

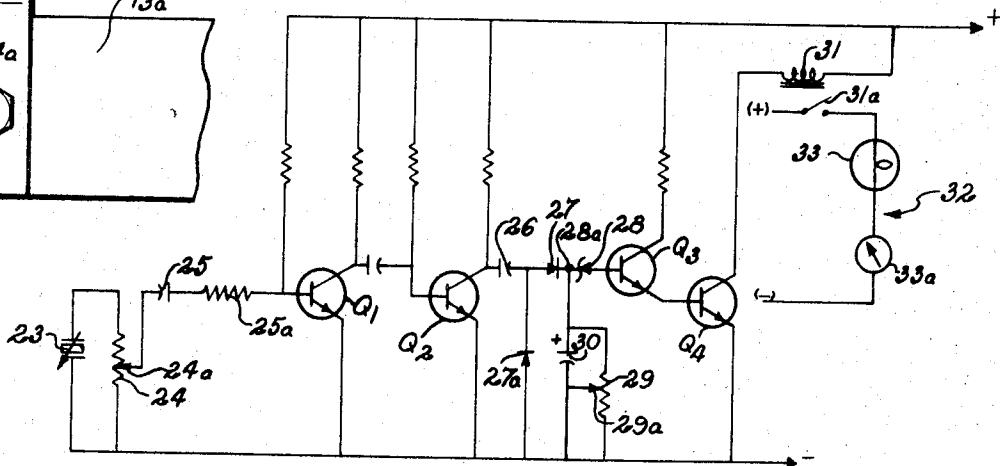
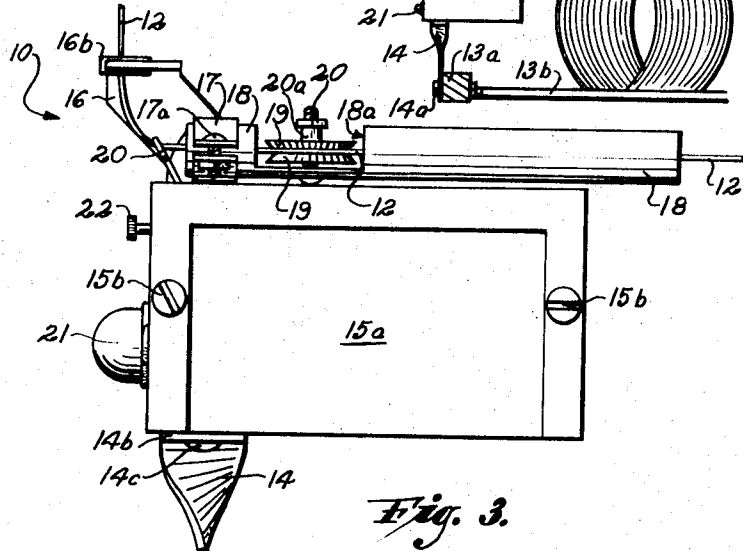
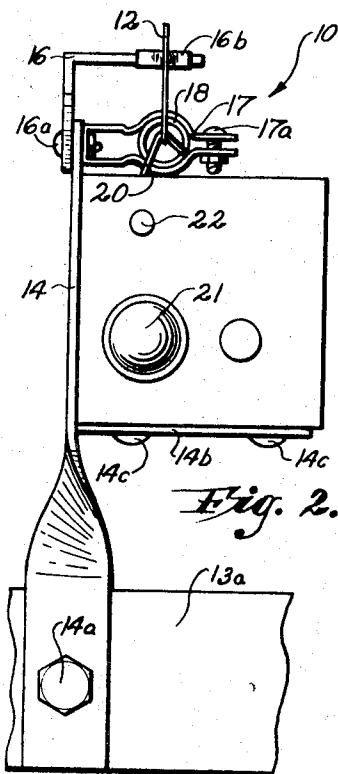
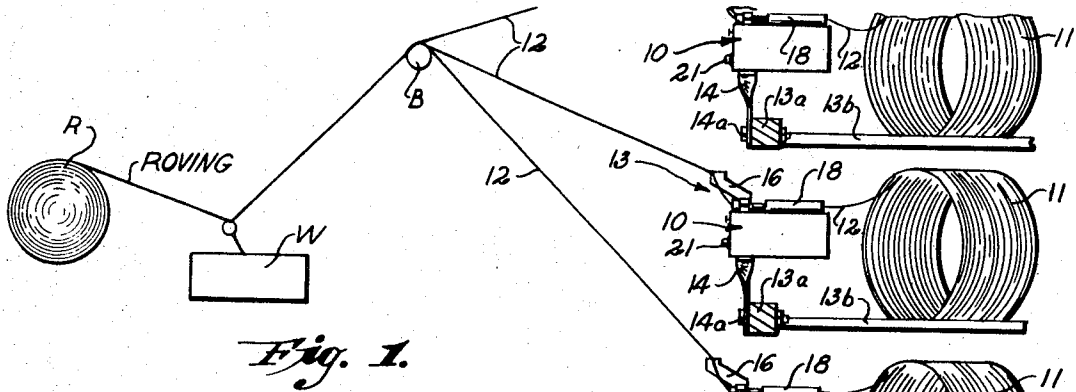
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STOP MOTION DEVICE

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STOP MOTION DEVICE

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2 Claims

ABSTRACT OF THE DISCLOSURE

A device for detecting and indicating a broken strand condition during the forming of glass fiber roving. The device utilizes a combination stylus and crystal cartridge to produce an electrical signal in accordance with movement of a glass fiber strand relative to the stylus. This signal, when suitably amplified, is usable to maintain an electrical relay in a prescribed condition. The absence or lack of strand movement produces a no voltage condition at the crystal cartridge, thereby causing the relay to actuate a warning device and/or stop the forming operation.

BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION

It is common practice to use glass fiber roving as a reinforcing material with certain plastics. A roving (in the glass fiber industry) is generally constructed by mechanically bringing together a number of strands of textile glass fibers and eventually forming what is essentially an untwisted cord. The roving may be specifically designed for use in filament winding operations or with applicator guns which cut and spray the strands with a combination resin and catalyst on suitable forms. The strands, acting as the reinforcing material, substantially strengthen the over-all product.

The number of strands which comprise a roving become very important to the physical characteristics of the finished product. It is often the practice of glass fiber manufacturers to guarantee a minimum number of strands per roving. For example, a commonly designated 60-end (strands) roving may have as many as 64 strands but not less than 60 when used with applicator guns. Filament winding specifications are even more stringent and require "no ends out." As a result, prior art roving winders generally include "warning" detectors which indicate and signal the breakage of a particular strand during the winding process. The signalling of a broken strand condition allows an attendant operator of the winder to make a quick repair in order to maintain the strand count above 60. If several warnings are detected at once, or if a "no ends out" specification is being followed, then a brake is applied to the winder and all broken strands are spliced before continuing with the winding operation.

A typical winding process will include a number of sliver cakes (in excess of 60 if a 60-end roving is desired) mounted on a creel with a single strand being played out of the interior of each cake. Each strand passes up over elevated horizontal bars with all of the strands finally diverging at a conventional winding device and mandrel. The winding device directs the roving into a cylindrical roll.

As suggested above, the number of sliver cakes and individual strands moving therefrom determine the number of strands per roving as the roving is wound into the cylindrical roll by the winder device. Since the strands sometimes break during movement from the sliver cakes to the winder, a warning device is normally provided therewith. The most commonly used warning device is activated by loss of tension on the strand. Tension operated warning devices are mounted on the creel adjacent the

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play-out end of the sliver cakes with one warning device for each strand. In its usual form, the tension of the strand positions the switch arm so that an alarm or warning light will not be actuated. Once a strand breaks and there is no longer tension on the strand, the switch arm is allowed to initiate the actuation of the warning signal. I have found the conventional tension operated warning devices are not entirely satisfactory due to the fact that many breaks are not detectable when strand tension is used as a basis for detection. A strand may break at a point remote from the sliver cake (such as beyond the elevated horizontal rods) thereby allowing the strand to remain under tension at the stop motion device. As a result, the roving cylindrical roll may be formed with roving having less than the required minimum number of strands.

My invention does not sense or rely upon the tension of the strand to detect strand breakages. Rather, the subject device senses the motion of the strand and will activate the warning signal upon loss of motion. The physical orientation of the subject stop motion device is similar to the conventional tension type devices, however I utilize a crystal cartridge with a stylus extending therefrom and bearing against the strand. As long as the strand is moving against the stylus, a vibration is established therein causing the cartridge to produce an electrical signal. This signal is amplified and applied to maintain a conventional relay in a preset condition (with associated contacts open). When the strand motion stops, the vibration in the stylus and the electrical signal from the cartridge are also stopped. The loss of voltage allows the normally open relay to close, thusly connecting a warning light (and/or audible signal and winder brake) across the line to indicate the lack of motion and, therefore, the breakage of a glass fiber strand between the winder and a particular sliver cake.

One of the principal objects of the invention is to provide an uniquely constructed stop motion device for use with winders of strands of textile fibers, said device operating in an improved manner to detect the breakage of a single strand during the winding process. It is an important feature of my invention that the subject stop motion device senses and detects the motion of the strand during the winding process and is constructed to initiate a warning signal or a shutdown control system when an associated strand breaks and no motion is detectable.

Another object of the invention is to provide a device of the character described which enables the manufacturer of wound strands of textile fibers to confidently guarantee the number of strands per roving. Since strand movement is inherent in conventional winding systems, the lack of motion of a particular strand is quickly detectable by my device, thusly facilitating in easy repair splice so that a guaranteed minimum of strands per roving may be maintained during the entire winding operation.

A further object of my invention is to provide a stop motion device of the character described that is more compact, rugged and that significantly eliminates many of the moving parts heretofore required by devices of a similar nature. Since the glass fiber industry from the manufacturing stage to the winding stage is oftentimes performed in a significantly less than sterile atmosphere, dirt and foreign particles in and around the device have substantially less effect upon the operation of same with the elimination of many moving parts therein.

A still further object of the invention is to provide a stop motion device of the character described which does not affect the quality of the strands during a winding process. It is conventional practice to apply a sizing to each strand during the manufacture of same. The prior art warning devices passed a sized strand through a tension ring of a tension warning device. Since the strands were required to be under tension as they contacted the

ring, there was a tendency to rub off the sizing, thereby losing the clinging effect of the fiber on one side or generally fuzz the strand. Additionally, the maintaining of the strands under tension was another factor that promoted the possible breakage of the strands during winding operations. My invention has successfully eliminated both difficulties as a crystal cartridge with an associated stylus need only lightly contact the moving strands to detect their condition, and as a result, there is no tension or bearing against the strands in any substantial degree.

Other and further objects of the invention, together with the features of novelty appurtenant thereto, will appear in the course of the following description.

DETAILED DESCRIPTION OF THE INVENTION

In the accompanying drawings, which form a part of the specification and are to be read in conjunction therewith, like reference numerals indicate like parts in the various views;

FIG. 1 is a schematic view of the roving winding operations showing a portion of the creel mounted sliver cakes, a subject stop motion device operatively associated with each cake, and the combination winder and roll of wound roving;

FIG. 2 is a front elevational view of the subject stop motion device;

FIG. 3 is a side elevational view of the stop motion device as shown in FIG. 2; and

FIG. 4 is a schematic circuit diagram of the electrical circuit utilized in the subject stop motion device.

Turning now more particularly to the drawings, the subject stop motion device is represented by the numeral 10 in FIGS. 1-3. In FIG. 1, each stop motion device 10 is directly associated with a respective sliver cake 11 which is mounted on a suitable creel generally indicated at 13. These sliver cakes are tubular packages of textile glass fibers, each having a single strand 12 that unwinds from the interior of the sliver cake tubular package. In actual practice, the creel will support several sliver cakes 11 and stop motion devices 10 usually depending on strand requirement per roving. Each strand 12 passes over an elevated horizontal bar B and then to a conventional winder W. Winder W completes the operation by forming cylindrical rolls of wound roving R.

The creel is a rack-like support structure having frontal bars 13a and horizontal interconnecting cake supporting framework 13b. Each of the stop motion devices is supported relative to one of the sliver cakes on the creel by bracket 14. Since the stop motion devices and brackets are identical, the following discussion will be limited to a description of a single device and bracket.

The bracket is bolted to the forward surface of a bar 13a at 14a. A 90° twist in bracket 14 allows substantially the upper half of same to extend interiorly of the forward surface of bar 13a. Horizontally extending support 14b is welded to bracket 14 above the twist and is suitably apertured to accommodate bolts 14c which fixedly connect the lower surface of a square faced rectangular sided steel box 15 thereto and the left hand surface (FIG. 2) flush against the vertical portion of bracket 14. In this manner, the stop motion device (which is housed substantially within box 15) is supported for operation opposite the open forward end of its respective sliver cake 11. The end extremity of bracket 14, which extends above the upper surface of box 15, has a right angle extension 16 bolted thereto at 16a. The bolt-nut combination 16a also serves to mount contoured bracket 17 which supports and holds guide tube 18. Angle extension 16 may be pivotally moved on the shaft of bolt 16a, where its associated nut is sufficiently loosened to avoid frictional engagement. In this manner, extension 16 is allowed to assume either an up position (shown in FIGS. 1-3) or down (not shown), depending on the position of the device relative to the elevation of the winder apparatus.

Bracket 17 is of the clamp type and, while contoured

to hold guide 18, is generally U-shaped with a tightening bolt 17a extending between registering holes in the outer end portions of its upper and lower legs. In this manner, bracket 17 extends generally parallel with the upper surface of box 15.

Turning now more particularly to FIG. 3, the profile view of guide tube 18 indicates that it extends from a position near the forward face to and beyond the rear face of metal box 15 and has a cut out portion represented by the numeral 18a. A pair of tensioning wheels 19 are mounted for rotation on the shaft of screw 20 which extends upwardly through a suitable aperture in the lower central portion of the cut out area. Lock nut arrangement 20a serves to further locate the wheels on screw 20.

The fiber strand 12 from sliver cake 11 enters the tube guide 18 at the right hand end (FIGS. 1 and 3) and passes between the tensioning wheels 19 and on through to the forward portion of tube 18. Upon exiting from tube 18, strand 12 engages the looped end of stylus 20, discussed in more detail, infra, and then passes up through the V-shaped strand guide 16b that is located on the horizontal portion of angle extension 16. Of course, angle extension 16 may be pivoted to its down position about bolt 16a and if such were the case, stylus 20 would have a "ring" end rather than the looped end shown in FIGS. 2 and 3.

As suggested above, steel box 15 houses the circuitry for the stop motion device 10. For convenience of manufacture, and assembly, a side of box 15 (identified by the numeral 15a in FIG. 3) is affixed to the intumed or flanged sides of box 15 by machine screws 15b. In this manner, a printed circuit board may be easily placed parallel to side 15a within suitable holding brackets (not shown), and access obtained thereto whenever needed. The front face of the box 15 is apertured to facilitate the mounting of warning light 21 and the stylus thumb screw 22.

A crystal cartridge, schematically shown in FIG. 4 and indicated therein by the numeral 23, is mounted on brackets interiorly of box 15 and extends generally parallel to the upper surface of the box. The aperture through which thumb screw 22 extends is positioned relative to the forward portion of the crystal cartridge so that it may be used to tighten the stylus within the cartridge or to facilitate the removal of same in case of excessive wear.

Turning now more particularly to the electrical circuitry used with the subject stop motion device, and as shown in more detail in FIG. 4, numeral 23 schematically designates the conventional crystal cartridge used with the subject device. The stylus 20 is in physical contact with both strand 12 and cartridge 23 so that strand motion results in vibrations in the stylus which are in turn transmitted to crystal cartridge 23. The resulting vibrations of the cartridge develop a usable voltage across same.

Potentiometer 24 with sliding contact 24a provides a sensitivity adjustment and picks off the crystal cartridge developed voltage and transmits same through coupling capacitor 25, resistor 25a, and on to a conventional two-stage transistor amplifier identified by the transistor number Q1 and Q2, respectively. This section significantly amplifies the pick off voltage with the amplified output appearing at the collector of Q2. The Q2 collector voltage is coupled through capacitor 26, and positively poled diode 27 to the cathode of Zener diode 28. A delay circuit including the parallel resistor combination of resistor 29 and capacitor 30 is connected in parallel with Zener diode 28 and as a result, charges capacitor 30 to a value equal to the amplified voltage. Diode 27a is poled to further isolate the positive Q2 collector voltage to the junction (hereinafter referred to as junction 28) of the Zener and the delay circuit.

Zener diode 28 has typical Zener characteristics in that

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when the value of the voltage at junction 28a exceeds a preselected value, the Zener resistance breaks down and approximates a short circuit to the base of transistor Q3.

Transistors Q3 and Q4 form another amplifier-switch type circuit with a relatively high voltage gain. The voltage input to the base of transistor Q3 is again amplified with the output appearing at the collector of Q4. A current operated relay winding 31 is in its energized state with a low (near ground) condition on the collector of transistor Q4. In other words, the collector voltage of Q4 with the second amplifier circuit on, is only slightly positive thereby enabling current to flow from the positive potential to ground through Q4. With current flowing through the relay winding 31, its flux linked contact 31a open circuits a conventional warning light circuit shown schematically by the numeral 32. This warning circuit includes a voltage source, which may be common with the positive voltage with the amplifier circuit, normally open relay contacts 31a which are controlled by the condition of winding 31 and warning light 33. An ammeter 33a may be connected in series with all of the warning lights associated with a particular winding operation as will be seen.

The operation of the subject stop motion device relies primarily on the continued movement of strand 12 through the looped or eye end of stylus 20. As suggested above, the voltage fluctuations created by the vibration of stylus 20 within crystal cartridge 23 is picked off by potentiometer 24, amplified by the two stage amplifier consisting of transistors Q1 and Q2 and applied to the cathode of Zener diode 28. When this positive voltage exceeds the preselected value at junction 28a, Zener diode 28 breaks down and essentially shorts the voltage to the base of Q3. The second amplifier circuit, comprising transistors Q3 and Q4, operates as a quick switching device for the relay winding 31. The collector of Q4 will be essentially negative with respect to the positive voltage source and a current path is established from the positive voltage source through current relay winding 31 and the collector-base emitter circuit of transistor Q4 to ground. With the current flow through relay winding 31 energizing same, its associated relay contact 31a open circuits the warning light circuit 32. This condition is maintained as long as the strand movement causes the vibration of stylus 20.

It is possible that kinks or a whipping of the strand during the winding operation results in a no voltage condition at the crystal pickup head 23. In this situation, the voltage at the junction 28a is maintained in excess of the Zener breakdown value for a time period determined by the RC value of resistor 29 and capacitor 30. Diodes 27 and 27a are biased to preclude a rapid voltage decay to ground, thusly maintaining the on status of Q4 and relay 31 in its energized condition even though there is a momentary loss of voltage at the collector of transistor Q2. Wiper arm 29a allows this time period to be changed by an appropriate resistive setting thereon. When the whipping action of the fiber has ceased and relative strand movement has resumed, the operation of the circuit returns to normal and capacitor 30 will recharge and remain at this level until a temporary loss of voltage is again experienced.

If strand 12 breaks, no motion is sensed and the accompanying loss of voltage at the collector of transistor Q2 exceeds the preset time interval. As a result, substantially all of the voltage on capacitor 30 will discharge to ground, thereby cutting off the voltage to transistor Q3 and de-energizing relay winding 31. Relay contact 31a closes and warning light 33 is connected across the line.

A further embodiment includes the connection of several warning light circuits in series with a current limit ammeter and winding system brake. For example, if each warning light draws 200 milliamps and if a mini-

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mum of two strands may be broken in order to guarantee a number of strands per roving, the ammeter dial may be set at slightly over 400 so that when the third strand breaks, its warning light results in a total of 600 milliamps being drawn which is, of course, in excess of the 400 milliamps limit. The third strand break may then either be used to completely close down the winding operation or apply a brake to the winder. In this manner, the winding operation may be either manually or automatically controlled.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are inherent to the structure.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. A device for detecting and indicating a broken strand condition during the operation of a roving winder which forms glass fiber roving from a plurality of sources of glass fiber strands, said device comprising

a means associated with a strand during the formation of said roving for producing an electrical signal in response to the movement of said strand, said signal producing means including a crystal cartridge having a vibration sensing stylus in contact with said strand, said cartridge operable to produce said signal in response to the movement of said strand relative to said stylus,

a guide tube, said guide tube located intermediate said strand source and said stylus with said strand passing therethrough, said guide tube operable to attenuate the whipping motion of said strand as said roving is formed,

a pair of tensioning wheels, said tensioning wheels operable to locate said strand relative to said stylus so that said stylus may sense vibrations produced by the motion of said strand, and

a circuit including a warning light, said circuit having a means for turning on said warning light in response to said signal falling below a preselected value thereby indicating that said strand has broken.

2. The combination as in claim 1 wherein said device includes a box-like housing mounted in close proximity to said strand source, said tube mounted on said housing between said stylus and said strand source, said strand coming from said source and passing through said guide tube and between said tensioning wheels, said tube being of sufficient length to attenuate whipping motion in said strand during the winding operation.

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