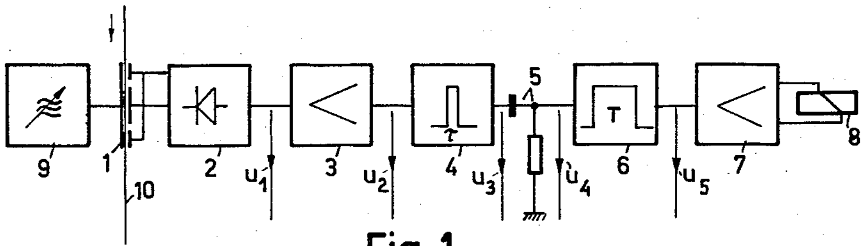

Fig. 1

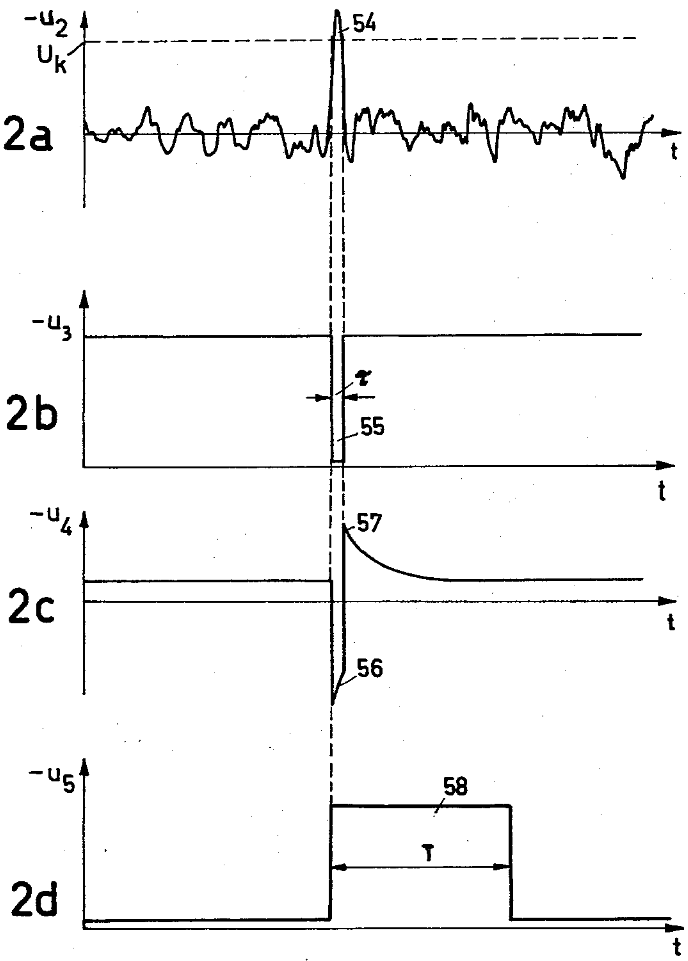

Fig. 2a
Fig. 2b
Fig. 2c
Fig. 2d

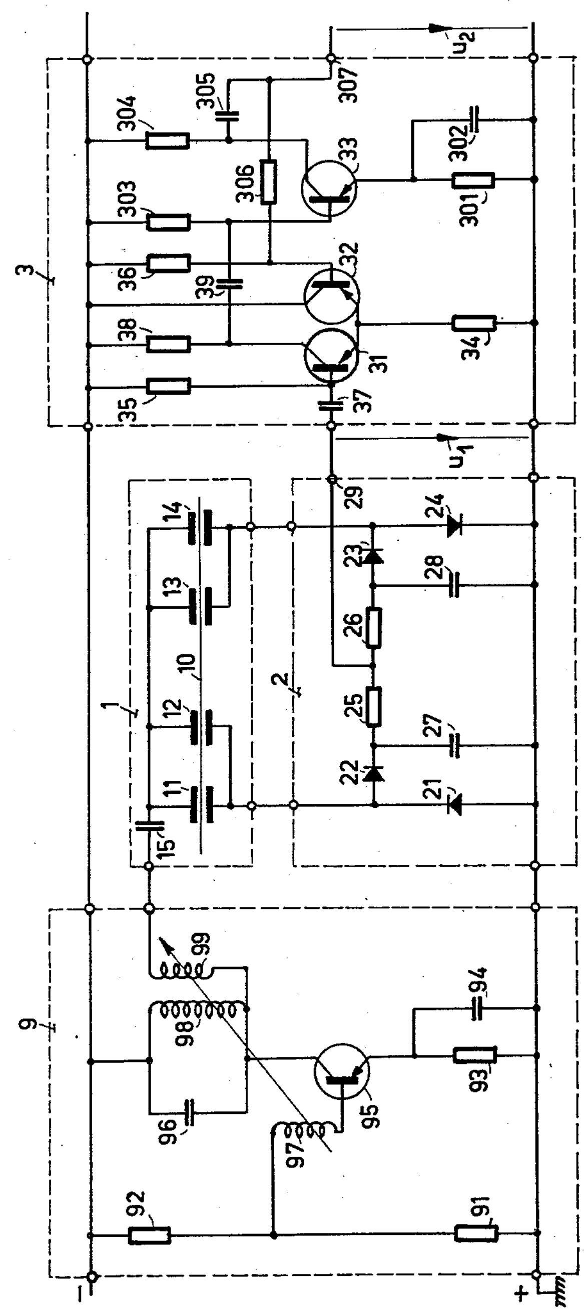
u2
307
305
304
303
306
302
301
33
32
31
3
36
39
38
35
37
34
u1
29
14
13
10
12
11
15
1
2
24
23
28
26
25
27
22
21
9
99
98
94
93
95
96
97
92
91
-
+

Fig. 3

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APPARATUS FOR DETECTING AND REMOVING DEFECTIVE SECTIONS OF ADVANCING TEXTILE MATERIAL

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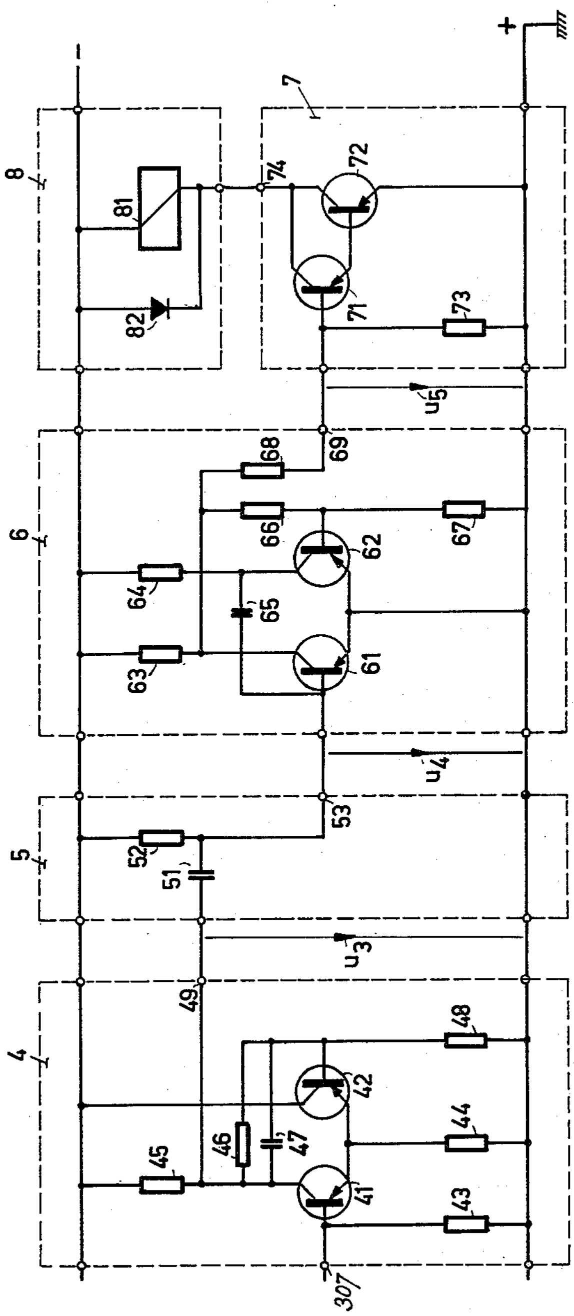

Fig. 4

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APPARATUS FOR DETECTING AND REMOVING DEFECTIVE SECTIONS OF ADVANCING TEXTILE MATERIAL

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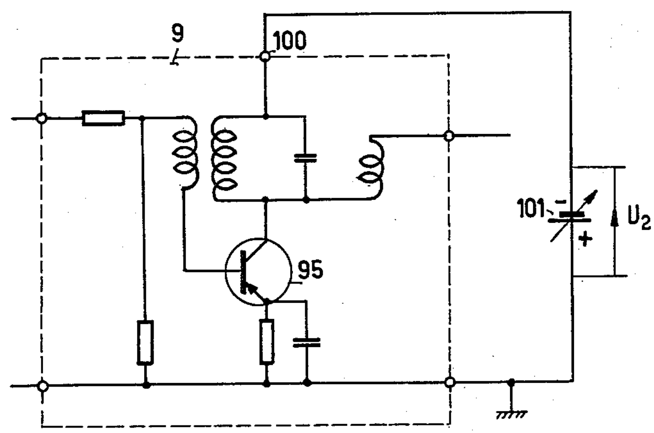

Fig. 5

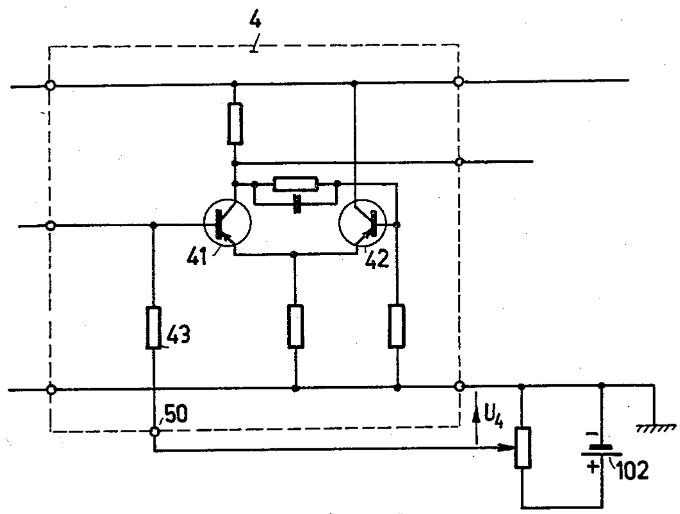

Fig. 6

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3,122,956

APPARATUS FOR DETECTING AND REMOVING DEFECTIVE SECTIONS OF ADVANCING TEXTILE MATERIAL

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Claims priority, application Switzerland Sept. 11, 1959
1 Claim. (Cl. 83—361)

This invention relates to the detection and removal of defective spontaneous cross-section variations in textile material, particularly in yarns, rovings and slivers.

Methods and devices are known in the textile industry for removing yarn defects before they become troublesome in subsequent manufacturing processes or even in the finished product made from the yarn. Such yarn defects are most frequently recognizable as local heavy thickening.

The known methods and devices operate by the textile material being explored by a measuring member. As soon as a yarn defect enters the measuring member, a yarn severing member is released for severing the textile material in the immediate vicinity of the defective place.

Very extensive use is made of measuring members which give an electrical signal representing a reproduction of the particular cross section of the textile material. These signals are usually very weak and are amplified by electron tubes. The consequence of this is that the working reliability of the known devices does not satisfy practical requirements since, in most cases, such devices are mounted on heavily vibrating machine parts and the life of the tubes is therefore very short. Attempts have, therefore, been made to make such devices with the least possible number of tubes, but this has seriously impaired the long-period stability of the response sensitivity as well as the uniformity of the response sensitivity of a number of devices mounted on the same machine.

Further disadvantages of the known devices with tubes are the high working voltages required as these have to be supplied by means of leads to various measuring points which are often difficult of access; the long heating-up times of the devices before the necessary stability of their response sensitivity is reached; and also the size of the devices resulting from the tube dimensions.

Recently, there have also been used for the detection of spontaneous cross-section variations in textile material devices in which a simple relaxation circuit, fitted with transistors, serves to operate a thread severing member on the occurrence of voltage peaks in the input signal. Such simple relaxation circuits, however, cannot provide response sensitivities which are reproducible with sufficient accuracy, because the evaluation of the signal given by the measuring member and the generation of the necessary pulses for operating the thread severing member to some extent impose conflicting requirements on the relaxation circuit. Such a device has the serious disadvantage that its response is dependent on the form of the pulses.

The principal object of this invention is a method and apparatus which overcomes these disadvantages of prior systems for the detection and removal of defective sections of textile material, particularly yarns, rovings and slivers.

According to the invention, there is produced, from a signal varying with the variation in the advancing textile, a second signal comprising pulses representing only those sections of the material in which the cross sectional variations are of sufficient magnitude to require their removal. From these pulses, which are of indefinite duration, there are produced corresponding pulses of definite uniform magnitude and duration for actuating the defect-removing means. In this way reliable and positive operation of the defect-removing means can be obtained for any desired range of cross sectional variations in the material.

In one embodiment of the invention, the varying signal from the textile-measuring member is applied to a bi-stable circuit in such a way that the circuit is changed from one stable condition to the other only during the intervals in which the signal is greater than a definite value. The output of this circuit is used to control a mono-stable circuit, such as a multi-vibrator which has a time constant and other characteristics such that the pulses of indefinite length are effective in producing substantially identical pulses of uniform duration and magnitude. Such pulses are capable of reliably operating the textile-severing means, thereby making the system sensitivity independent of the length and diameter of the defective section of the material.

These and other features of the invention will now be explained by way of example with reference to the accompanying drawing wherein:

FIG. 1 is a block circuit diagram of a complete device according to the invention.

FIGS. *2a–d* show momentary voltage values as a function of the time at the connecting points of individual circuit groups of the device.

FIGS. 3 and 4 are a complete circuit diagram of the device.

FIG. 5 is a detail of the circuit diagram.

FIG. 6 is a further detail of the circuit diagram.

The block circuit diagram of FIG. 1 shows a measuring member 1 in which the cross-section variations of the textile material 10 cause capacity variations in a manner known per se. The measuring member 1 is fed with HF voltage by an HF oscillator 9. The high-frequency voltage fluctuations resulting from the capacity variations are rectified in a demodulator 2 and arrive as an electrical signal μ_1 at a pre-amplifier 3, where the signal is amplified and is applied as input signal μ_2 to a known type trigger circuit 4. This circuit is adapted, when its characteristic threshold voltage U_k is exceeded, to give rectangular pulses μ_3 of short duration τ, which are differentiated in a C-R link 5 and, as pulses μ_4, control a monostable multi-vibrator 6 known per se. This multi-vibrator supplies a rectangular pulse μ_5, which starts simultaneously with the input pulse μ_4, but continues for a time T which is constant and generally greater than the time interval τ. This rectangular pulse μ_5 is applied to a pulse power amplifier 7, which provides the necessary power for controlling a thread severing member 8.

FIGS. *2a–d* show the voltages occurring at the connections between the circuit groups as a function of time and thus illustrate the mode of operation of the device according to the invention.

FIG. *2a* shows the variation of the input signal u_2

corresponding to the cross-section variation of the textile material 10. The trigger circuit 4 is biased so that all voltage fluctuations at its input, which do not reach its its characteristic trigger voltage U_k, have no influence on its output voltage u_3. However, as soon as the input signal u_2 reaches the characteristic trigger voltage U_k, as is represented by the peak 54, a rectangular pulse 55 occurs at the output and continues until the input signal u_2 has again dropped below the trigger voltage U_k. This behavior is shown in FIG. 2*b*.

The duration τ therefore corresponds to the time during which the input signal u_2 exceeds the trigger voltage U_k and is thus not constant. In the examination of textile material for the detection of defective spontaneous cross-section variations, which produce such voltage peaks 54, the time τ is in general very short. Only in rare cases does it attain values such as are necessary for the direct and reliable operation of an electro-magnetic relay.

The rectangular pulse 55 given by the circuit 4 is differentiated in a C–R link 5 and the resultant voltage pulse 56, 57 is shown in FIG. 2*c*. The positive voltage peak 56 of the pulse u_4 is used for triggering the following mono-stable multi-vibrator 6 while the negative voltage peak 57 of the pulse u_4 has no effect.

The mono-stable multi-vibrator 6 is excited by the positive voltage peak 56 of the pulse u_4 to trigger over into its unstable working condition in which it remains during a definite time interval T. After the lapse of this time interval it trips back, without external impulse, to the original stable working condition, as is shown in FIG. 2*d*. The time interval T is independent of the time τ of the pulse 55 and is constant.

FIGS. 3 and 4 show as a construction example a detailed circuit diagram of a device according to the invention. It will be understood, of course, that instead of any or all of the particular components shown, other circuit arrangements may be used, provided they serve the same purpose.

The oscillator 9 for feeding the measuring member 1 may, for example, be of the inductively coupled, high-frequency type. A high-frequency transistor 95 receives its necessary working voltages by way of the resistances 91, 92, 93 and the coil 98. The condenser 94 is for the high-frequency bypassing of the resistance 93. The frequency determining circuit for the oscillator comprises the coil 98 and the condenser 96. Feed-back and phase rotation from the collector of the transistor 95 to its base is effected inductively from coil 98 to coil 97. The high-frequency voltage is coupled out by way of the auto-transformer 98—99.

The measuring member 1 comprises a number of measuring condensers 11, 12, 13 and 14 to which high-frequency voltage is supplied from the oscillator through an isolating condenser 15. The demodulator 2 has diodes 21, 22, 23, 24, for charging condensers 27 and 28, and resistances 25 and 26 and the demodulated signal u_1 appears between terminal 29 and ground as shown.

The pre-amplifier is constructed as two-stage LF circuit in which the signal u_1 is fed across a condenser 37 to the first pre-amplifier stage acting as difference amplifier. This first stage comprises the transistors 31 and 32, the resistances 34, 35 and 36 for working point adjustment and the output resistance 38. A further amplifier stage, comprising a transistor 33, resistances 301 and 303 for working point adjustment, condenser 302 for decoupling the resistance 301, and the output resistance 304, is coupled across condenser 39. The amplifier singal u_2 is coupled out across condenser 305. The amplifier is stabilized by being back-coupled through resistance 306.

The trigger circuit 4 with shunt 43 across the input comprises two transistors 41 and 42, an output resistance 45, voltage dividing resistances 46 and 48, a condenser 47 and a common emitter resistance 44. The pulse 55 produced across the resistance 45 is taken off at the terminal 49 and fed to the C-R link 5 comprising condenser 51 and resistance 52.

The voltage peaks 56, 57 produced in the C-R link 5 pass via terminal 53 to the mono-stable multi-vibrator 6. The latter comprises the transistors 61 and 62, output resistances 63 and 64, voltage dividing resistances 66 and 67 and a feed-back condenser 65. The pulse with the pulse length T is led through resistance 68 to terminal 69 where it appears as pulse 58.

Pulse 58 is amplified in the power amplifier 7 comprising the transistors 71 and 72 in compound connection and the resistance 73 and is led to terminal 74 and the thread severing member 8. The magnet coil 81 of the member 8 forms the output impedance for the amplifier 7 and a diode 82 suppresses the high switching voltage peaks which would otherwise be produced by the collapse of the field of the coil at the end of each pulse.

The sensitivity with which the cross-section variations in the textile material 10 to be examined are detected must be adjustable within certain limits for the following reasons:

(1) For adaptation to the yarn count so as to permit all cross-sections occurring to be examined with the same measuring member;

(2) For satisfying the practical requirement of being able to detect spontaneous cross-section variations as desired as a function of their magnitude and frequency.

Since as a rule a number of devices of the kind described are mounted on one machine and the same textile material 10 is presented to them for examination, it is advantageous if the adjustment of sensitivity can be controlled centrally for entire groups of devices. A possible solution of this is to vary the amplitude of the high-frequency voltage common to all devices by varying the direct-current voltage U_2 supplied to the oscillator. FIG. 5 shows a high-frequency oscillator 9, the direct-current voltage U_2 of which is supplied by a variable voltage source 101 by way of terminal 100.

A second possible solution is to impress on the input signal u_2 at the input of the trigger circuit 4 a variable biasing voltage which again is adjustable in common for all the devices. FIG. 6 shows the trigger circuit 4 with the shunt 43 connected to ground through terminal 50 and a central variable direct-current voltage source 102.

The voltage U_k required to trigger the circuit 4 has an instability which, regarded absolutely, is approximately constant and, therefore, it becomes relatively smaller with increasing trigger voltage. At the same time, however, the instability is reduced relatively to the signal u_2 at the input of the trigger circuit 4, so that large signals u_2 and consequently large values of the trigger voltage U_k are advantageously employed. Under such conditions the response sensitivity to spontaneous cross-section variations is much more stable than if small input signals with low trigger voltages were to be used.

While the invention has been described with reference to a particular system in which the cross sectional variations are measured in terms of their capacitative effect, many modifications are possible within the scope of the following claims. For example, the electrical signal u_1, or the input signal u_2 may be obtained by measurement of the cross section of the textile material 10 photoelectrically, by mechanical exploration, by pneumatic means or by means of radioactivity produced by natural or artificial means. The important requirement is that the electrical signal u_1 be an approximate reproduction of the cross-section variation of the textile material 10 to be examined.

I claim:

Apparatus for detecting and removing defective sections of advancing textile material comprising a source of high frequency oscillations, a modulator for varying the amplitude of the oscillations in accordance with variations in the cross sectional area of the material, a bi-stable trigger circuit biased to a trigger voltage which is large compared with its inherent instability, a circuit including a demodulator and an amplifier connecting the modulator to the trigger circuit, means for adjusting the output level of the amplifier so that the bi-stable circuit is triggered only by variations representing defective sections of material to be eliminated, a textile-severing device and a mono-stable circuit controlled by the trigger circuit for generating a long pulse of high amplitude for each operation of the trigger circuit and a circuit for applying the long pulses to the severing device.

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