Aug. 5, 1969 H. WERFFELI 3,458,912

YARN MONITORING SYSTEM

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Fig. 1

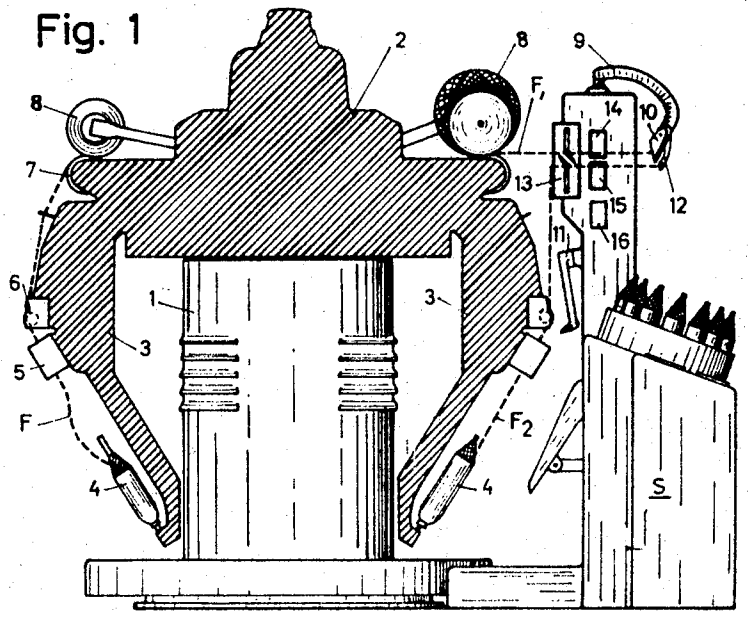


Fig. 6

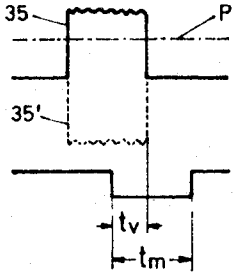


Fig. 7

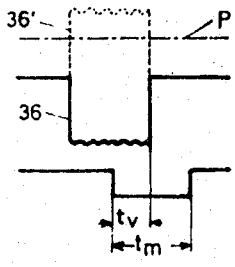
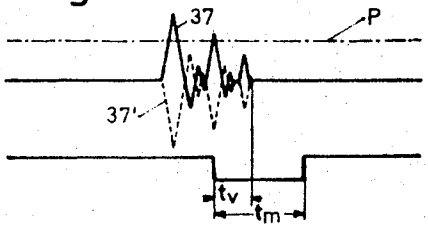


Fig. 8



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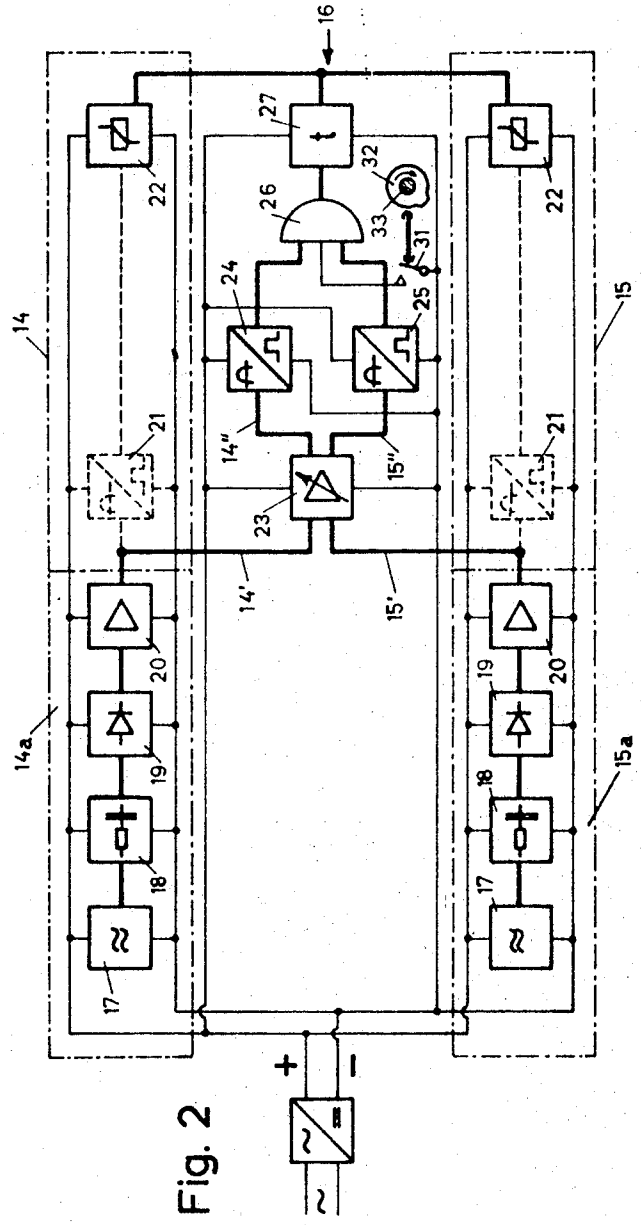


Fig. 2

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YARN MONITORING SYSTEM

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Fig. 9

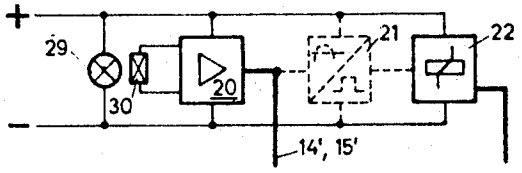


Fig. 3

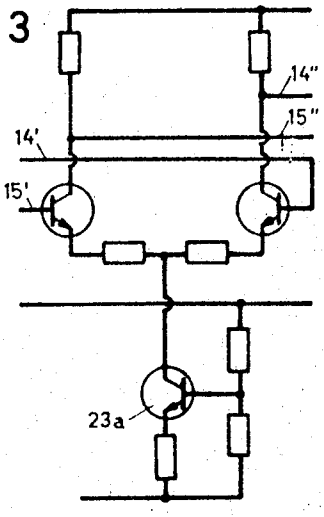


Fig. 4

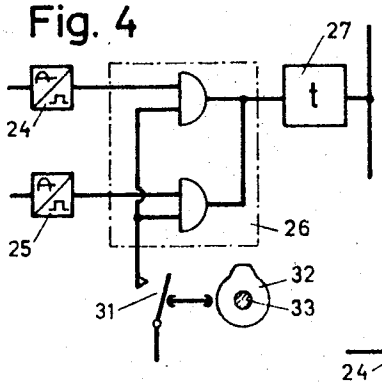
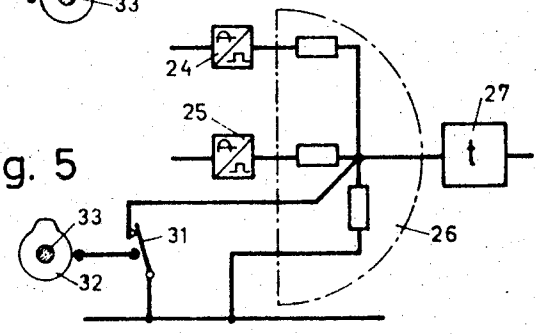


Fig. 5



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3,458,912

YARN MONITORING SYSTEM

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Filed Aug. 7, 1967, Ser. No. 658,910
Claims priority, application Switzerland, Aug. 17, 1966, 11,847/66
Int. Cl. B65h 69/04
U.S. Cl. 28—64 11 Claims

ABSTRACT OF THE DISCLOSURE

A yarn monitoring system including measuring cells, one measuring cell being associated with each yarn so as to provide an individual monitoring of the condition of each yarn. The individual monitorings are correlated by an evaluation circuit. Yarn cutting means, one for each yarn, are operatively connected with the evaluation circuit.

BACKGROUND OF THE INVENTION

The present invention relates to an improved yarn monitoring system for an automatic winding machine or winder.

In automatic winding machines with an automatic knotting mechanism or knotter, occasionally the yarn grippers or catchers therein do not faultlessly deliver broken yarn ends from both the wind-off bobbin and the wind-up bobbin to the knotter. For example, one or the other yarn end might not be delivered at all to the knotter or might be presented to the knotter in the form of a loop or sling. This, of course, results in a new disturbance or at least in errors during the next successive working operations or procedures of the machine.

In an attempt to overcome these drawbacks, prior art machines have been provided with two photoelectric or capacitive measuring cells for a knotter having opposite feed direction of both of the yarn ends which are to be knotted together. Each of these two measuring cells is located in the path of both yarn ends, so that when there is an impermissible change of the yarn mass or characteristic, they will respond and trigger a yarn cutting knife or the like.

However, even with such an arrangement erroneous triggering operations are readily possible. One or the other measuring cell is capable of signaling the presence of possibly three yarns when, in fact, only two yarns are actually located in the measuring zone of the relevant measuring cell, each of the two yarns individually exhibiting completely tolerable thickened portions. Additionally, in such case, it is possible only to cut the yarn end coming from the wind-off bobbin or the yarn end coming from the wind-up bobbin with a yarn cutting knife. Furthermore, this prior art arrangement is not capable of being used without modification with knotters having yarn feed in the same direction.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide an improved yarn monitoring system which overcomes the aforementioned drawbacks. Other and more specific objects of the present invention include:

(a) The provision of a yarn monitoring system wherein each yarn is individually monitored;

(b) The provision of a yarn monitoring system operable with yarn feeds of the same direction;

(c) The provision of a yarn monitoring system including means for correlating measurements of the condition of each individual yarn; and

(d) The provision of a yarn monitoring system wherein

separate yarn cutting means are provided for each individual yarn.

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 yarn monitoring system incorporates means for cutting the yarn, said means including two yarn cutting knives, each of which is associated with one yarn. These yarn cutting knives are operably connected via an evaluation circuit with two measuring cells, each measuring cell being associated with one yarn.

Due to these measures, it is now possible to initially monitor or supervise each individual yarn by means of its associated measuring cell without influence by the other measuring cell, and then correlate in the evaluation circuit the yarn conditions detected by both of the measuring cells. Then, if a triggering of the means for cutting the yarn is called for, there occurs an actuation of two yarn cutting knives, each of which is associated with one of the yarns. Furthermore, these measures can be effected independently of the feed direction of the yarn ends into the knotter.

Additionally, in accordance with a preferred physical manifestation of the present invention, the measuring cells which are associated with respective yarns and the corresponding yarn cutting knives can be elements of a conventional yarn cleaner, whereby the evaluation circuit bridges the signal path between the measuring cells and the yarn cutting knife.

BRIEF DESCRIPTION OF THE DRAWINGS

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 drawings wherein:

FIGURE 1 schematically illustrates the arrangement of a knotting mechanism for an automatic winding machine;

FIGURE 2 is a circuit diagram of a yarn cleaner equipped with an evaluation circuit;

FIGURE 3 illustrates a detail of the circuit arrangement according to FIGURE 2;

FIGURES 4 and 5 are modifications of a detail of the circuit arrangement according to FIGURE 2;

FIGURES 6, 7 and 8 are different voltage diagrams of the voltage at the output of a differential amplifier in the circuit arrangement according to FIGURE 2; and

FIGURE 9 illustrates a variant form of yarn cleaner.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Describing now the drawings, in FIGURE 1 there is depicted an automatic winder or winding machine, wherein a revolving table or turret 2 having a number of winding locations or stations 3 is arranged upon a stationary machine stand or upright 1. A so-called tending or servicing apparatus S for the removal of disturbances occurring at the winding stations 3 is located externally of the revolving path of travel of the aforementioned winding stations 3. Each winding station 3 can be placed into operable association with this tending or servicing apparatus S.

A machine of this general type is known to the art and has been described in detail in the commonly assigned, copending U.S. patent application of Jakob Stapfer, Ser. No. 391,516, filed Aug. 24, 1965 (3,380,677, granted Sept. 30, 1968) and entitled "Method for Increasing the Efficiency of Automatic Winding Machines and Control Mechanism for Carrying Out the Aforesaid Method." Accordingly, the following description will only be directed to such details that are necessary to fully understand and comprehend the underlying concepts of the present invention.

Continuing, at each winding station 3, a yarn F is with-

drawn from a delivery or wind-off bobbin 4 and guided by a balloon breaker 5, a yarn break 6, and a grooved drum 7 to a wind-up bobbin or spool 8, as shown at the left-hand winding location of FIGURE 1. If a yarn rupture occurs as depicted at the right-hand winding location of FIGURE 1, the yarn end F_1 at the wind-up bobbin 8 is entrained by a pipe or hose 9 provided with a suction nozzle 10 and arranged at the disturbance removal-tending apparatus S, whereas the yarn end F_2 at the delivery bobbin 4 is delivered by means of catcher or gripper means 11 at the disturbance removal-tending apparatus S to a further suction nozzle 12 provided at the aforesaid pipe or hose 9. Thereafter, the pipe 9 pivots in counter-clockwise direction into the illustrated position, whereby both of the yarn ends F_1 and F_2 are presented to a knotter mechanism 13 associated with the yarn disturbance removal-tending apparatus S.

In order to monitor the proper feed of both of the yarn ends F_1 and F_2, there is provded at the region of the knotting mechanism in each yarn path of travel, a yarn cleaner 14 and 15 respectively, each yarn cleaner being operably connected with one another via an evaluation circuit 16 as will be more fully explained below.

FIGURE 2 depicts the circuit arrangement of both of the yarn cleaners 14 and 15 coupled with evaluation circuits 16, each yarn cleaner 14 and 15 embodying a measuring cell 14*a* and 15*a* respectively. Each measuring cell 14*a* or 15*a* of the yarn cleaners 14 and 15 consists of an oscillator 17, a capacitive voltage divider 18 serving as the actual measuring element, demodulator 19, an amplifier 20, and a magnetically actuatable cutting knife 22. A conventional yarn cleaner is normally provided with still further circuit components disposed within the phantom-line indicated signal path between either measuring cell 14*a* or 15*a* and associated cutting knife 22. Such circuit components could be Schmitt trigger 21, which need not be considered herein as it does not play any role in the inventive apparatus.

As can be readily recognized by an inspection of FIGURE 2, the signal path between either measuring element 14*a* or 15*a* and the associated cutting knife 22 is bridged by means of an evaluation circuit generally designated 16. At the input side of the evaluation circuit 15, a differential amplifier is provided, generally designated 23, which is coupled by means of respective inputs 14′ and 15′ with the output of the measuring cells 14*a* and 15*a* respectively. As will be further explained, the differential amplifier 23 should deliver an appropriate and mirror-image output signal in response to positive or negative input voltages. Accordingly, a conventional circuit is employed which is shown in greater detail in FIGURE 3, wherein the usual resistance of a "long tail" circuit for obtaining an equivalent current with a low supply voltage is replaced by transistor 23*a* with associated resistors determining the working or operational level.

Threshold switches or Schmitt triggers 24 and 25 are connected with both outputs of differential amplifier 23. Each of the threshold switches or Schmitt triggers 24 and 25 is coupled with a gate circuit 26, two embodiments of which being depicted in greater detail in FIGURES 4 and 5. Blocking and opening of the gate circuit 26 is effected by means of a contact 31 which can be actuated by a cam 32 or equivalent structure. Cam 32 is seated upon a schematically represented control shaft 33 of a knotting mechanism 13 of servicing apparatus S. The output of the gate circuit 26 is connected with a response-delayed relay 27 which represents the actual output of the evaluation circuit 16 and provides a common excitation of both separating or cutting knives 22 of the yarn cleaners 14 and 15.

The apparatus and monitoring system described above functions in the following manner:

Assume, for instance, that a yarn is present in yarn cleaner 15 located at the delivery side of the wind-off bobbin 4 and that a yarn is absent in yarn cleaner 14 located at the wind-up bobbin side. Different signal voltages from the measuring cells 14*a* and 15*a* would then appear at the inputs 14′ and 15′ respectively of the differential amplifier 23. In this case, the differential amplifier 23 delivers at output 14″ thereof a positive signal 35 and at output 15″ thereof a mirror-image signal 35′. These signals are depicted in FIGURE 6. The positive signal 35 arrives at trigger circuit 24, whereupon the latter responds after the signal has exceeded a certain response threshold *p*. Thereafter, cutting knife 22 is placed into operation by means of gate circuit 26 and relay 27.

On the other hand, if a yarn is absent at yarn cleaner 15, then, as shown in FIGURE 7, a negative signal 36 is delivered at the output 14″ of the differential amplifier 23 and a mirror-image positive signal 36′ is delivered at the output 15″. If signal 36′ exceeds the response threshold *p*, the trigger circuit 25 will respond.

The above operation takes place in the same manner during the formation of loops or nooses in one of the yarn cleaners 14 or 15, as different signals are once again delivered to both of the measuring cells 14*a* and 15*a* to the inputs 14′ and 15′ of the differential amplifier 23.

In FIGURE 8 there is depicted corresponding voltage curves or diagrams when both yarn cleaners 14 and 15 monitor the condition of a respective yarn. The depicted voltage peak 37 might possibly occur if one yarn F_1 is inserted in the knotter or its associated yarn cleaner somewhat after the other yarn F_2. Such voltage peaks which could exceed the response threshold *p*, are rendered ineffectual with respect to the cutting knife 22 in that the measuring time *tm* is limited by cam 32 as switch 31 is only held closed for a short time after the beginning of the knotting operation. Additionally, relay 27 possesses a response delay time *tv*. Thus, cutting knives 22 can only be actuated if the switch 31 is closed and the signals 35 or 36 from differential amplifier 23 are of a duration longer than the response delay time period *tv*.

Although the present invention has been described as being utilized with electronic yarn cleaners having capacitive measuring cells, it is to be expressly understood that yarn cleaners having photoelectric measuring cells could be employed with equal success. In such case, oscillator 17, voltage divider 18 and demodulator 19 would be replaced by a light source 29 and photocell 30 as shown in FIGURE 9. The remainder of the inventive circuit arrangement corresponds to that described and shown in FIGURE 2.

What is claimed is:

1. In a monitoring system for an automatic yarn winding machine provided with grippers for leading broken yarn ends to a knotter, measuring cells disposed in the path of said yarn ends to be knotted associated with said knotter, said measuring cells responding to intolerable changes of the yarn condition, and means for triggering yarn cutting, the improvement which comprises:

an individual yarn cutting knife associated with each yarn; and

evaluation circuit means operatively associating each of said yarn cutting knives with said measuring cells associated with each yarn.

2. The improvement defined in claim 1, further including yarn cleaner means, and wherein each measuring cell and yarn cutting knife associated with a respective yarn are elements of said yarn cleaner means, said evaluation circuit means bridging a signal path between each measuring cell and said yarn cutting knives.

3. The improvement defined in claim 2, wherein said evaluation circuit means includes a differential amplifier having two inputs and two outputs, each of said two inputs being connected to one of said measuring cells associated with a respective yarn, and coupling means for coupling said two outputs of said differential amplifier with said yarn cutting knives, said coupling means comprising threshold switch means, gate circuit means and response time delayed relay means.

4. The improvement defined in claim 3, wherein said

knotter includes a control shaft and a cam thereon, said gate circuit of said evaluation circuit means including a control input, and control switch means operated by said cam and connected with said control input.

5. A yarn monitoring system associated with an automatic yarn winding machine having a knotting mechanism for joining two yarn ends together, said monitoring system comprising:

an individual measuring cell means disposed in the path of each of said two yarns, said measuring cell means detecting intolerable changes in yarn dimension and condition and producing an output signal in response thereto;

an evaluation circuit means connected to each individual measuring cell means for correlating said output signals; and

individual yarn cutting means associated with each of said two yarns and operatively connected to said evaluation circuit means.

6. A monitoring system according to claim 5, wherein said evaluation circuit means serves to actuate both of said individual yarn cutting means in response to an output signal having predetermined characteristics from either of said measuring cell means.

7. A monitoring system according to claim 6, further including a time delay means connected between said evaluation circuit means and said yarn cutting means.

8. A monitoring system according to claim 6, wherein said evaluation circuit means comprises a differential amplifier connected to said measuring cell means.

9. A monitoring system according to claim 5, wherein said measuring cell means are capacitive.

10. A monitoring system according to claim 5, wherein said measuring cell means are photoelectric.

11. A monitoring system according to claim 7, wherein said evaluation circuit means further comprises a control gate, threshold switch means connecting said control gate to said differential amplifier, and time delay relay means connected between said control gate and said yarn cutting means.

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U.S. Cl. X.R.

242—35