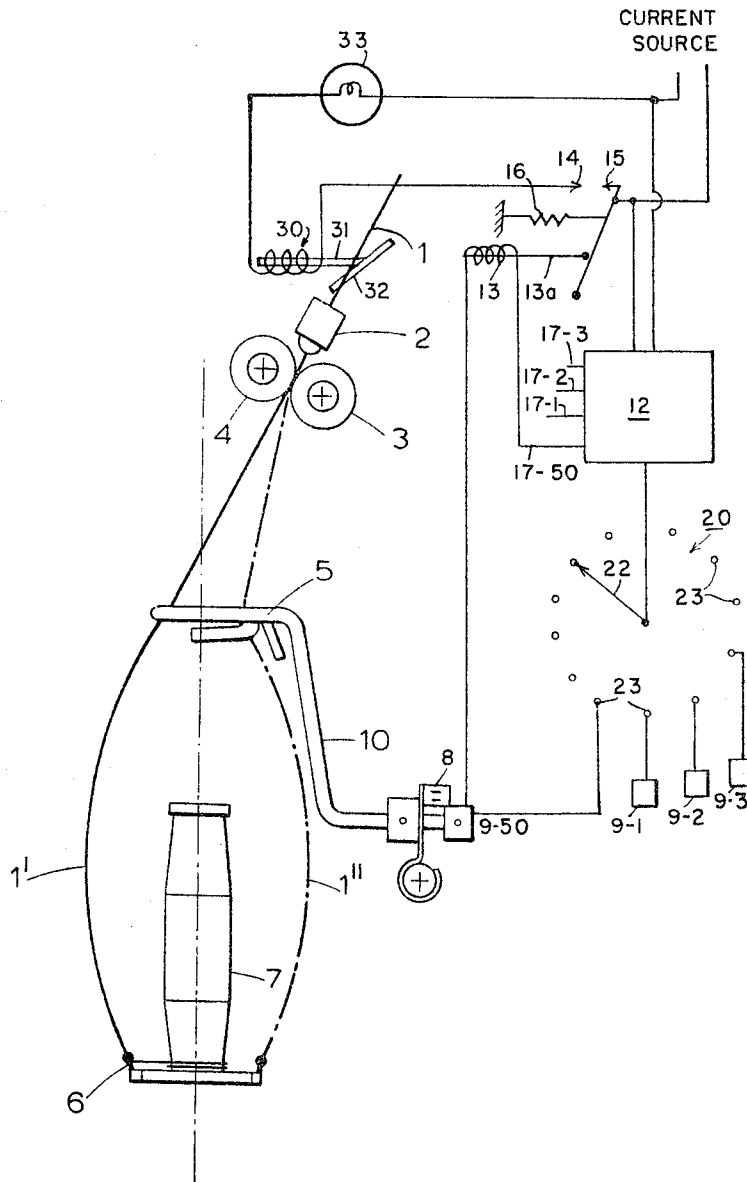


Sept. 13, 1966

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APPARATUS FOR THE DETECTION OF BROKEN YARN
AND THE LIKE ON TEXTILE MACHINES
Filed Aug. 5, 1964

3,272,048



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APPARATUS FOR THE DETECTION OF BROKEN YARN AND THE LIKE ON TEXTILE MACHINES

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Filed Aug. 5, 1964, Ser. No. 387,634

Claims priority, application Great Britain, Aug. 10, 1963, 27,353/63

10 Claims. (Cl. 83—370)

This invention relates to apparatus for the detection of breaks in textile material such as yarns, rovings and slivers, in textile machines, and is particularly applicable to multi-spindle spinning machines. The invention will be described by way of example only with particular reference to a ring spinning machine, but it will be appreciated that the invention is applicable to any type of textile machine or machinery where it is required to detect the existence of a break in the textile material in order that suitable action may be taken to avoid wastage of the textile material and/or damage occurring to the textile material and/or machinery.

In continuous spinning machines, the textile material is delivered, twisted and wound on to a package or spindle, simultaneously and without interruption. An example of such a machine is a ring spinning machine in which the bobbins of roving are positioned in a creel on the upper part of the framework of the machine. The roving from each bobbin is fed to the drafting rollers of a drafting unit, and wound on to a spindle which rotates at a speed usually between 5000 and 10,000 revolutions per minute. Located around each spindle is a ring having a traveller which is arranged to move around the ring. The ring and traveller are traversed in relation to the spindle, to build a package on the spindle.

The yarn issuing from the drafting rollers is threaded through a small ring-shaped yarn guide known in the art as a ballooning eye, twizzle guide, pigtail, lappet or thread guide and will be hereinafter referred to as the yarn guide. The yarn guide is located vertically above the spindle and the yarn is passed through the yarn guide, through the traveller and thence on to the spindle.

A feature of ring spinning is that a "balloon" of yarn is formed intermediate the yarn guide, which forms the apex of the yarn balloon, and the traveller. The "balloon" is the shape formed by the yarn path in this region during spinning and the shape of the "balloon" is determined by the air resistance in passing the yarn around the spindle, the centrifugal force exerted in the revolving yarn, the count and type of yarn, the yarn winding speed and other factors.

It has been found that due to the twisting and rotation of the yarn, the "balloon" vibrates at the frequency of rotation of the spindle and in the vicinity of the yarn guide, these vibrations are transmitted thereto as long as the yarn remains unbroken.

In the present invention use is made of this phenomena to provide an indication of the occurrence of a break in the textile material.

It is an object of the present invention to provide apparatus for the detection of breaks in textile material without adding to the strain imposed on the material in process.

A further object of the present invention is to provide means for the detection of breaks in textile material and arranged upon the occurrence of a break, to actuate means, such as warning apparatus, machine stop motions, feed interrupting means and the like.

Thus, according to the present invention there is provided apparatus for detecting the existence of a break in textile material passing through a textile machine, com-

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prising transducing means responsive to vibrations imparted to the material by an operation performed thereon during passage thereof through the machine to produce electrical signals in response to said vibrations and means responsive to the absence of, or interruption of said vibrations and signals to provide an indication of the existence of a break in the material.

According to one specific embodiment of the present invention there is provided apparatus for detection of a broken yarn in a ring spinning machine in which a roving is passed through drafting rollers and via a yarn guide to a spindle on which the yarn is wound, comprising a transducing head responsive to vibrations imparted by the yarn balloon to the yarn guide such as to produce electrical output signals continuously from said transducing head whilst the yarn is unbroken, and means responsive to any interruption of the electrical output signals for operating warning devices, feed interrupting devices or stop motions.

A feature of the present invention is that use is made of the existing components of textile machines and no additional means is introduced into the path of the textile material. Thus, no additional wear or strain is imposed on the material as it passes through the machine.

The invention will now be described by way of example only with particular reference to the accompanying drawing wherein the figure is a side elevational view of the drafting unit, lappet and spindle of a ring spinning machine and schematically illustrates the broken yarn detector of the instant invention.

Although the invention will be described with reference to a ring spinning machine, it will be appreciated that, as previously stated, the detector means according to the present invention may be used in any textile machine where the material has vibrations imparted thereto by any operation performed thereon during passage of the material through the machine, and where such vibrations are of sufficient magnitude to produce detectable electrical signals from the output of a transducer.

Referring to the drawing, the yarn 1 is passed by drafting unit 2 and drafting rollers 3, 4, through yarn guide or lappet 5, to traveller 6 for winding on bobbin 7. The path traced out by the yarn, i.e., the "balloon" is shown by the full and chain-dot lines 1', 1'', in the figure.

The vibrations of the yarn in the region of the yarn guide 5 are imparted thereto and transmitted to a transducer 8 which preferably comprises an extremely sensitive multi-electrode piezo-electric crystal mounted in the detector head 9, which, as shown in the figure, is arranged in the vicinity of the yarn guide 5 so as to respond to vibrations imparted to the yarn at this point and to produce electrical output signals continuously therefrom whilst the yarn is passing through the yarn guide.

It is clear that the detector device should operate to detect the absence of yarn, i.e., the existence of a broken yarn and because of the fragility of the yarn, no contact should be made by the detector, with the yarn to avoid breakage thereof.

To meet the above requirements, the yarn guides of existing spinning machines may be modified by providing a suitably mounted arm 10 formed integrally with the yarn guide 5 and responsive to the vibrations imparted thereto, such as to transmit such vibrations to the crystal 8. The constructional features of a transducing head are described in co-pending application No. 473,094.

The electrical output signals from the crystal are passed to an amplifier 12 which may be of conventional form and preferably transistorised and the amplified signals travel through lead 17 and are applied to the coil 13 of a relay, to the effect energisation thereof such that the contacts 14, 15 thereof are biased open by the relay. A biasing means, e.g., spring 16, biases contacts 14, 15 closed when the coil 13 is de-energized.

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In a spinning machine, the spindles may be arranged in banks and fifty. In the figure note that there are schematically shown a plurality of transducers 9 and a plurality of leads 17. Every spinning apparatus has a yarn guide and a transducer 9. The apparatus shown is an example of all the others. Each spindle would have associated therewith a separate detector head 9 sensitive to the vibration of the spinning yarn 1 being wound on the respective spindle; the frequency being determined by the speed of rotation of the spindle which is normally rotating at approximately 7000 r.p.m. However, it is not necessary to provide a separate amplifier 12 for each detector head 9.

According to a preferred embodiment of the invention, a scanning device such as a uniselector, e.g. 20, is used to scan a bank of 50 to 100 detector heads 9-1 to 9-50, et al. within a predetermined time interval, e.g., 10 seconds. Should it be necessary to reduce the natural speed of scan of the wiper 22, of the uniselector from, e.g., 1 revolution per second, to, e.g., 1 revolution every 10 seconds, it would be necessary to provide a delay-type relay for reasons set out below.

The outputs from the detector heads 9 would be connected to a respective one of the contacts 23 of the uniselector 20 and the output from the uniselector connected to the input of the amplifier unit 12. Thus as the wiper 22 of the uniselector traverses a bank of contacts 23, current impulses will be passed to the input of the amplifier unit and the amplified signals passed to the coil 13 of the output relay, to effect energisation thereof and retain the associated relay contacts 14, 15 in the normally-open position. These contacts 14, 15 are connected in circuit with a plurality of cutter units 30 corresponding in number to the number of detector heads 9. Each cutter unit comprises a solenoid 31 connected to the respective output of the uniselector and arranged when energised to operate a cutting device 32 located at a predetermined point, preferably immediately prior to the back rollers of the drafting system 2. Thus, when a break occurs in the yarn of any unit of a bank, the output signals from the respective detector head 9 are interrupted and as the wiper 22 of the uniselector traverses its bank of contacts, the input to the amplifier will be interrupted when the wiper is in contact with the contact of the uniselector corresponding to the detector head from which the output signals have been interrupted. The normally energised relay 13 located in the output of the amplifier unit will be de-energised and cause the associated contacts 14, 15 to close, complete a circuit to the respective cutter solenoid 31, to effect energisation thereof and consequent actuation of the cutter to cut the yarn 1 behind the back rollers of the drafting system. Since the wiper 22 closes the circuit between each transducer 9 and each relay 13 only once every cycle of the uniselector, unless a time delay device is connected to the relay, the absence of impulses through each coil during the time the wiper 22 is wiping the other transducer contacts 23 will cause each relay 13 to allow each set of contacts 14, 15 to engage.

If necessary, two uniselectors may be employed to scan two 50 bank units in unison. In such an arrangement, the output signals from the detector units are fed to respective contacts of one or other of the uniselectors and a single amplifier unit coupled to the outputs of both uniselectors. Similarly, the cutter unit solenoids are connected to a respective one of the uniselector contacts via the normally-open contacts of the output relay of the amplifier unit.

It will be seen from the above description that since the individual detector heads 9 are each responsive to the vibrations of the yarn 1 passing through the respective yarn guide 5, any broken yarn will immediately be detected by the absence of vibrations and the interruption of the output signals from the respective detector head 9.

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As soon as the scanning device detects the particular unit of a bank in which a yarn has broken, the cutting device 30 of that unit is operated to cut the roving 1, thereby reducing the possibility of damage occurring to the roving on adjacent spindles, to a minimum and enabling an operator to rejoin the yarn with the minimum possible delay and effort.

If necessary, the output relay from the amplifier unit may have further contacts associated with an audible or visual warning device e.g., light bulb 33, such as to provide an immediate indication to the operator, of the existence of a broken yarn in any unit of a bank.

It will be appreciated that although the invention has been described in connection with the operation of yarn cutters following the detection of a broken yarn, the invention is equally applicable to textile machines where no cutting operation is necessary and to machines where the broken material may be automatically joined in response to an indication of the existence of a break in the material.

I claim:

1. A yarn spinning apparatus comprising a yarn drafting means, a yarn guide, means for winding yarn about a bobbin and means for holding a bobbin;

said drafting means feeding yarn toward said yarn guide and said winding means;

said yarn guide engaging the yarn between said drafting means and said winding means; the operation of said winding means vibrating said yarn guide by vibrating the yarn in engagement therewith;

a detector device connected to said yarn guide for detecting a break in the yarn;

said device being responsive to the presence of vibrations in said yarn guide and being differently responsive to the absence of vibrations in said yarn guide due to a break in the yarn.

2. The apparatus of claim 1 in which said device comprises transducing means which changes the vibrations of said guide into electrical impulses;

and electrical impulses responsive means being so constructed as to respond to the presence of electrical impulses emanating from said transducing means and to be differently responsive to the cessation of such impulses.

3. The apparatus of claim 2 in which said impulse responsive means comprises a relay containing a coil, cooperating contacts, first means for keeping said cooperating contacts apart, biasing means for biasing said contacts together and an electrical circuit including a separate power source, said cooperating contacts and a second means responsive to the completion of said circuit;

the presence of electrical impulses in said coil causing said first means to keep said cooperating contacts apart; cessation of the electrical impulses permitting said biasing means to bias said contacts together to complete said circuit which permits said power source to actuate said second means.

4. The apparatus of claim 3 in which said second means comprises a means to cut the yarn before it enters said drafting means.

5. The apparatus of claim 4 in which said second means comprises a solenoid device.

6. The apparatus of claim 3 in which said second means comprises an electrically operated indicator which indicates closing of said circuit and thereby indicates a break in the yarn.

7. A textile producing machine comprising a plurality of yarn spinning apparatus and a detector device for detecting a break in the yarn passing through any of the plurality of apparatus;

each of said plurality of apparatus comprising a yarn drafting means, a yarn guide, a means for winding yarn about a bobbin and means for holding a bobbin; said drafting means feeding yarn toward said yarn guide and said winding means;

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said yarn guide engaging the yarn between said drafting means and said winding means; the operation of said winding means vibrating said yarn guide by vibrating the yarn in engagement therewith;

a transducer connected to each of said guides for changing the vibration of each of said guides into electrical impulses;

a plurality of first electrical contacts; the output of each of said transducers going to a different one of said first contacts;

electrical impulse responsive means being so constructed as to respond to the presence of electrical impulses and to be differently responsive to the cessation of such impulses;

a scanning device having a wiper contact and being electrically connected to each of said impulse responsive means; said scanning device being so constructed that the said wiper contact engages each of said first contacts in turn, thereby completing the circuit between each of said first contacts and said responsive means.

8. The machine of claim 7 in which each of said impulse responsive means comprises a relay containing a coil, cooperating contacts, first means for keeping said cooperating contacts apart, biasing means for biasing said contacts together and an electrical circuit including a separate power source, said cooperating contacts and a second means responsive to the completion of said circuit;

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the electrical impulses in each of said coils causing each of said first means to keep each of said cooperating contacts apart; cessation of the electrical impulses in any one of said coils permitting the respective biasing means to bias the respective cooperating contacts together to complete the respective circuit which permits said power source to actuate the respective second means.

9. The machine of claim 8 in which said second means comprises a means to cut the yarn before it enters said drafting means of the apparatus having a break in the yarn.

10. The machine of claim 8 in which said second means comprises an electrically operated indicator which indicates a closing of said separate circuit and thereby indicates a break in the yarn.

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