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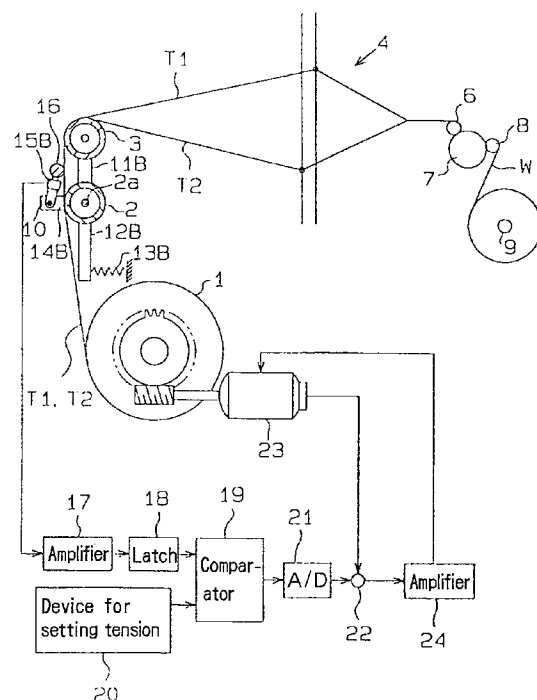
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(54) **Apparatus for detecting warp tension in a loom.**

(57) To provide a warp tension detecting apparatus in a loom which can permit accurate warp let-off controlling by detecting true warp tension.

The tension levers (11A, 11B) and easing levers (12A, 12B) are supported on the loom frame by way of the shaft (2a) for integral swinging movement. The back roller (2) is rotatably supported by the shaft (2a), and the tension levers (11A, 11B) carry rotatably at their upper ends the tension roller (3). The arm portions (14A, 14B) of the tension levers have the pressure detectors (15A, 15B) and the tension detecting roll (16). The tension detecting roll (16) is adapted to detect the tension of warp yarns (T1, T2) and transmit the tension to the pressure detectors (15A, 15B).

F i g . 1



The present invention relates to a warp tension detecting apparatus in a loom wherein the tension of warp yarns being let off from a warp beam is detected and the rotation of the warp beam is controlled on the basis of information resulting from the detection of warp tension.

Publication of unexamined Japanese patent application No. 63-42941 (1988) discloses a warp letting-off apparatus in a weaving loom, having a tension roller which is loaded by a balance weight for contact with warp yarns extending between a warp beam and weaving station of the loom. The tension roller is displaceable toward and away from the weaving station in response to a change of warp tension exerted thereto and this displacement of the tension roller is transmitted to a speed change lever on warp beam driving transmission. That is, the rotational speed of the warp beam, hence the rate at which warp yarns are let off from the warp beam, is controlled according to the tension roller displacement in such a way that warp tension is maintained substantially constant. In other words, warp tension is detected in terms of tension roller displacement.

Publication of unexamined Japanese patent application No. 1-42941 (1989) discloses an apparatus, including a detecting lever which is swingably mounted on a loom frame and has at its lower end a load cell connected thereto and at its upper end a tension lever swingably mounted thereto. The tension lever in turn has at its upper end a tension roller. An easing spring is installed between the other end of the tension lever and the loom frame to take up the periodic variation of warp tension occurring during normal weaving operation of the loom. Warp tension applied to the tension roller is transmitted through the tension lever and detecting lever to the load cell which generates electrical signals accordingly. The rate of warp let-off is controlled in response to such electrical signals in such a way that the warp tension is maintained substantially constant at all times.

In the above arrangements for detecting warp tension, load exerted to opposite bearings of the tension roller is regarded as the warp tension, which means that the load cell will also respond to the force of inertia developed by the tension roller displacing to absorb the periodic warp tension variation and, therefore, the operation of the speed-change transmission for the warp beam is influenced by such inertia force. As a result, the signal generated by the load cell, i.e. speed change controlling of the transmission, fails to correspond to actual warp tension, so that the desired accuracy of warp let-off controlling cannot be accomplished. When the warp tension is relatively low, the influence of friction between the tension roller and its bearings on the load cell becomes noticeable, thus affecting the accuracy in detecting the warp tension.

Therefore, it is an object of the present invention to provide a warp tension detecting apparatus in a

loom which can permit accurate warp let-off controlling by detecting true warp tension.

According to the present invention, there is provided a warp tension detecting apparatus in a weaving loom, comprising support member swingably provided on frame of the loom, a tension roller supported by said support member for guiding warp yarns while applying tension thereto, means for absorbing variation of warp tension by allowing said support member to swing in synchronism with the shedding movement of said warp yarns to thereby change the path of warp yarns over said tension roller, and means supported by said support member for contact with the warp yarn moving over said tension roller for detecting the tension of said warp yarns.

In the warp tension detecting apparatus according to the invention, the tension roller and the warp tension detecting means can swing integrally together with the support member and the detecting means can detect the warp tension directly without intervention of the tension roller. Therefore, the warp tension detecting means is free from the influence of the tension roller such as the force of inertia developed by its swinging motion. The result is that, unlike the conventional apparatus which detects apparent warp tension under the influence exerted by the tension roller, the warp tension detecting means according to the invention is capable of detecting true warp tension.

The examples that follow explain the invention. Ways of carrying out the invention are described below with reference to the drawings, which illustrate only specific embodiments.

FIG. 1 is a schematic view showing an embodiment of apparatus for detecting warp tension and feeding warp yarns in a weaving loom according to the present invention; and

FIG. 2 is a perspective view showing an arrangement for detecting warp tension.

The following will describe an embodiment of the apparatus according to the invention with reference to FIGS. 1 and 2. Referring to FIG. 1, a number of warp yarns T1, T2 unwound from a warp beam 1 are fed toward a weaving station 4 of the loom by way of a back roller 2 and tension roller 3. The warp yarns T1, T2 are woven with weft yarns (not shown) at the weaving station 4 into a fabric W, which is moved via an expansion bar 6, surface roller 7 and press roller 8 to be taken up round a winding shaft 9.

Referring also to FIG. 2, the back roller 2, which is of a hollow construction as shown in FIG. 1, is rotatably supported on loom frames by way of a shaft 2a extending through the back roller 2. A pair of L-shaped tension levers 11A, 11b having arm portions 14A, 14B are swingably supported on the shaft 2a adjacently to the back roller 2, and a pair of easing levers 12A, 12B is supported on the shaft 2a for integral swinging with the tension levers 11A, 11B. The tension roller 3, which is also made hollow, is rotatably

supported by and between the upper distal ends of the tension levers 11A, 11B.

Easing springs 13A, 13B are installed between the respective easing levers 12A, 12B and loom frame. During weaving operation of the loom, the tension levers 11A, 11B and easing levers 12A, 12B are swung integrally about the shaft 2a together with the tension roller 3 then swinging alternately toward and away from the weaving station 4 in synchronism with the periodic shedding movement of warp yarns T1, T2 and beating-up operation of a reed of the loom. Thus, the tension of warp yarns T1, T2 is maintained substantially constant independently of the shedding and beating operation of the loom in the manner as well known in the art.

Between the arm portions 14A, 14B of the tension levers 11A, 11B is disposed a support bar 10 having at its opposite ends a pair of pressure detectors 15A, 15B. Additionally, a tension detecting roll 16 is supported on the pressure detectors 15A, 15B. As shown in FIGS. 1 and 2, this tension detecting roll 16 is located between the back roller 2 and tension roller 3 at such position where it is kept in contact with warp yarns T1, T2 for detecting the warp tension and then transmitting the same to the pressure detectors 15A, 15B.

As shown schematically in FIG. 1, the pressure detectors 15A, 15B are electrically connected through an amplifier 17 and latch 18 to a comparator 19 to which an input device 20 for setting the desired tension is electrically connected. The comparator 19 is operable to compare the information of warp tension received from the pressure detectors 15A, 15B with the tension setting stored in the device 20 and also to generate a compensation signal, which corresponds to the tension difference as obtained through the comparison, to an adder 22 through an A/D converter 21.

The adder 22 is operable to add a signal from a warp beam driving servomotor 23, which signal is representative of the rotational speed of that servomotor, and the compensation signal transmitted from the comparator 19 to thereby transmit a control signal back to the servomotor 23 through an amplifier 24 for feedback controlling. Thus, the rotational speed of the servomotor 23, i.e. the rate at which warp yarns T1, T2 are let off from the warp beam 1, is controlled.

As it is apparent from the foregoing, those parts in the above-described embodiment which include the tension levers 11A, 11B, easing levers 12A, 12B, tension roller 3, pressure detectors 15A, 15B and tension detecting roll 16 can swing as an integral unit. Therefore, the position of the tension detecting roll 16 relative to the tension roller 3 is unchanged by the periodic swinging operation of the latter tension roller 3, whereby that the detecting roll is free from the influence of the force of inertia developed by the tension roller. Unlike the conventional apparatuses

which only detect apparent warp tension due to the influence of the inertia force of the tension roller 3, the pressure detectors 15A, 15B in the above embodiment can detect true warp tension. Thus, the warp let-off by the servomotor 23 can be controlled with a high accuracy and, therefore, successful maintenance of warp tension can be accomplished.

It is noted that warp tension detecting instrument used in conventional apparatus has been subjected to load due to the inertia force of its tension roller and, therefore, required to be made with sufficient strength to resist vibration and other harmful influences, which has made the instrument expensive. In the above embodiment of the invention, however, the pressure detectors 15A, 15B which only have to carry the load of warp tension does not require the use of robust and hence expensive detecting instrument. Additionally, because the detectors can be used for a prolonged period of service, the embodiment is advantageous in terms of economy of the pressure detecting instrument.

In the above embodiment wherein the hollow tension roller 3 is supported by the tension levers 11A, 11B which are connected by the shaft 2a extending axially through the back roller 2, the tension roller 3 does not have to incorporate therein a heavy part like a shaft extending therethrough. This can help reduce the moment of inertia of the swinging members such as the tension levers 11A, 11B, easing levers 12A, 12B, tension roller 3, pressure detectors 15A, 15B and tension detecting rolls 16. Accordingly, the responsibility in swinging motion of these members, particularly the responsibility of the tension roller 3 can be improved.

It is noted that the present invention is not limited to the above-described embodiment, but it can be practiced in other changes and modifications as exemplified below.

(1) Though in the above embodiment warp tension is detected in the region between the back roller 2 and the tension roller 3, the pressure detectors 15A, 15B and the tension detection roll 16 may be located below the arm portions 14A, 14B of the tension levers 11A, 11B so that the warp tension is detected in the region between the back roller and the warp beam 1.

(2) In the embodiment, tension of all warp yarns T1, T2 is detected by the tension detecting roll 16, it may be so arranged that warp yarns only in a given region is detected.

As it is now apparent from the foregoing description, according to the present invention wherein the warp tension detecting means is carried by a support member which also carries the tension roller, the tension roller, support member and warp tension detecting means can swing as an integral unit. Therefore, the position of the tension detecting means relative to the tension roller is unchanged by the swinging mo-

tion of the tension roller, with the result that the tension detecting means is free from the influence of the force of inertia developed by the tension roller and thus capable of detecting true warp tension.

To provide a warp tension detecting apparatus in a loom which can permit accurate warp let-off controlling by detecting true warp tension.

The tension levers 11A, 11B and easing levers 12A, 12B are supported on the loom frame by way of the shaft 2a for integral swinging movement. The back roller 2 is rotatably supported by the shaft 2a, and the tension levers 11A, 11B carry rotatably at their upper ends the tension roller 3. The arm portions 14A, 14B of the tension levers have the pressure detectors 15A, 15B and the tension detecting roll 16. The tension detecting roll 16 is adapted to detect the tension of warp yarns T1, T2 and transmit the tension to the pressure detectors 15A, 15B.

BRIEF EXPLANATION OF THE DRAWINGS

FIG. 1 is a schematic view showing an embodiment of apparatus for detecting warp tension and feeding warp yarns in a weaving loom according to the present invention; and

FIG. 2 is a perspective view showing an arrangement for detecting warp tension.

DESIGNATION OF REFERENCE NUMERALS

1 Warp beam; 3 Tension rollers; 11A, 11B Tension levers as part of the support member; 12A, 12B Easing levers as part of the support member; 14A, 14B Easing springs as part of the means for maintaining warp tension substantially constant; 15A, 15B Pressure detectors as part of the warp tension detecting means; 16 Tension detecting roll as part of the warp tension detecting means; T1 T2 Warp yarns.

Claims

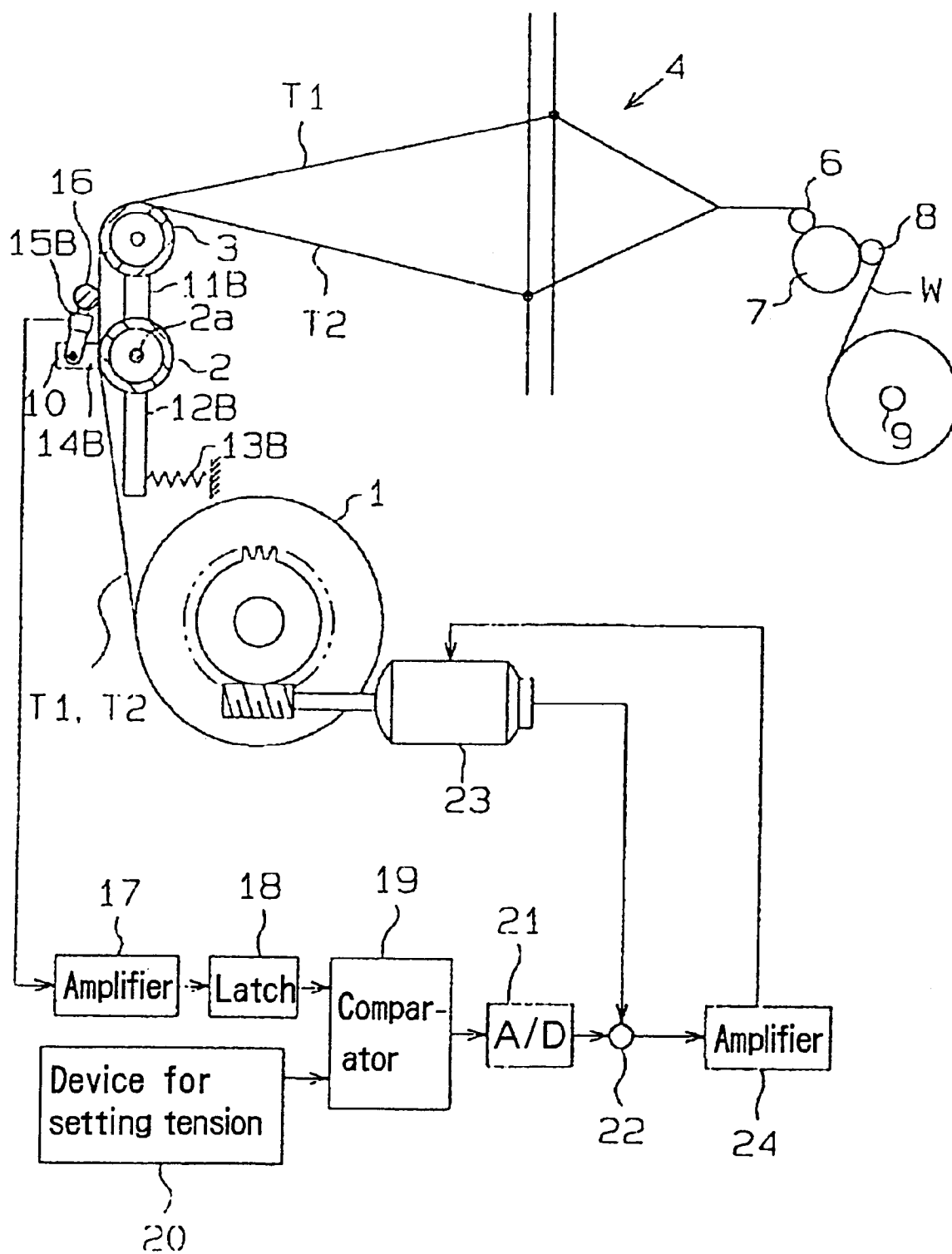
1. Apparatus for detecting warp tension in a loom wherein the tension of warp yarns (T1, T2) being let off from a warp beam (1) is detected and the rotation of said warp beam (1) is controlled on the basis of information resulting from the detection of warp tension, said apparatus comprising:
 - support member (11A, 11B) swingably provided on frame of the loom;
 - a tension roller (3) supported by said support member (11A, 11B) for guiding warp yarns (T1, T2) while applying tension thereto;
 - means (13A, 12B) for absorbing variation of warp tension by allowing said support member (11A, 11B) to swing in synchronism with the shedding movement of said warp yarns (T1, T2) to

thereby change the path of warp yarns (T1, T2) over said tension roller (3); and

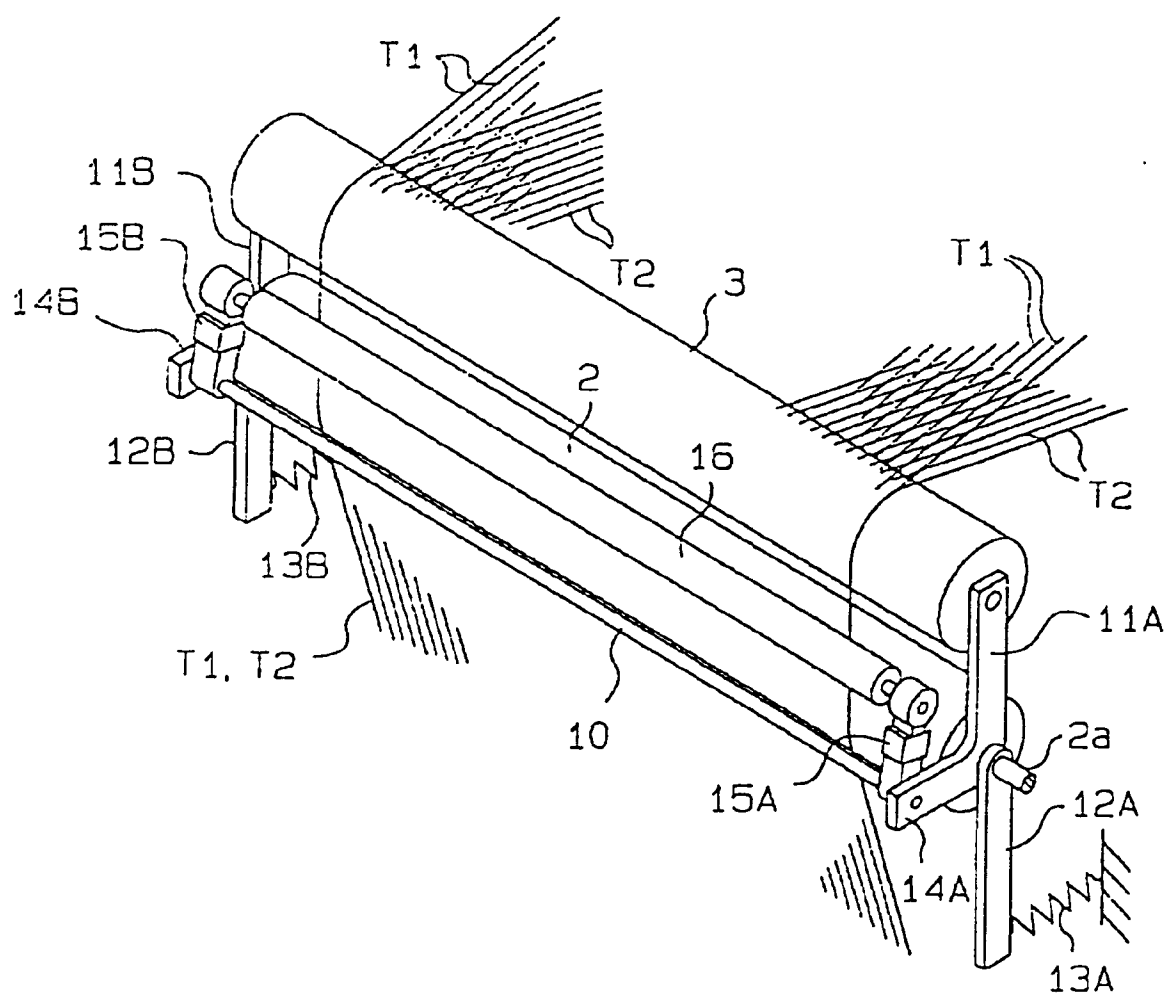
means (14A, 14B, 15A, 15B, 16) supported by said support member (11A, 11B) for contact with the warp yarns (T1, T2) moving over said tension roller (3) for detecting the tension of said warp yarns (T1, T2).

2. Apparatus as claimed in claim 1, further comprising support means (2), for backing said warp yarns (T1, T2) and being positioned between said tension roller (3) and said warp beam (1)
3. Apparatus as claimed in claim 1 or claim 2, said means (14A, 14B, 15A, 15B, 16) for detecting the tension of said warp yarns being positioned in the path of the warp yarns (T1, T2) and between said support means (2) and said tension roller (3).
4. Apparatus as claimed in any of claims 1 to 3, said means (14A, 14B, 15A, 15B, 16) for detecting the tension of said warp yarns is extending over a part or parts of the warp yarns (T1, T2) only and is detecting the tension of that part or that parts of the warp yarns (T1, T2) only.
5. Apparatus as claimed in any of claims 1 to 4, further comprising control means (17, 18, 19, 20, 21, 22, 24) for controlling the speed of the motor (23) driving said warp beam (1), according to the warp tension detected by said warp tension detecting means (15A, 15B).
6. Loom with an apparatus as claimed in any of claims 1 to 5.

F i g. 1



F i g . 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 81 0750

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.5)
A	CH-A-559 793 (PATAX TRUST) * the whole document *	1, 5, 6	D03D49/04
A	DE-A-3 833 685 (MERTENS & FROWEIN)		
A	BE-A-777 545 (MICHEL VAN DE WIELE)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D03D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 JANUARY 1993	Examiner BOULEGIER C.H.H.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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