

SPECIFICATION **Device for Detecting Interrupted Portions in a Sliding Clasp Fastener Chain**

Description

5 The present invention relates to a device for detecting an interrupted portion in a coupling element chain on a pair of coupled sliding clasp fastener stringers.

10 To manufacture sliding clasp fasteners having filamentary coupling elements of a coiled or zigzag configuration, a chain of interengaged rows of such coupling elements is sewn or otherwise attached to a pair of continuous stringer tapes while they are being advanced, and then the produced fastener stringers are provided with coupling-element-free gaps, sliders, top and bottom end stops, and finally are severed to predetermined fastener lengths, all performed in a continuous operation at a high speed. However, 15 since the rows of coupling elements are of a limited length, or they may be broken apart during a finishing process, the coupling element chain usually has interrupted portions therein free of coupling elements. The chain is suitably connected at such interrupted portions for allowing a finishing operation on a substantially endless chain of coupling elements. A requirement at various processing steps is that the element interruptions should be detected to stop advancing movement of the fastener stringers and suitably treated while the stringers are at rest in a manner to facilitate the processing in such finishing steps.

Such detection and treatment involve 35 unwanted downtime of the finishing machines and should be carried out in as short a period of time as possible. One of the ways to minimize such downtime is to increase the speed at which the fastener stringers advance. However, the faster the fastener stringer progress, the faster the interrupted portions pass through the detector and the more difficult it becomes to reliably detect the interrupted portions. Such a difficulty is serious especially where the fastener stringers are fed along by an electric motor controllable by a relay since the relay is not responsive to a signal of an extremely short period of time produced in response to rapid movement of the interrupted chain portions through the detector.

50 According to the invention there is provided a device for optoelectrically detecting a portion of a sliding clasp fastener chain while the chain is moving along, the portion having a lower power of light transmission than that of the remainder of the moving sliding clasp fastener chain, comprising: means for detecting light passing through the sliding clasp fastener chain and generating a first signal in response to a reduction in the amount of detected light caused by the portion on the sliding clasp fastener chain; 60 switching means responsive to said first signal for generating a second signal; and control means for stopping the movement of the sliding clasp fastener chain in response to reception of said

65 second signal, characterised in that said switching means comprises an electric switching element switchable from a first state to a second state to cause generation of said second signal and from said second state to said first stage to stop generation of said second signal, said switching element being responsive to said first signal to switch from said first state to said second state and being non-responsive to termination of said first signal to switch back to said first state, the device comprising selectively operable reset means to switch the switching element back to said first state.

70 The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:—

80 Figure 1 is a fragmentary plan view of a pair of coupled sliding clasp fastener stringers with a coupling element chain having an interrupted portion to be detected;

85 Figure 2 is a transverse cross-sectional view of the sliding clasp fastener stringers of Figure 1 passing through a detecting section of a no-element detector according to the invention; and

90 Figure 3 is an electrical circuit diagram, partly shown in block form, of the no-element detector of the invention.

As shown in Figure 1, a pair of coupled sliding clasp fastener stringers 10, 11 include a pair of stringer tapes 12, 12 and a chain 13 of interengaged rows of coupling elements 14, 14 mounted on and along opposed edges of the stringer tapes 12, 12, the coupling elements 14, 14 being in the form of a helical coil as better shown in Figure 2.

100 In Figure 2, the coupling elements 14, 14 are secured to the stringer tapes 12, 12 by threads 16, 17 sewn over the elements 14, 14 to the tapes 12, 12 and extending through a pair of reinforcing cords 17, 17 disposed in the coiled coupling elements 14, 14. With the fastener stringers 10, 11 coupled together, there is a space 18 between the confronting edges of the stringer tapes 12, 12, the space 18 being located just below interengaged heads 19, 19 of the coupling elements 14, 14.

110 The coupling element chain 13 on the interconnected fastener stringers 10, 11 has an interrupted portion 15 (Figure 1) in which there are no coupling elements. Such an element interruption is caused typically by the chain's being accidentally broken or by end-to-end connection of the supply lengths of chain. The coupling element interrupted portion 15 should be detected while the fastener stringers 10, 11 are running at high speeds through a fastener finishing machine so as to minimize possible downtime of the finishing machine.

120 An adhesive tape or sheet 20 that is typically 1 centimeter long in the longitudinal direction of the fastener stringers 10, 11 is applied manually over the interrupted portion 15 in the chain 13. The adhesive tape or sheet 20 serves to connect the ends of fastener chains and, particularly, to connect the chains end-to-end while they are

being sewn to stringer tapes. The adhesive sheet 20 is substantially opaque so as to block transmission of light therethrough. The coupling element chain 13, however, permits light to pass through fine clearances at the coupled heads 19 and through the space 18. While the fastener stringers 10, 11, are transferred along at a high speed, therefore, the chain is substantially transparent.

A no-element detector 21 shown in Figure 3 allows the coupled fastener stringers 10, 11 to be fed along as long as light passes through the coupling element chain 13 while the fastener stringers 10, 11 are fed through detecting section 22 of the no-element detector 21, and automatically stops the advancing movement of the fastener stringers 10, 11 in response to the blocking of light by the sheet 20 arriving at the detecting section 22. The no-element detector 21 also comprises a switching section 23 for energizing or de-energizing an electric motor 24 through a control 25 including a relay, the motor 24 being utilized to feed the fastener stringers 10, 11. The detecting section 22 includes a light emitting diode 26 with its cathode grounded and anode connected to a pulse generator 27 of a conventional design composed of an astable multivibrator and a differential circuit for producing a train of pulses each having an exponential wave form. The light emitting diode 26, when supplied with such pulses, produces flashes of light.

The detecting section 22 further includes a phototransistor 28 having its collector connected through a variable resistor 36 to a d.c. power supply 35. As illustrated in Figure 2, the light emitting diode 26 and the phototransistor 28 are oppositely disposed in spaced relation. The switching section 23 contains a transistor 29 with its base connected to the emitter of the phototransistor 28. The collector of the transistor 29 is coupled via a resistor 30 to the power supply 35. A point between the resistor 30 and the collector of the transistor 29 is connected to the gate terminal of a thyristor 31 having its anode connected to the control 25. The emitter of the transistor 29 and the cathode of the thyristor 31 are directly grounded, and the gate of the thyristor 31 is grounded through a resistor 32. A resistor 33 and a capacitor 34 coupled in series therewith are connected across the thyristor 31 and act as a protection circuit for the thyristor 31.

The no-element detector 21 operates as follows: the coupled fastener stringers 10, 11 are fed along through the detecting section 22 wherein the space 18 is held between and in vertical alignment with the oppositely disposed light emitting diode 26 and phototransistor 28, before the fastener stringers 10, 11 are processed in a finishing machine. As long as the coupling element chain 13 travels between the light emitting diode 26 and the phototransistor 28, flashes of light pass through the clearances in the chain 13 and through the space 18, and reach the base of the phototransistor 28. The

phototransistor 28 and the transistor 29 are simultaneously turned on and off in synchronism with the frequency of light flashes incident on the base of the phototransistor 28. The turning on of the transistor 29 produces a voltage drop across the resistor 30 and the turning off of the transistor 29 produces no voltage drop across the resistor 30. With the transistor 29 alternately energized and de-energized, a current for a short period of time is applied repeatedly to the gate of the thyristor 31, which however is not actuated thereby with a turn-on interval of time preselected to prevent energization of the thyristor 31 by such pulse signal on the gate. As long as the thyristor 31 is de-energized, the relay in the control 25 is de-energized and the motor 24 continues running.

When the adhesive sheet 20 arrives at the detecting section 22 and blocks light transmission from the light emitting diode 26 to the phototransistor 28, the phototransistor 28 and hence the transistor 29 become de-energized, allowing a current to flow through the resistor 30 to the gate of the thyristor 31 for a relatively long period of time that corresponds to a time interval during which light from the light emitting diode 26 is prevented from being applied to the base of the phototransistor 28. Such time interval is so selected that it exceeds the turn-on time interval of the thyristor 31. With such a current supplied as a trigger signal to the gate of the thyristor 31, the thyristor 31 is energized to actuate the relay in the control 25, whereupon the motor 24 is de-energized. Once the thyristor 31 is switched on, it remains energized even if the trigger signal on the gate is removed unless the thyristor 31 is not forwardly biased or is reversely biased. The advancing movement of the fastener stringers 10, 11 is then stopped for the treatment of the coupling element interrupted portion 15 before it enters the finishing machine.

When the control 25 is reset to switch on the motor 24, the thyristor 31 is rendered non-conductive again for allowing continuous operation of the motor 24.

With this arrangement, the no-element detector 21 can reliably detect the coupling element interrupted portion 15 covered by the opaque sheet 20 in the fastener stringers 10, 11 while they are being advanced at high speeds.

Claims

1. A device for optoelectrically detecting a portion of a sliding clasp fastener chain while the chain is moving along, the portion having a lower power of light transmission than that of the remainder of the moving sliding clasp fastener chain, comprising: means for detecting light passing through the sliding clasp fastener chain and generating a first signal in response to a reduction in the amount of detected light caused by the portion on the sliding clasp fastener chain; switching means responsive to said first signal for generating a second signal; and control means for stopping the movement of the sliding clasp



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A no-element detector 21 shown in Figure 3 allows the coupled fastener stringers 10, 11 to be fed along as long as light passes through the coupling element chain 13 while the fastener stringers 10, 11 are fed through detecting section 22 of the no-element detector 21, and automatically stops the advancing movement of the fastener stringers 10, 11 in response to the blocking of light by the sheet 20 arriving at the detecting section 22. The no-element detector 21 also comprises a switching section 23 for energizing or de-energizing an electric motor 24 through a control 25 including a relay, the motor 24 being utilized to feed the fastener stringers 10, 11. The detecting section 22 includes a light emitting diode 26 with its cathode grounded and anode connected to a pulse generator 27 of a conventional design composed of an astable multivibrator and a differential circuit for producing a train of pulses each having an exponential wave form. The light emitting diode 26, when supplied with such pulses, produces flashes of light.

The detecting section 22 further includes a phototransistor 28 having its collector connected through a variable resistor 36 to a d.c. power supply 35. As illustrated in Figure 2, the light emitting diode 26 and the phototransistor 28 are oppositely disposed in spaced relation. The switching section 23 contains a transistor 29 with its base connected to the emitter of the phototransistor 28. The collector of the transistor 29 is coupled via a resistor 30 to the power supply 35. A point between the resistor 30 and the collector of the transistor 29 is connected to the gate terminal of a thyristor 31 having its anode connected to the control 25. The emitter of the transistor 29 and the cathode of the thyristor 31 are directly grounded, and the gate of the thyristor 31 is grounded through a resistor 32. A resistor 33 and a capacitor 34 coupled in series therewith are connected across the thyristor 31 and act as a protection circuit for the thyristor 31.

The no-element detector 21 operates as follows: the coupled fastener stringers 10, 11 are fed along through the detecting section 22 wherein the space 18 is held between and in vertical alignment with the oppositely disposed light emitting diode 26 and phototransistor 28, before the fastener stringers 10, 11 are processed in a finishing machine. As long as the coupling element chain 13 travels between the light emitting diode 26 and the phototransistor 28, flashes of light pass through the clearances in the chain 13 and through the space 18, and reach the base of the phototransistor 28. The

phototransistor 28 and the transistor 29 are simultaneously turned on and off in synchronism with the frequency of light flashes incident on the base of the phototransistor 28. The turning on of the transistor 29 produces a voltage drop across the resistor 30 and the turning off of the transistor 29 produces no voltage drop across the resistor 30. With the transistor 29 alternately energized and de-energized, a current for a short period of time is applied repeatedly to the gate of the thyristor 31, which however is not actuated thereby with a turn-on interval of time preselected to prevent energization of the thyristor 31 by such pulse signal on the gate. As long as the thyristor 31 is de-energized, the relay in the control 25 is de-energized and the motor 24 continues running.

When the adhesive sheet 20 arrives at the detecting section 22 and blocks light transmission from the light emitting diode 26 to the phototransistor 28, the phototransistor 28 and hence the transistor 29 become de-energized, allowing a current to flow through the resistor 30 to the gate of the thyristor 31 for a relatively long period of time that corresponds to a time interval during which light from the light emitting diode 26 is prevented from being applied to the base of the phototransistor 28. Such time interval is so selected that it exceeds the turn-on time interval of the thyristor 31. With such a current supplied as a trigger signal to the gate of the thyristor 31, the thyristor 31 is energized to actuate the relay in the control 25, whereupon the motor 24 is de-energized. Once the thyristor 31 is switched on, it remains energized even if the trigger signal on the gate is removed unless the thyristor 31 is not forwardly biased or is reversely biased. The advancing movement of the fastener stringers 10, 11 is then stopped for the treatment of the coupling element interrupted portion 15 before it enters the finishing machine.

When the control 25 is reset to switch on the motor 24, the thyristor 31 is rendered non-conductive again for allowing continuous operation of the motor 24.

With this arrangement, the no-element detector 21 can reliably detect the coupling element interrupted portion 15 covered by the opaque sheet 20 in the fastener stringers 10, 11 while they are being advanced at high speeds.

Claims

1. A device for optoelectrically detecting a portion of a sliding clasp fastener chain while the chain is moving along, the portion having a lower power of light transmission than that of the remainder of the moving sliding clasp fastener chain, comprising: means for detecting light passing through the sliding clasp fastener chain and generating a first signal in response to a reduction in the amount of detected light caused by the portion on the sliding clasp fastener chain; switching means responsive to said first signal for generating a second signal; and control means for stopping the movement of the sliding clasp

fastener chain in response to reception of said second signal, characterised in that said switching means comprises an electric switching element switchable from a first state to a second state to cause generation of said second signal and from said second state to said first state to stop generation of said second signal, said switching element being responsive to said first signal to switch from said first state to said second state and being non-responsive to termination of said first signal to switch back to said first stage, the device comprising selectively operable reset means to switch the switching element back to said first state.

2. A device according to claim 1, said detecting and generating means including a light emitting diode for producing light, and a phototransistor

for producing said first signal in response to said reduction in the amount of light incident on the base of said phototransistor.

3. A device according to claim 1 or 2, said switching means including a transistor for being turned on in response to the reception of said first signal, and resistor means for generating said first signal in the form of a trigger signal thereacross in response to energization of said transistor, said electric switching element comprising a thyristor for generating said second signal in response to application of said trigger signal to the gate of said thyristor.

4. A device substantially as herein described with reference to and as illustrated in the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1982. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

