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[54] **APPARATUS FOR DETECTING THE TENSION OF YARNS DELIVERED FROM A ROTARY YARN BEAM**

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[51] **Int. Cl.**.....**G01l 5/10**

[58] **Field of Search**.....73/143; 242/75.44

[56] **References Cited**

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[57] **ABSTRACT**

An apparatus for detecting the tension of yarns delivered from a rotary yarn beam that is movably supported at one end and supported for rotative movement on a pivotal arm at the other end. The tension of the yarn causes the pivotal movement of the arm which contacts and actuates an adjacently positioned detector that produces a signal corresponding to the amount of tension. A visual indicator and a braking mechanism can be actuated by this signal.

6 Claims, 2 Drawing Figures

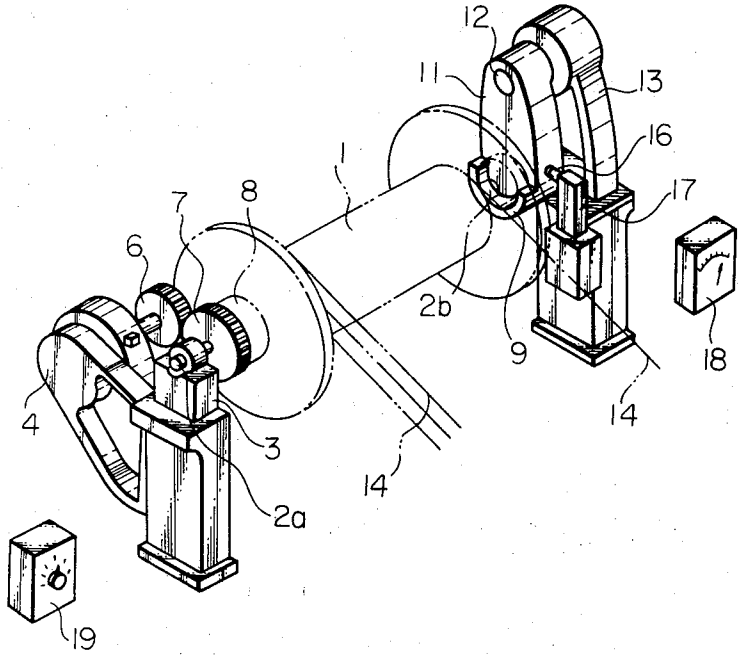


Fig. 1

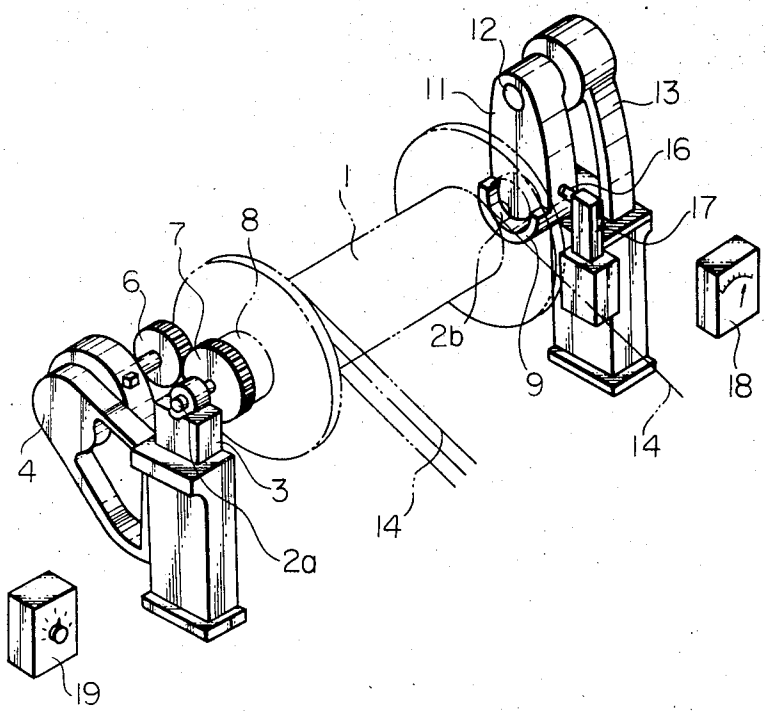
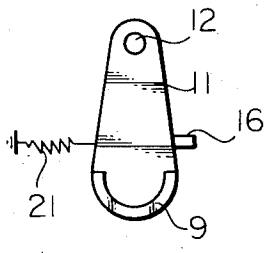


Fig. 2



APPARATUS FOR DETECTING THE TENSION OF YARNS DELIVERED FROM A ROTARY YARN BEAM

The present invention relates to an apparatus for detecting tension of yarns being delivered from a rotary yarn beam.

Although the term "yarn" is used in the following description, the conception of the present invention is understood as applicable, without introducing any significant modification, to any process wherein strand materials assembled in a sheet form or one or more laminar materials are delivered from their wound body such as a beam.

In a process for delivering yarns from a yarn beam with rotation of the latter, e.g., a yarn sizing or a warping process in a textile mill, there is a need for the operator to have an exact detection of the tension operating on the yarns during the operation. This is for the purpose of manual and/or automatic adjustment of the tension magnitude so that the yarns can always have an optimum tension.

Various mechanisms have been proposed in the field for this effect. In one conventionally known detection mechanism, a separate roller or rollers are provided in the yarn delivering path. Detection of the yarn tension is carried out through a direct contact of the roller or rollers with the yarns. This detection mechanism is, due to the direct contact of the yarns with the rollers, accompanied with a considerable disadvantage that the yarn sheets may be disturbed by the rollers resulting in an undesirable entanglement of adjacent yarns and yarn, quality is thereby degraded through such direct contact with the rollers.

In order to mitigate the disadvantage possessed by the above-described direct contact type detection mechanism, there has been proposed an indirect type detection mechanism. In the mechanism of this type, where horizontal movement of the yarn beam shaft in a yarn delivering direction is caused by the tension operating on the yarns, the magnitude of such horizontal movement is electro-mechanically detected by load cells associating with a beam core shaft and the magnitude is, using a computer, converted into a tension indicating signal. In addition to the complexity in its structure, this detection mechanism cannot ascertain an exact detection of the tension actually operating on the yarns throughout an entire period of one cycle of the yarn delivering operation. This is because the detecting mechanism is affected by the weight of the yarn beam, which weight gradually decreases as the yarn delivering progresses.

The present invention provides a novel apparatus of a simple structure for detecting tension of yarns being delivered from a yarn beam correctly throughout an entire period of one yarn delivering cycle without any disturbance to the operation and any damage on the yarns.

In order to attain this object, the apparatus of the present invention utilizes a pivotal suspension arm holding a beam core shaft, which pivoting is caused by the tension operating on the yarn. Upon pivoting of the suspension arm, a detection terminal is accordingly actuated, and a signal is produced in proportion to the tension magnitude, i.e., the pivoting magnitude. The signal may be used for a visible indication of the tension and when required, for a control of a braking action to be exerted on the beam rotation.

Further detailed features, functions and effect of the apparatus of the present invention will be made more apparent from the following description, reference being made to the accompanying drawings, wherein;

FIG. 1 is a perspective illustration of one embodiment of the present invention; and,

FIG. 2 is a view of a modified embodiment of the present invention seen in an axial direction of a yarn beam.

Referring to FIG. 1, an illustrated arrangement of the tension detecting apparatus of the present invention is shown. One end **2***a* of a yarn beam **1** is supported by a stand **3** in an arrangement that is freely movable in diametral directions like a flexible joint mechanism. A predetermined braking force is exerted upon the yarn beam **1** by a braking mechanism **4** disposed in combination with the stand **3** via a gear **6** connected to the braking mechanism **4** and a further gear **7** mounted firmly on a core shaft **8** of the yarn beam **1** in an arrangement meshing with the gear **6**. On another side of the yarn beam **1**, another end **2***b* of the yarn beam **1** is mounted on a seat **9** formed on a lower end of a suspension arm **11**, an upper end of which is pivotally mounted on a shaft **12** fixed to a stationary stand **13**. In the drawing, the yarn beam **1** is illustrated with two-dot chain lines for a clear illustration of the entire mechanism. Yarns **14** are delivered from the yarn beam **1** in a sheet form upon corresponding axial rotation of the yarn beam **1**. On a yarn delivery side of the lower portion of the suspension arm **11**, there is disposed a projection **16**, and a fixed detection terminal **17** is provided at a location corresponding to said projection **16** of the suspension arm **11**. Being connected to this detection terminal **17** via an electric connection (not shown), a visible tension indicator **18** is provided. Further, being connected to the braking mechanism **4** via an electric connection (not shown), there is provided a visible braking force indicator **19**.

The tension detecting apparatus having the above-described construction functions as hereinafter described.

When the yarns **14** are delivered from the yarn beam **1** under tension, this tension operating on the yarns **14** tends to urge the yarn beam **1** towards the delivering direction. Because one end **2***a* of the yarn beam **1** is movably supported by the stand **3** and the beam supporting suspension arm **11** is pivotally mounted at its upper end on the fixed shaft **12**, this urging force causes the suspension arm **11** to pivot on the fixed shaft **12**, and the lower end of the suspension arm **11** moves towards the yarn delivering direction. This movement of the lower end of the suspension arm **11** brings about a pressure contact of the projection **16** with the detection terminal **17**. The magnitude of the developed pressure operative on the detection terminal **17** is proportional to the extent of the pivoting movement of the suspension arm **11**. Since the extent of this pivoting movement is proportional to the magnitude of the tension operative on the yarns **14**, the magnitude of the pressure operative on the detection terminal **17** is proportional to the magnitude of the tension operating on the yarns **14** during the yarn delivery. The detection terminal **17** emits an electric signal according to the magnitude of the pressure, and this signal is carried to the tension indicator **18** for a visible indication of the detected yarn tension.

In a preferred modification of the illustrated arrangement, the electric signal can be used for adjusting the braking force generated by the braking mechanism **4**, and this is provided by a conventional control element combined with the above-explained arrangement in a known manner.

When the extent of the pivoting movement of the suspension arm **11** is too large, there is a possibility of producing a gap between the actual yarn tension and the tension value shown on the tension indicator **18**, such valve changing by a sequential reduction in the beam weight. In order to minimize or eliminate such undesirable gap, it is desirable to restrain the pivoting movement of the suspension arm **11** to an appreciable extent.

An arrangement illustrating this restrain of the pivoting movement of the suspension arm **11** is shown in FIG. **2**, wherein the suspension arm **11** in the vicinity of its lower end is provided with a tension spring **21** for urging the suspension arm **11** towards a counter-delivery direction of the tensioned yarns **14**. A spiral spring may be substituted for this tension spring **21** being mounted, for example, on the fixed shaft **12** in an arrangement to urge the suspension arm **11** in a direction for the above-described effect.

As is well-understood from the foregoing description, through employment of the apparatus of the present invention, the tension operating on the yarns during their delivery from the yarn beam can be exactly detected without any possible damage of the yarn quality and complication of the mechanism for this function.

What I claim is:

1. Apparatus for detecting tension of delivered yarns comprising

a rotary yarn beam from which the yarns are delivered, said yarn beam having a first end and an opposite second end;

a rotatable core shaft on which said yarn beam is mounted;

a fixed first stand providing a first seat to support said first end of said yarn beam, said first end being supportingly mounted to be transversely movable on said first seat to provide a flexible rotating support therebetween;

a fixed second stand on which a second shaft is mounted to be spaced from said core shaft;

a suspension arm pivotally mounted at its upper part on said second shaft, said suspension arm having a lower part formed as a second seat to support said second end of said yarn beam and allow swinging movement of said second end in response to changing tension of the yarns;

means located in said lower part of said suspension arm and swingable therewith; and

detection means fixed in position and located to be contacted by said suspension arm means during swinging movement thereof thereby generating a signal proportional to the change in tension.

2. Apparatus according to claim **1** in which said suspension arm means comprises a projection adapted to provide a pressure contact with said detection means, the magnitude of the pressure determining the magnitude of the signal generated.

3. Apparatus according to claim **1** in which a tension indicator is associated with said detection means, said tension indicator being operable by the signal to give a visible indication of the tension of the yarns.

4. Apparatus according to claim **1** in which means are provided to exert a resilient force on said suspension arm in a direction opposite to the direction said suspension arm is urged by increased tension of the yarns.

5. Apparatus according to claim **4** in which said resilient means comprises a spring connected to said lower part of said suspension arm.

6. Apparatus according to claim **1** in which braking means is operable connected with said yarn beam to control the rotation thereof, and said braking means is operated by the signal to apply braking force to the yarn beam.

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