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Domig

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[54] **APPARATUS FOR MONITORING A THREAD OR THE LIKE**

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[51] **Int. Cl.** **D04b 35/14**

[58] **Field of Search** 66/161, 162, 163, 164; 200/61.18; 139/370

[56] **References Cited**

UNITED STATES PATENTS

1,358,483	11/1920	Wachsman	66/161
2,956,392	10/1960	Ohnishi	200/61.18
3,676,769	7/1972	Loepfe	139/378

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[57] **ABSTRACT**

An apparatus for monitoring the travel and tension of a thread or the like preferably at a textile machine, comprising a guide element which is held by a counter force against a tension force normally exerted by the thread in a position in which the thread is in contact with the guide element, but upon the presence of an impermissibly high tension force releases the thread. The guide element is equipped with a mechanical-electrical transducer possessing a contact body, the transducer, upon release of the thread from the contact body or upon standstill of the thread, generating an electrical signal serving to trigger a control operation or an indicating operation.

9 Claims, 6 Drawing Figures

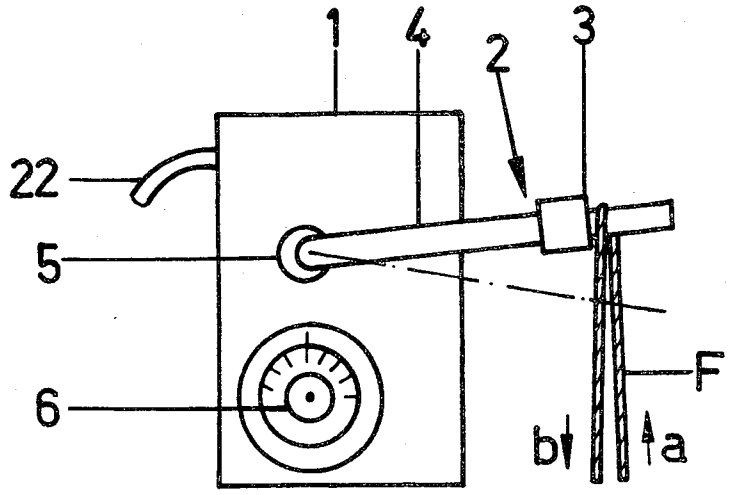


Fig.1

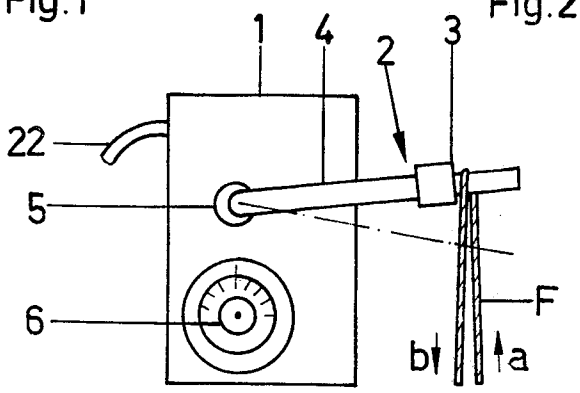


Fig.2

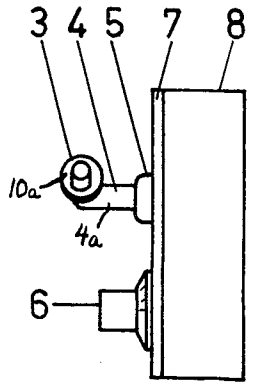


Fig.4

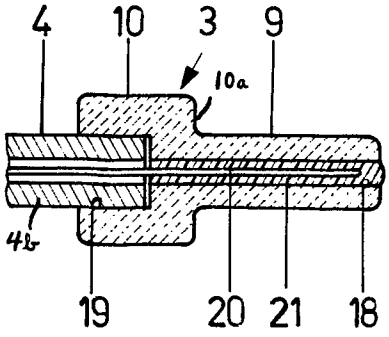


Fig.3

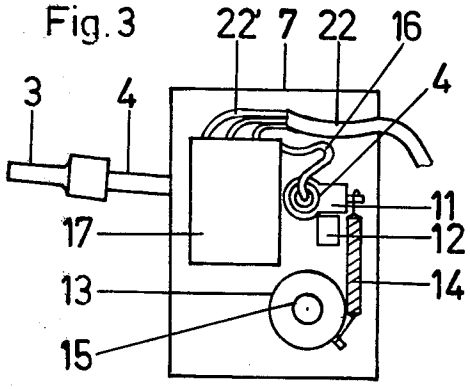


Fig.5

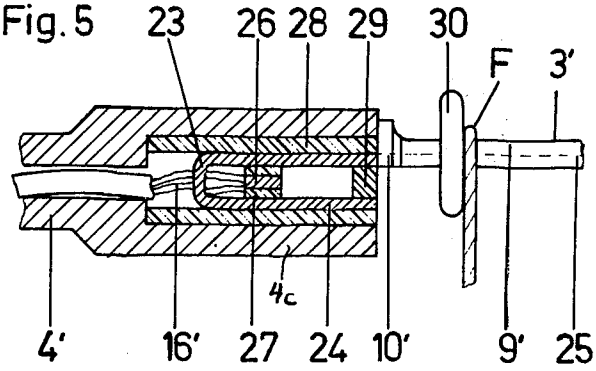
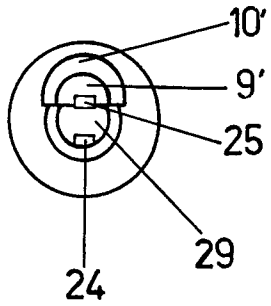


Fig.6



APPARATUS FOR MONITORING A THREAD OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved construction of apparatus for monitoring the travel and tension of a thread or the like, preferably at a textile machine, of the type incorporating a guide element which is retained by a counter force, against the action of a tension force normally exerted by the thread, in a position in which the thread is in contact with the guide element, but in the presence of an impermissibly high tension force releases the thread.

In the context of this disclosure, the term "thread" is intended to be understood as being employed in its broadest sense as covering various types of filamentary material, such as threads, yarns or the like.

There are already known to the art such above-mentioned general types of monitoring devices which are employed at circular knitting machines and which are equipped with two fork-like feeler levers which interengage with one another and which are known in the art under the designation "plucking or pick monitors."

The thread to be monitored bears against the fork tongs of one spring-loaded feeler lever and rocks such downwardly against the force of the spring when the thread tension becomes impermissibly great, so that the thread is then released from such feeler lever. The second feeler lever which is loaded by a counter weight bears with its tongs from below against the thread and rocks upwardly as soon as thread rupture occurs or the thread tension falls below a predetermined boundary value. In the aforementioned cases both levers actuate an electrical contact by means of which there is triggered standstill or shutdown of the machine.

With the heretofore known plucking monitors there are thus provided for the purpose of monitoring the thread tension, with respect to an upper and lower boundary value, two separate mechanical-electrical operating feeler elements which, of necessity, exhibit a relatively large mechanical inertia and thus respond rather slowly. Additionally, the electrical contacts which are present are subject to contamination and corrosion, thereby impairing the operational reliability of the monitoring device. Also such monitoring devices are not very easy to adjust, since in each instance both feeler levers must be regulated separately from one another with respect to a given yarn with regard to the counter forces which act thereat.

SUMMARY OF THE INVENTION

Hence, it will be recognized that this particular field of technology is still in need of apparatus for monitoring a thread or the like which is not associated with the aforementioned drawbacks and limitations of the prior art proposals. Therefore, it is a primary object of the present invention to provide an improved construction of monitoring device which effectively and reliably fulfills the existing need in the art.

Another and more specific object of the present invention aims at the provision of a new and improved construction of thread monitor which avoids the drawbacks of the heretofore known plucking or pick monitors and additionally possesses a simpler construction and an improved mode of operation.

Yet a further significant object of the present invention relates to an improved construction of monitoring apparatus for threads or the like which is relatively simple in construction and design, economical to manufacture, extremely reliable in operation, not readily subject to breakdown or malfunction, and requires a minimum of servicing and maintenance.

A further objective of the invention is directed to replacing both of the mechanical-electrically operating feeler levers of the heretofore known plucking monitor by a single guide element for the thread and the electrical contact by electronic means.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the invention contemplates that the guide element is equipped with a mechanical-electrical transducer possessing a contact body, the transducer upon release of the thread from the contact body or upon standstill of the thread generating an electrical signal serving to trigger a control operation or an indicating operation.

According to a first exemplary embodiment of the apparatus of this development the guide element is constructed to possess a carrier or support arm which is pivotably mounted, this arm supporting at its free end a tribo-electric transducer or piezoelectric transducer, by way of example. According to another manifestation of the invention the guide element is fixedly mounted and constructed to be resilient, wherein the contact body can be resiliently arranged relative to its support arm.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawing in conjunction with which there will be described purely by way of example a thread monitor of this development which is intended, for instance, to be used at a circular knitting machine, and wherein:

FIG. **1** is a schematic side view of a thread monitor designed according to the teachings of the present invention;

FIG. **2** is a front view thereof;

FIG. **3** is a view of the thread monitor from the rear of FIG. **1** with the cover hood of the housing removed so as to expose internal structure;

FIG. **4** is an enlarged longitudinal sectional view through the outer end of the support arm of the thread monitor and which carries a tribo-electric transducer;

FIG. **5** is a fragmentary sectional view of another embodiment of thread monitor employing a piezoelectric transducer wherein the contact body is resiliently arranged relative to the fixedly mounted support or carrier arm; and

FIG. **6** is an end view of the variant embodiment of thread monitor depicted in FIG. **5**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawing, according to the exemplary embodiment of thread monitor depicted in FIGS. **1** to **3** it will be recognized that the same comprises a metallic housing **1** which is of a size approximating that of a matchbox and consisting of a rectangular mounting

plate 7 and a cover hood member 8 and housing the remaining components.

There is further provided a guide element 2 which embodies a contact body 3 and a carrier or support arm 4 formed of metal and in the form of a right angle flexed small pipe. The one flexed leg 4*a* of the support arm 4 is pivotably mounted by means of a bearing bushing or sleeve 5 which is guided through the mounting plate 7. According to the showing of FIG. 4 at the outer end 4*b* of the support arm 4 there is mounted the rotationally symmetrical contact body 3 formed of a hard insulating material, for instance oxide ceramic. The contact body 3 possesses a cylindrical shaft 9 and a thickened or enlarged piston 10 which functions as a stop for the thread F or the like and is provided at its front portion with a longitudinal or lengthwise bore 18 and at the piston 10 with a counter-bore 19 of larger diameter which receives the end of the support arm 4. A conductor wire 16 (FIG. 3) is guided through the entire length of the support arm 4 and almost through the entire length of the contact body 3. The front end or portion of this conductor wire 16 forms an electrode 20 which is fixed in bore 18 by means of any suitable sealing compound 21 and is sealed towards the outside. The electrode 20 together with the contact body 3 and the sealing compound or mass 21 forms a tribo-electrical transducer which, when the thread F or the like is traveling, delivers an electrical thread travel signal, and which electrical signal disappears upon rupture or standstill of the thread or when the thread slides off of the contact body 3.

According to the showing of FIG. 3 there is furthermore secured to the mounting plate 7 an adjustable tensioning device encompassing the components or parts 6, 13, 14, 15. The one end of a tension spring 14 of the tensioning device engages with a projection 11 which is fixedly connected with the inner end of the support arm 4 and bears under the action of the force of spring 14 against a stop 12 which is secured to the mounting plate 7. The other end of the tension spring 14 is attached to the periphery of a disk 13 which can be adjusted in the peripheral direction by means of an adjusting or adjustment knob 6 or the like, the disk 13 being connected with the adjustment knob 6 by means of a shaft 15.

Furthermore, at the inside of the mounting plate 7 there is mounted an electronic unit 17 which serves to amplify and transform the thread travel signal delivered by the tribo-electrical transducer. This thread travel signal is delivered to the input of the electronic unit 17 by means of the conductor wire 16. An electrical cable 22 possessing a number of conductors or lines 22' serves for the infeed of the supply voltage to the electronic unit or device 17 and for the delivery of the output signal.

With the benefit of the foregoing description of the embodiment of thread monitor depicted in FIGS. 1 to 4 its mode of operation, when employed for instance at a not particularly illustrated circular knitting machine, will now be considered. As is well known in the circular knitting art such type machine possesses, for instance, 24 or 36 knitting stations or locations; each such knitting location has associated therewith a thread monitor which is mounted at a frame at a height of at least one meter above the knitting location. The thread F or the like travels from a supply spool, through a knot catcher, and further in the direction of the arrow *a* to the contact body 3, over and past the latter downwardly in the direction of the arrow *b*, and finally over a thread or yarn guide to the knitting location which directly follows the same. As illustrated in FIGS. 1 to 3 the guide element 2 is thus located in a slightly upwardly extending or slanted position, so that the thread F will be held against the contact body 3 by the thread tension and the front end surface 10*a* of the piston 10 serves as a stop for the thread. In any event with the aid of the adjustment knob 6 the tension of the spring 14 can be adjusted such that the guide element 2, during normal operation, retains the position which has been imparted to it, however is rocked downwardly as soon as the tension of the thread F exceeds a predetermined value. As long as the thread F travels over the contact body 3 then a thread travel signal is delivered to the electronic unit or device 17 which indicates the proper functioning of the associated knitting location.

Now if by virtue of a blockage of or interference with the thread travel at the supply spool or the like or upon the arrival of a knot at the knot catcher the thread tension increases to an impermissibly high value, then the guide element 2 is rocked downwardly into a position which has been indicated by the phantom or broken lines in FIG. 1, so that the thread F slides off the contact body 3. Thereafter, the guide element 2 is again returned upwardly into its original position by the force of the spring 14. As soon as the thread is released from the contact body 3 the thread travel signal is interrupted and due to the action of the output signal generated by the electronic unit 17 upon a suitable shutdown or stop motion mechanism the knitting machine is shutdown or stopped. The time between sliding off of the thread until shutting down the machine amounts to about 20 milliseconds. This time is so short that the length of the thread which is used until shutdown of the knitting location is smaller than the thread reserve which is provided by the ejection of the thread from the thread monitor, so that depletion of such reserve and therefore thread rupture is positively prevented.

FIG. 5 illustrates a longitudinal sectional side view through the end of a carrier or support arm 4' of an exemplary embodiment of thread monitor equipped with a piezoelectric transducer system which encompasses the components 23 to 27, and FIG. 6 illustrates a view of the forward end of the guide element with the component or part 30 removed. A substantially U-shaped flexed holding or holder bracket 23 consisting of resilient metal has a short leg 24 and a longer leg 25 which extends out of the tubular shaped support arm 4'. Between the legs 24 and 25 there is fixedly clamped internally of the support arm 4' a piezoelectric element 26 in the form of a short cylinder by means of two insulating disks 27. The holding or holder bracket 23 is secured at the forward widened end 4*c* of the support arm 4' by means of a small insulating tube 28 formed of soft elastic material. The inner compartment of the transducer system 23–27 is sealed in a dustproof manner towards the outside by means of a closure element 29 which likewise can consist of a soft elastic material.

The protruding portion of the long leg 25, which possesses a substantially rectangular cross-sectional configuration, carries a contact body 3' which preferably consists of a hard ceramic material. This contact body 3' possesses an essentially semi-cylindrical shape and consists of a shaft 9' and a piston 10'.

The piezoelectric element **26**, as is known, is constructed as an electrical polarized ceramic body or as a piezoelectric crystal with two electrodes (not particularly shown) arranged at its opposite surfaces; the electrodes are connected by two conductor wires **16'** with an electronic unit **17**, as the same has been depicted in FIG. **3**.

As long as a thread F or the like is traveling with a normal tension over the contact body **3'** it bears against a stop or impact disk **30** and the piezoelectric element **26** delivers an electrical thread travel signal. If, however, the thread tension increases to an impermissibly high value, then, the contact body **3'**, owing to the spring or resilient action of the bracket **23** and the soft elastic tube **28**, is rocked downwardly relative to the support arm **4'**, so that the thread F slides off the contact body **3'**. In this case the carrier or support arm **4'** is preferably attached so as to be non-movable at the mounting plate **7** and the provision of a tensioning device in the housing is not necessary.

For adjusting the response threshold of the thread monitor, i.e. the force which is necessary for throwing-off or rejecting the thread F, different measures can be provided for such thread monitor. Thus, the contact body **3'** can be equipped with a stop which is adjustable in its lengthwise direction and which is in the form of a disk **30** as such has been shown in FIG. **5**. During normal operation the thread F or the like bears against this disk-stop **30**. By adjusting the disk **30** the effective lever arm and thus the moment, with which the force exerted by the travel of the thread F acts upon the long arm of the bracket **23** and and its mounting, is changed. A further possibility for changing the response threshold resides in altering the inclination of the contact body **3'** towards the horizontal or towards the direction of travel of the thread in that the support or carrier arm **4'** is adjustably mounted as concerns its angular position relative to the housing, or however the entire thread monitor can be adjustably mounted at its support by means of a rotary bearing.

The described thread monitors are not only of simpler construction than the known plucking or pick monitors, since they only possess a single pivotable element, but they are also insensitive against dust contamination of the guide element and the contact body; additionally they do not possess any electrical contacts which are to be mechanically actuated and which are susceptible to dust contamination and corrosion, and furthermore they respond decisively quicker than the known plucking monitors, so that there can be positively prevented consumption of the thread reserve with subsequent thread rupture and the thus brought about ejection of the material hose from the machine. Also in the case of thread rupture without actuating the guide element there nonetheless occurs standstill of the machine owing to the disappearance of the thread travel signal.

Finally it is still to be remarked that tribo-electrical thread or yarn monitors of different type are known and in principle have already been disclosed in Swiss Pat. No. 479,478, the disclosure of which is incorporated herein by reference. Also piezoelectrical thread monitors are known to the art, for instance as disclosed in Swiss Pat. No. 439,791, the disclosure of which is likewise incorporated herein by reference.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims. Accordingly,

What is claimed is:

1. An apparatus for monitoring the travel and tension of a thread or the like preferably at a textile machine, comprising a guide element, means for holding the guide element by means of a counter force against a tension force normally exerted by the thread in a position in which the thread is in contact with the guide element, but in the presence of an impermissibly high tension force prevailing at the thread said guide element releases the thread, said guide element being equipped with a tribo-electric transducer, said tribo-electric transducer embodying a substantially elongate contact body equipped with a lengthwise bore and an electrode arranged in said lengthwise bore, said tribo-electric transducer upon release of the thread from the contact body or upon standstill of the thread generating an electrical signal serving to trigger a predetermined operation.

2. The apparatus as defined in claim **1**, wherein said predetermined operation is a control operation.

3. The apparatus as defined in claim **1**, wherein said predetermined operation is an indicating operation.

4. The apparatus as defined in claim **1**, further including a stationary component, said guide element comprising a support arm, means for pivotably mounting the support arm at the stationary component, and said holding means incorporating a spring for retaining the support arm in a work position.

5. The apparatus as defined in claim **1**, further including a housing having a component, and means for mounting the guide element at said housing component, said transducer having at least one electrode, an electronic unit housed at said housing and connected with said at least one electrode of the transducer.

6. The apparatus as defined in claim **5**, wherein said housing is provided with an adjustable tensioning device.

7. An apparatus for monitoring the travel and tension of a thread or the like preferably at a textile machine, comprising a guide element, means for holding the guide element by means of a counter force against a tension force normally exerted by the thread in a position in which the thread is in contact with the guide element, but in the presence of an impermissibly high tension force prevailing at the thread said guide element releases the thread, said guide element being equipped with a piezoelectric transducer possessing a contact body, a substantially U-shaped flexed holding bracket formed of resilient material, said holding bracket having a pair of legs, said piezoelectric transducer further including a piezoelectric element arranged between the legs of said holding bracket, said piezoelectric transducer upon release of the thread from the contact body or upon standstill of the thread generating an electrical signal serving to trigger a predetermined operation.

8. The apparatus as defined in claim **7**, further including a stationary component, said guide element including means imparting thereto a resilient construction, and means for fixedly mounting said guide element at the stationary component.

9. The apparatus as defined in claim **7**, said guide element including a support arm, and means for resiliently arranging the contact body relative to the support arm.

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