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Kaalverink

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[54] **DEVICE FOR DETECTING A TEXTILE THREAD CARRIED THROUGH A CHANNEL**

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[52] **U.S. Cl.** **356/199,** 139/370, 250/571, 356/200, 356/238

[51] **Int. Cl.** **G01m 21/18,** G01m 21/30

[58] **Field of Search** ..... 356/199, 200, 238; 139/127 P, 273 A, 370; 250/578, 571

[56] **References Cited**

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[57] **ABSTRACT**

A reed beam has mounted thereon a series of reed blades which have, in their beating edges, aligned U-shaped notches forming a transport channel for the weft. A stationary blowing nozzle is in position to project a weft thread through such aligned notches when the reed is retracted. An apparatus for projecting a substantially parallel beam of light is carried by the reed beam and is arranged to project, through the space between at least two adjacent blades at the end of the reed beam remote from said blowing nozzle, a beam of light covering substantially the entire area of a notch. A photoelectric receiver comprising a series of light-sensitive elements is arranged to receive at least a portion of such beam of light that extends substantially across the width of a notch.

7 Claims, 5 Drawing Figures

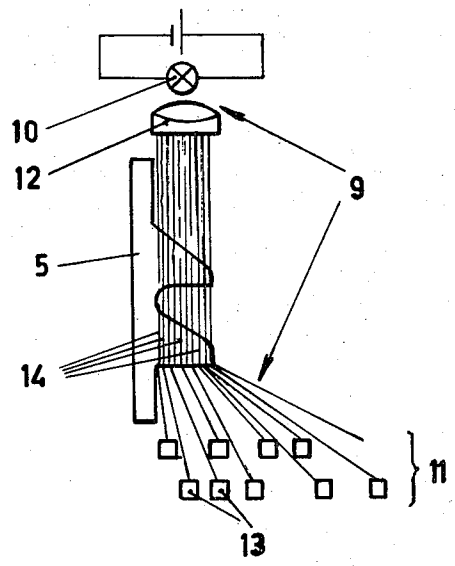


FIG. 1

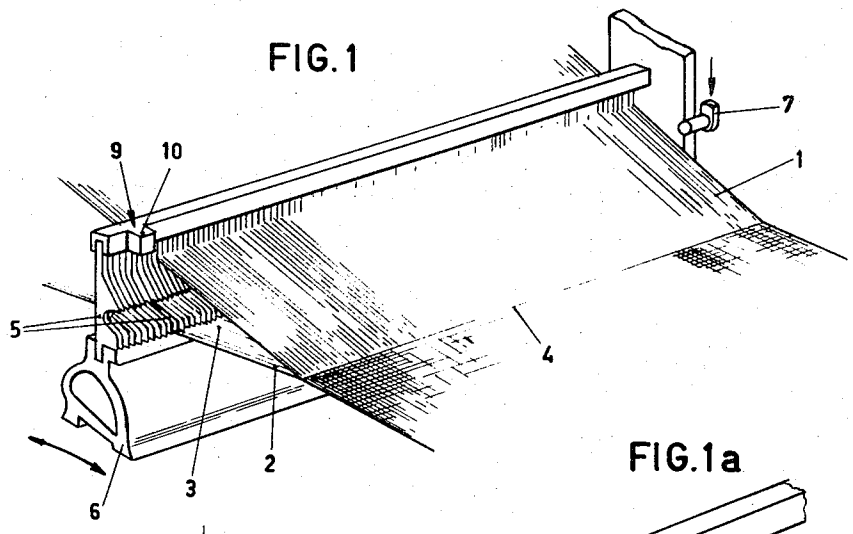


FIG. 1a

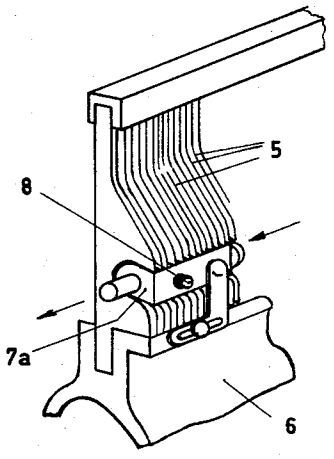


FIG. 2

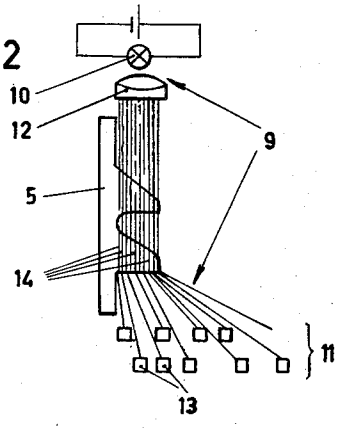


FIG. 4

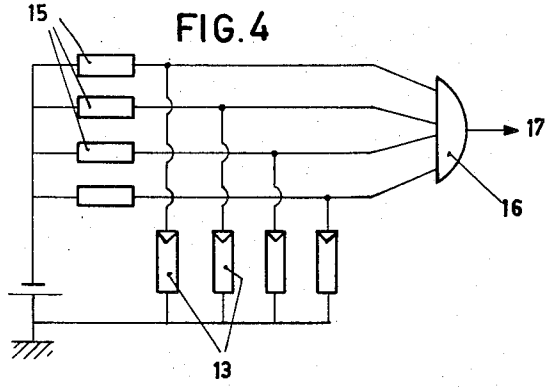
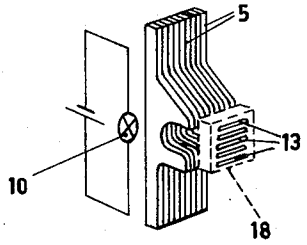


FIG. 3



DEVICE FOR DETECTING A TEXTILE THREAD CARRIED THROUGH A CHANNEL

BACKGROUND OF THE INVENTION

The invention relates to a device for detecting a textile thread carried through a channel, particularly a weft thread carried through the weaving shed of a shuttleless weaving loom, said device comprising a source of light and a photoelectric receiver co-operating therewith.

Such a detection device is known e.g., from British Pat. No. 1,236,346.

In this known device the source of light emits a single light ray in a substantially vertical direction intersecting the tunnel-shaped transportation path of the weft thread. Since the position of the weft in its transportation path may vary considerably not only in vertical direction but also transverse to the weft direction, a positive movement of the weft transverse to the weft direction is imperative in this detection device in order to be able to determine whether or not a weft has been inserted into the weaving shed. Now in the known detection device said movement transverse to the weft direction takes place during the beating up movement of the reed. For this purpose the weft is constrained to move in a longitudinal discharge slot provided in a transportation tunnel secured to the reed proper, in which slot the components of the detection device are mounted.

A disadvantage of this known weft detection device is that the detection of the weft occurs in a relatively late stage viz. only when the beating up phase of the reed has already started.

SUMMARY OF THE INVENTION

The invention aims at removing the above-mentioned disadvantage of the known weft detection device.

This aim is attained according to the invention in that the source of light is adapted to emit from one side light rays covering the complete cross-section of the transport channel for the weft, the photoelectric receiver comprising a series of closely adjacent light-sensitive elements covering the full width of the transport channel.

This device has the advantages that the detection of the weft may occur at a suitable point of time during the inserting phase, and that it is not necessary to impart first a special transverse movement to the weft. With the device according to the invention it is e.g., also possible to detect at the beginning of the inserting phase.

The parallel light rays required for an optimal detection may be obtained by having the source of light, e.g., a Ga-As diode, co-operate with a (collimator) lens.

A special embodiment is obtained if a laser is used as the source of light.

The light-sensitive components may be mounted directly, combined into one assembly, against or in the wall of the transport channel, or may communicate with the transport channel chamber through optical connection by optical fibres.

The detection method according to the invention as applied to a shuttleless weaving machine, in which the transport channel is delimited by substantially U-shaped reed blades, offers the further possibility to tension the weft at the end of the inserting phase and during the beating up by the reed, in a very simple and effective way. It has been proposed to use a special reception and tensioning lever mechanism for tensioning the weft. In connection with the transverse movement of the weft, which has been indispensable for the detection, this mechanism is relatively complicated. With the application of the weft detection device according to the invention it is now possible to simply use a blowing nozzle carried by the reed at the end of the transport channel for tensioning the weft. Such a blowing nozzle should have small dimensions in order to obtain a sufficient tensioning action with a reasonable air consumption, and therefore the transport channel should have a correspondingly small cross-sectional area in order that such blowing nozzle may catch with certainty the inserted weft. A weaving machine of the type to which the invention is particularly applicable and in which the transport channel is delimited by the assembly of substantially U-shaped reed blades satisfies said last-mentioned condition. The "diameter" of the transport channel may then amount to 6 mm or less.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic perspective view of a weaving shed of a shuttleless weaving machine;

FIG. 1A is a perspective view on an enlarged scale of the left end portion of the reed according to FIG. 1, in which a blowing nozzle has been provided in the end of the transport channel, the detection device being omitted for clarity;

FIG. 2 is a cross-section through the transport tunnel formed by U-shaped blades, with the schematically shown detection device in a first embodiment;

FIG. 3 is a schematic view of the detection device according to the invention in a second embodiment, and

FIG. 4 is an electrical control diagram including the photo-sensitive components of the detection device.

In FIG. 1 in the shed 3 formed by the upper and lower warp threads 1 and 2, a somewhat tunnel-shaped transport channel having one side opening toward the beating up line 4 is formed by the substantially U-shaped reed blades 5, which are set in the reed beam 6.

The reed, comprising the reed beam 6 and the blades 5, is in FIG. 1 in its retracted position. In this position the transport channel formed by the reed blades 5 extends in alignment with the axis of the blowing nozzle schematically indicated at 7, which nozzle may launch the weft through the tunnel by means of an air jet. The launched weft is then received at the side remote from the blowing nozzle 7 by a similar blowing nozzle 7*a* (see FIG. 1A) mounted in the end portion of the tunnel, beyond the lateral edge of the cloth. Said blowing nozzle 7a serves for tensioning the weft and keeping it tensioned during the beating up movement of the reed. Therefore the nozzle 7*a* is supplied with air through a flexible connector 8 at the same time as or very shortly after the nozzle 7, and at least up to the end of the beating up movement of the reed. When the reed is retracted the end of the weft inserted into the cloth frees itself from the blowing nozzle 7*a* and is received in a suction nozzle in a manner known per se, and thereafter is cut by a cutting device.

In order to be able to determine at a certain moment, e.g., at or near the end of the weft inserting phase, whether indeed a weft has been inserted into the shed, a weft detection device 9 is mounted at the end of the

reed 5, 6 remote from the blowing nozzle 7. The weft detection device 9 comprises a source of light 10 and the photoelectric receiver 11.

The source of light 10 is adapted to emit a series of parallel light rays which cover the complete cross-section of the tunnel. Therefore a collimator lens 12 is used in the embodiment shown which converts the light of the source of light 10, which may be considered as a point of light, e.g., a Ga-As diode laser, into a beam of sufficiently parallel light rays.

The photoelectric receiver 11 comprises a plurality of light-sensitive components 13 which, in the embodiment of FIG. 2, each communicate with one of the bundles of optical fibres 14 provided in the slot-shaped space between the lower U-legs of two adjacent reed blades 5. The separate bundles of optical fibres 14 each form a light conductor to one of the light-sensitive components 13. The width of the fibre bundles is preferably in the order of the (average) diameter of the yarn to be used by the particular weaving machine, while the spacing between the bundles of fibres is small relative to said diameter. A weft passing the weft detection device under these conditions will always obscure such portion of the (light) entrance surface of a light conductor (bundle in optical fibres) that a considerable change of the quantity of light transmitted by that light conductor occurs and thereby a relatively strong detection signal will be generated.

In the embodiment according to FIG. 3 the weft detection device is positioned horizontally, i.e., the source of light 10 is mounted at the back of the reed blades and emits a horizontal beam of light through a number (e.g., three) of adjacent slots towards the photoelectric device mounted at the open side of the reed tunnel, the separate components 13 of that device being united, as is schematically indicated, to an integrated semi-conductor device 18. The photoelectric device thereby is adapted to receive a light beam covering several adjacent reed tunnel slots, and therefore a light beam which is large as seen in the direction of movement of the weft. Thereby a more simple and at the same time more reliable structure is obtained.

In the diagram of FIG. 4 the light-sensitive components 13 (four being indicated in this diagram), each having a series-resistance 15 connected in parallel therewith, are connected to the inputs of an OF-gate 16. If no weft is present in the reed tunnel all light-sensitive components 13 receive the maximum quantity of light and they have their low resistance whereby all inputs of the OF-gate 16 are closed and that OF-gate does not deliver an output signal. However, as soon as a light-sensitive component 13 is completely or partially obscured when a weft passes, the resistance of that component increases and an input signal is delivered to the corresponding input of the OF-gate, which results in a positive output signal 17 which indicates that the drive of the weaving machine may be continued.

I claim:

1. In a shuttleless loom having apparatus for detecting the insertion of a weft through the shed, comprising a reed beam having mounted thereon a series of reed blades which have, in their beating edges, aligned U-shaped notches forming a transport channel for the weft, and a stationary blowing nozzle which is in position to project a weft thread through such aligned notches when the reed is retracted, wherein the improvement comprises an apparatus for projecting a substantially parallel beam of light which is carried by the reed beam and is arranged to project, through the space between at least two adjacent blades at the end of the reed beam remote from said blowing nozzle, a beam of light covering substantially the entire area of a notch, and a photoelectric receiver comprising a series of light-sensitive elements arranged to receive at least a portion of such beam of light that extends substantially across the width of a notch.

2. A device according to claim 1, characterized in that the light-sensitive elements are in optical connection with the transport channel through bundles of optical fibres.

3. A device according to claim 1, characterized in that the light-sensitive components are united in one assembly and are provided directly in the wall of the transport channel.

4. A device according to claim 2, characterized in that the bundles of optical fibres are provided in the spacings between the blades.

5. A device according to claim 3, characterized in that the light-sensitive elements are mounted at the open side of the channel.

6. A device according to claim 1, comprising a device for tensioning the weft at the end of the inserting phase and during the beating up by the reed, characterized in that said device for tensioning the weft is constituted by a blowing nozzle carried by the reed at the end of the transport channel.

7. A device according to claim 6, characterized in that the blowing nozzle is mounted in a portion of the transport channel extending laterally beyond the weaving shed.

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