident from the foregoing discussion that the present invention has a number of embodiments.

[0038] While the above description contains much specificity, these should not be construed as limitation in the scope of the invention, but rather as an exemplification of the preferred embodiments thereof. It must be realized that modifications and variations are possible based on the disclosure given above. Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the appended claims.

Claims

1. A device for detecting breakage of or an end of warp yarns (9) or tapes on a fabric weaving loom, said device comprising:

a yarn-end detection means comprising:

- a drop wire (6) having an opening (6A) for passage of said warp yarn (9), and wherein said drop wire (6) is held in its normal operating position due to tension in said warp yarn (9); and
- a first element (6B) being fitted on the drop wire (6) and having an electrically conducting outer surface (6C), wherein the drop wire (6) and the first element (6B) are provided corresponding to each warp yarn (9);

an electric circuit of which said yarn-end detection means form a part, and a notification means to notify the breakage of or the end of the warp yarn (9), wherein the electric circuit comprises a pair of second elements (7) between which a physical gap (7A) is present; wherein each of said second elements (7) has an electrically conducting inner curved shaped surface (7B) corresponding to said drop wire (6) wherein said inner curved shaped surfaces (7B) are provided with a shape corresponding to that of said outer surface (6C) of the first element (6B), and wherein, subsequent to the falling of said drop wire (6) from its normal operating position due to substantial loss

of tension in said warp yarn (9), said electrical circuit gets completed by said electrically conducting outer surface (6C) of the first element (6B) and said electrically conducting inner curved shaped surfaces (7B) of the second elements (7) coming in contact with each other, thereby triggering the notification means for a notification signal generation of yarn/tape break or end.

- 5
2. A device as claimed in claim 1, **characterized in that** said electrically conducting outer surface (6C) is spatially curved, and said inner curved shaped surface (7B) has a number of sub-surfaces (7D), and wherein the interfaces between individual sub-surfaces (7D) are edges or points with said edges being sharp.
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3. A device as claimed in claims 1 or 2, **characterised in that** said notification signal is an audio or a visual or audio-visual signal, or a signal indicating apparatus failure sent to a monitor.
4. A device as claimed in any of claims 1 to 3, **characterised in that** said outer surface (6C) is substantially conical.
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5. A device as claimed in any of claims 1 to 4, **characterised in that** the device comprises a plurality of yarn-end detection means, wherein each of the yarn-end detection means is provided for a respective warp yarn (9).
6. A device as claimed in any of claims 1 to 5, **characterised in that** said notification means identifies the warp yarn (9) which has broken.
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7. A device as claimed in any of claims 1 to 6, **characterised in that** said notification signal is sent only in an event that said electric circuit remains closed for more than a predetermined time period.
8. A device as claimed in claim 7, **characterised in that** said predetermined time period is in the range between 0.1 to 2 seconds.
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9. A method for detecting breakage of or an end of warp yarns (9) or tapes on a circular weaving loom, **characterized in that** said method comprises the steps of
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- - providing a device as claimed in any one of claims 1 to 8,
 - - detecting the end of the warp yarn (9) or the breakage of the warp yarn (9) when the electrical circuit is completed upon substantial loss of elevation of the drop wire (6);
 - sending a notification signal indicating detection of the yarn end or the yarn breakage, and
 - stopping the work of said circular weaving loom.
- 35

Patentansprüche

- 40
1. Gerät bzw. Vorrichtung zum Erkennen von Bruch von oder einem Ende von Kettgarnen (9) oder Bändern an einer Gewebe- bzw. Stoffwebmaschine, wobei die Vorrichtung umfasst:
- ein Garnendeerkennungsmittel, umfassend:
- 45
- eine Lamelle (6) mit einer Öffnung (6A) für den Durchgang von dem Kettgarn (9) und wobei die Lamelle (6) durch Spannung auf dem Kettgarn (9) in ihrer normalen Betriebsposition gehalten wird; und
 - ein erstes Element (6B), das auf die Lamelle (6) montiert ist und eine elektrisch leitende äußere Fläche bzw. Außenfläche (6C) aufweist, wobei die Lamelle (6) und das erste Element (6B) entsprechend jeden Kettgarns bereitgestellt werden (9);
- 50
- ein elektrischer Stromkreis, von dem das Garnendeerkennungsmittel einen Teil bildet, und ein Benachrichtigungsmittel, um den Bruch oder das Ende des Kettgarns (9) anzuzeigen, wobei der elektrische Stromkreis ein Paar von zweiten Elementen (7) umfasst, zwischen denen eine physische Lücke (7A) besteht;
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- wobei jedes der zweiten Elemente (7) eine elektrisch leitende, innere, kurvenförmige Fläche (7B) aufweist, die der Lamelle (6) entspricht, wobei die inneren, kurvenförmigen Flächen (7B) mit einer Form versehen sind, die der der äußeren Fläche bzw. Außenfläche (6C) des ersten Elements (6B) entspricht, und wobei, anschließend an das Fallen der Lamelle (6) von ihrer normalen Betriebsposition aufgrund beträchtlichen

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Spannungsverlusts in dem Kettgarn (9) der elektrische Stromkreis dadurch geschlossen wird, dass die elektrisch leitende Außenfläche (6C) des ersten Elements (6B) mit den elektrisch leitenden, inneren, kurvenförmigen Flächen (7B) der zweiten Elemente (7) in Kontakt kommt und dadurch das Benachrichtigungsmittel für eine Erzeugung eines Benachrichtigungssignals für Garn-/Bandbruch oder -ende auslöst.

5

2. Gerät bzw. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die elektrisch leitende äußere Fläche bzw. Außenfläche (6C) räumlich gekrümmt ist und die innere, kurvenförmige Fläche (7B) eine Anzahl von unteren Flächen (7D) aufweist, und wobei die Grenzflächen zwischen einzelnen unteren Flächen (7D) Kanten oder Spitzen sind, wobei besagte Kanten scharfkantig sind.

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3. Gerät bzw. Vorrichtung nach einem der Ansprüche 1 und 2, **dadurch gekennzeichnet, dass** das Benachrichtigungssignal ein Audiosignal, ein visuelles Signal oder audiovisuelles Signal ist, oder ein Signal, das Geräteausfall anzeigt und an einen Monitor bzw. Bildschirm gesendet wird.

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4. Gerät bzw. Vorrichtung nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Außenfläche (6C) im Wesentlichen konisch ist.

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5. Gerät bzw. Vorrichtung nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Vorrichtung eine Mehrzahl von Garnendeerkennungsmitteln umfasst, wobei jedes der Garnendeerkennungsmittel für ein jeweiliges Kettgarn (9) bereitsteht.

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7. Gerät bzw. Vorrichtung nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Benachrichtigungssignal nur dann gesendet wird, wenn der elektrische Stromkreis länger als eine vorgegebene Zeitspanne geschlossen bleibt.

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8. Gerät bzw. Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** die vorgegebene Zeitspanne in dem Bereich zwischen 0,1 und 2 Sekunden liegt.

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9. Verfahren zum Erkennen von Bruch oder einem Ende von Kettgarnen (9) oder Bändern auf einer Rundwebmaschine, **dadurch gekennzeichnet, dass** das Verfahren die folgenden Schritte umfasst

- Bereitstellen eines Geräts bzw. einer Vorrichtung wie in einem der Ansprüche 1 bis 8 beansprucht,
- Erkennen des Endes des Kettgarns (9) oder des Bruchs des Kettgarns (9), wenn der elektrische Stromkreis aufgrund beträchtlichen Höhenverlusts der Lamelle (6) geschlossen wird;
- Senden eines Benachrichtigungssignals, das das Erkennen des Garnendes oder Garnbruchs anzeigt, und
- Beenden des Betriebs besagter Rundwebmaschine.

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Revendications

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1. Dispositif de détection de la rupture ou d'une extrémité de fils de chaîne (9) ou de rubans sur un métier à tisser un tissu, ledit dispositif comportant :

un moyen de détection de fin de fil comportant :

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- une lamelle d'arrêt (6) ayant une ouverture (6A) pour le passage dudit fil de chaîne (9) et dans lequel ladite lamelle d'arrêt (6) est maintenue dans sa position de fonctionnement normale en raison d'une tension dans ledit fil de chaîne (9) ; et
- un premier élément (6B) étant aménagé sur la lamelle d'arrêt (6) et ayant une surface extérieure (6C) électriquement conductrice, dans lequel la lamelle d'arrêt (6) et le premier élément (6B) sont prévus de manière correspondante sur chaque fil de chaîne (9) ;

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un circuit électrique dont fait partie ledit moyen de détection de fin de fil et un moyen de notification pour notifier la rupture ou la fin du fil de chaîne (9), dans lequel le circuit électrique comporte une paire de seconds éléments (7) entre lesquels un espace physique

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(7A) est présent ;

dans lequel chacun desdits seconds éléments (7) a une surface de forme incurvée intérieure (7B) électriquement conductrice correspondant à ladite lamelle d'arrêt (6)

dans lequel lesdites surfaces de forme incurvée intérieures (7B) sont dotées d'une forme correspondant à celle de ladite surface extérieure (6C) du premier élément (6B) et

dans lequel, à la suite de la chute de ladite lamelle d'arrêt (6) depuis sa position de fonctionnement normale en raison d'une perte substantielle de tension dans ledit fil de chaîne (9), ledit circuit électrique est terminé par le fait que ladite surface extérieure (6C) électriquement conductrice du premier élément (6B) et lesdites surfaces de forme incurvée intérieures (7B) électriquement conductrices des seconds éléments (7) entrent en contact les unes avec les autres, ce qui déclenche le moyen de notification pour la production d'un signal de notification de rupture ou de fin de fil/ruban.

2. Dispositif selon la revendication 1, **caractérisé en ce que** la surface extérieure (6C) électriquement conductrice est incurvée spatialement et ladite surface de forme incurvée intérieure (7B) a un certain nombre de sous-surfaces (7D) et dans lequel les interfaces entre des sous-surfaces (7D) individuelles sont des bords ou des points, lesdits bords étant pointus.
3. Dispositif selon les revendications 1 ou 2, **caractérisé en ce que** ledit signal de notification est un signal audio ou un signal visuel ou un signal audiovisuel ou un signal indiquant une défaillance d'appareil envoyé à un moniteur.
4. Dispositif selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** ladite surface extérieure (6C) est sensiblement conique.
5. Dispositif selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** le dispositif comporte une pluralité de moyens de détection de fin de fil, dans lequel chacun des moyens de détection de fin de fil est prévu pour un fil de chaîne (9) respectif.
6. Dispositif selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** ledit moyen de notification identifie le fil de chaîne (9) qui s'est rompu.
7. Dispositif selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** ledit signal de notification est envoyé uniquement dans un cas où ledit circuit électrique reste fermé plus longtemps que pendant une période prédéfinie.
8. Dispositif selon la revendication 7, **caractérisé en ce que** ladite période prédéfinie est comprise dans la plage entre 0,1 et 2 secondes.
9. Procédé de détection de rupture ou de fin de fils de chaîne (9) ou de rubans sur un métier à tisser circulaire, **caractérisé en ce que** ledit procédé comporte les étapes de
 - fourniture d'un dispositif selon l'une quelconque des revendications 1 à 8,
 - détection de l'extrémité du fil de chaîne (9) ou de la rupture du fil de chaîne (9) lorsque le circuit électrique est achevé en cas de perte substantielle d'élévation de la lamelle d'arrêt (6) ;
 - envoi d'un signal de notification indiquant la détection de la fin du fil ou d'une rupture du fil et
 - arrêt du travail dudit métier à tisser circulaire.

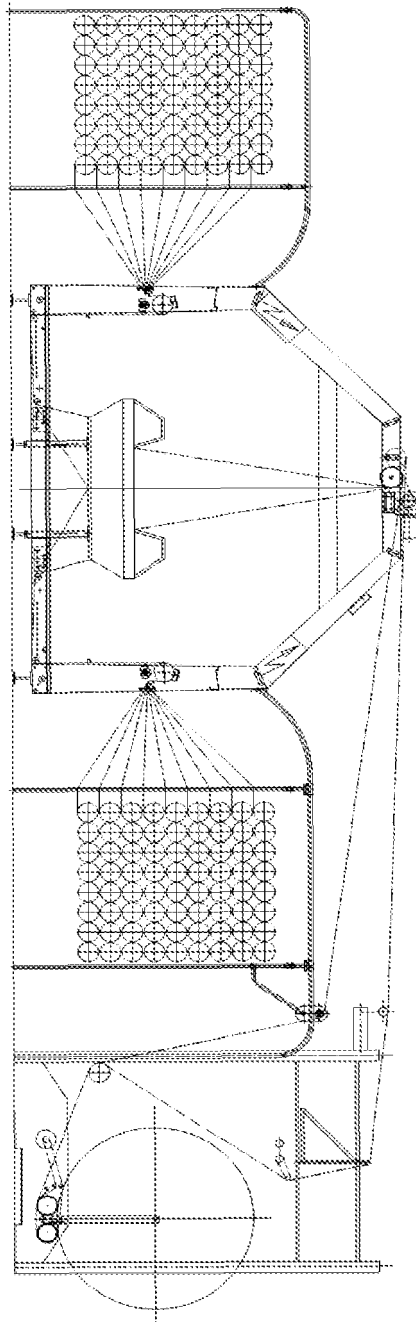


Figure 1

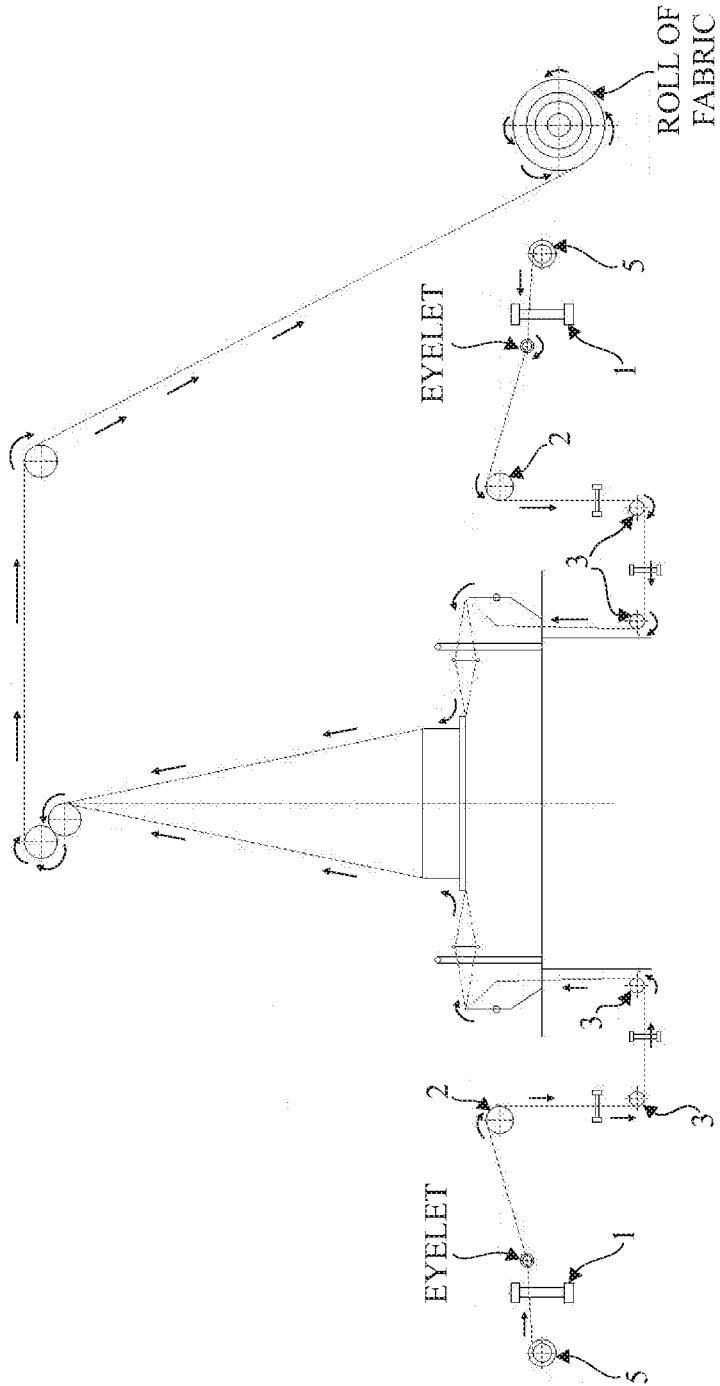


Figure 2

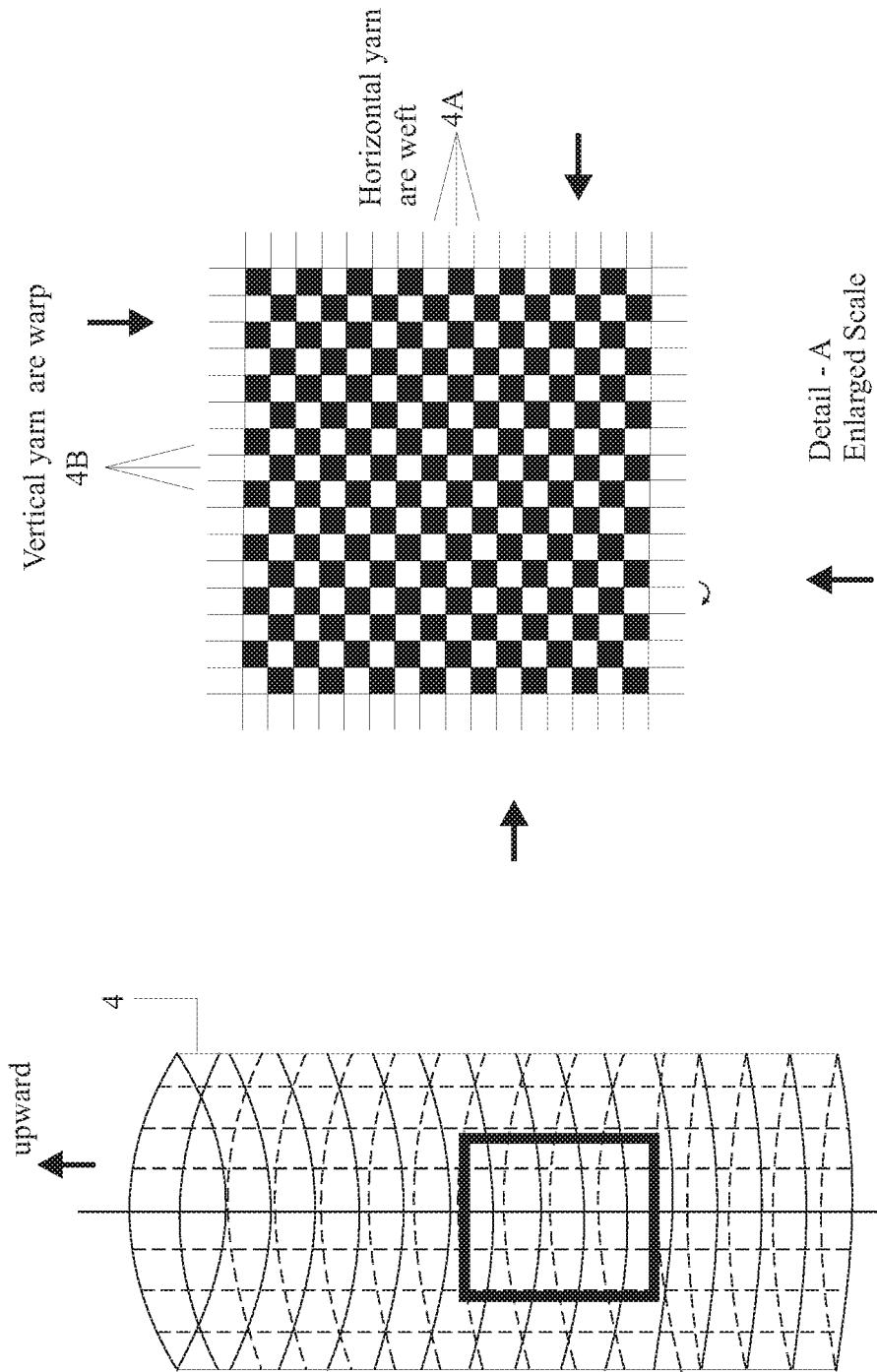
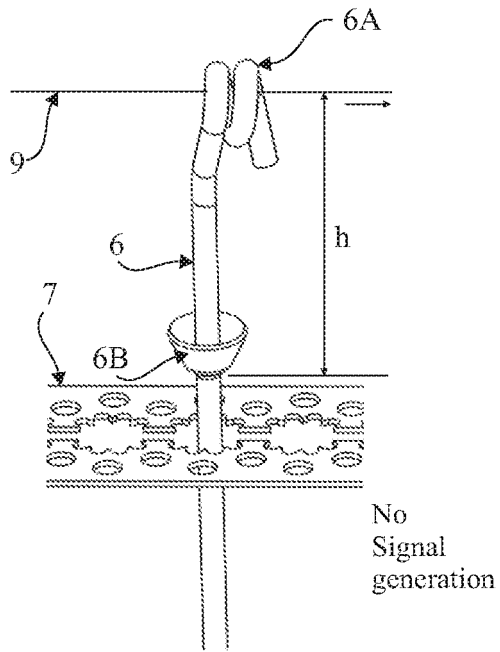
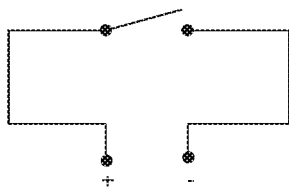


Figure 3

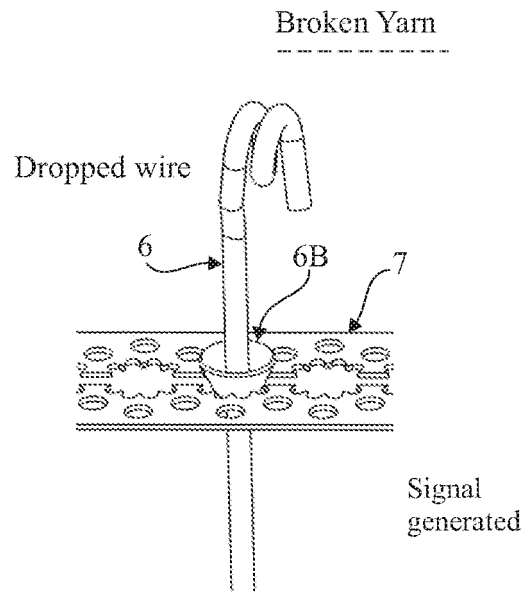


Equivalent electrical circuit:

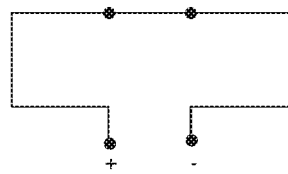


OFF
Before warp ends

Figure 4A



Equivalent electrical circuit:



ON
After warp ends

Figure 4B

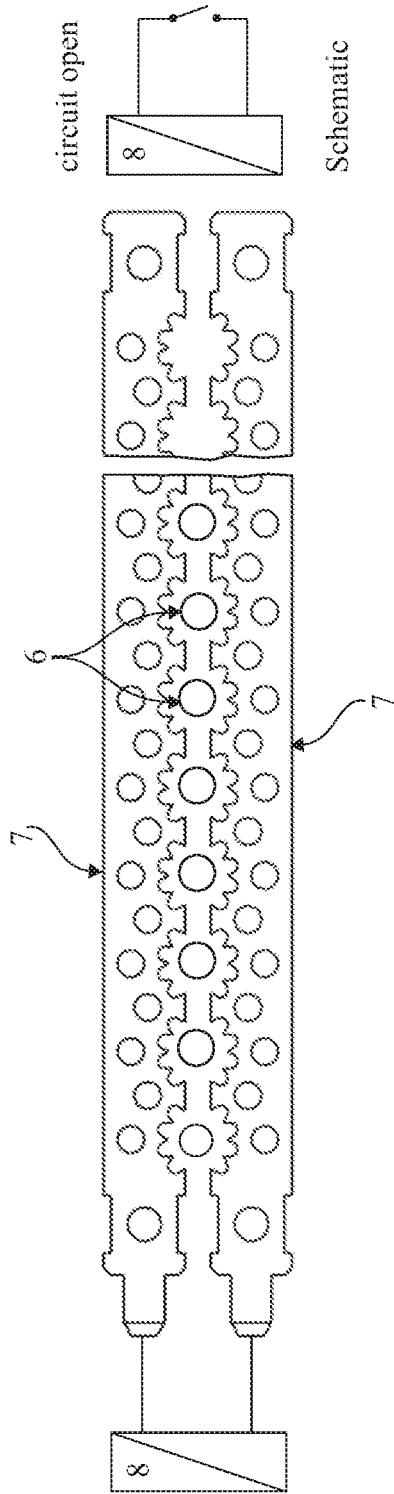


Figure 5A

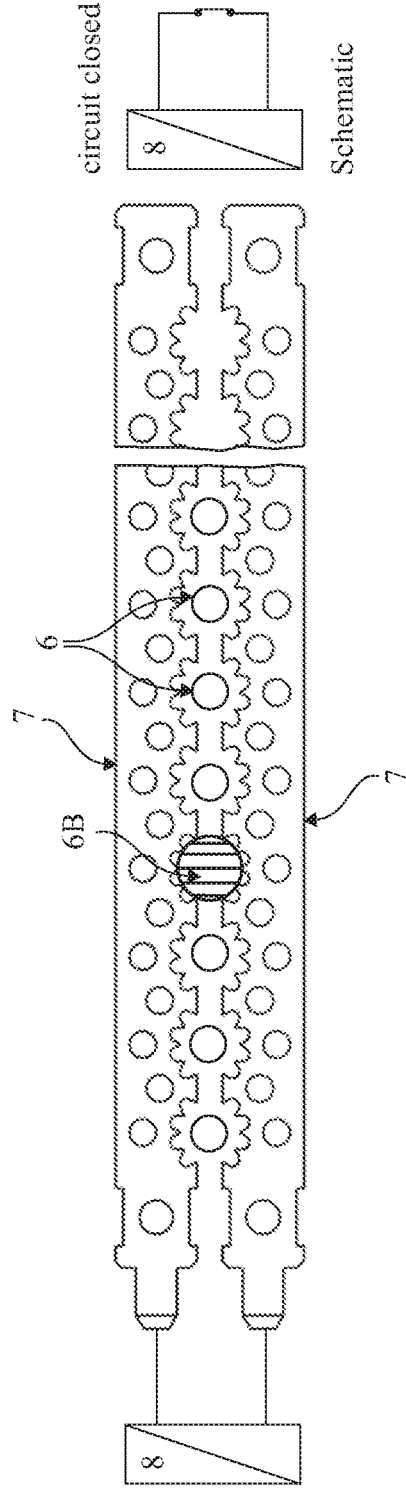


Figure 5B

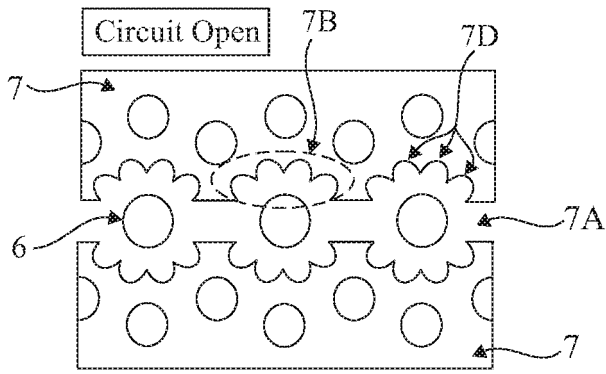


Figure 6B

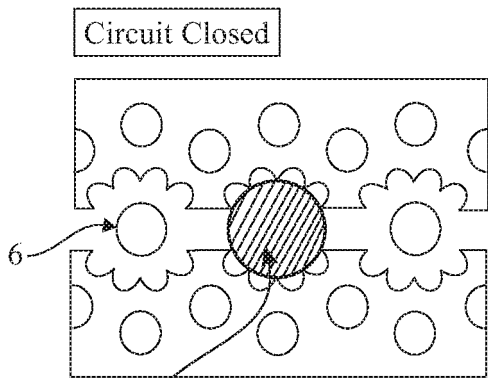


Figure 6C

6B

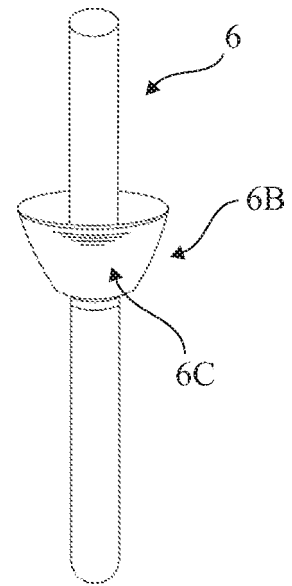


Figure 6A

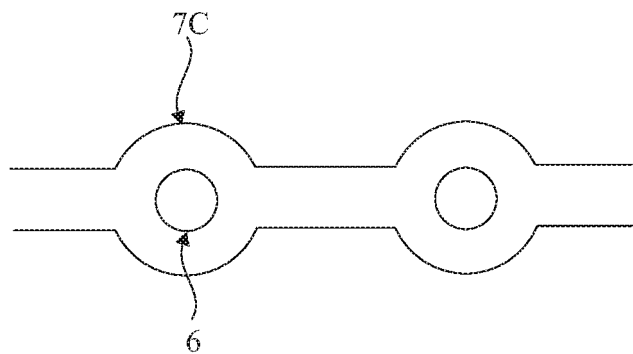


Figure 6D

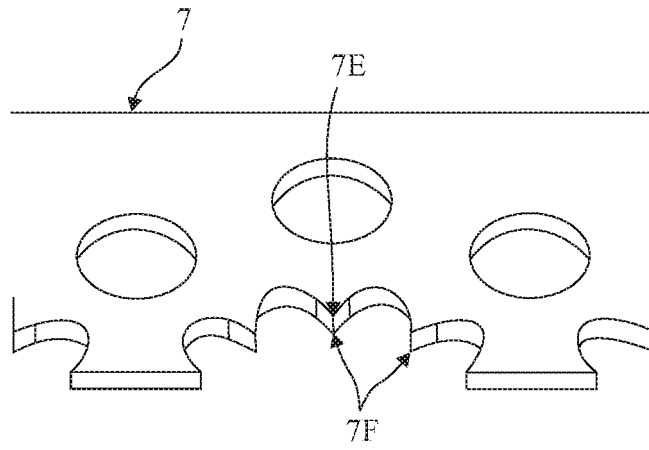


Figure 7