Multi-Channel Device for Control of Defects of Fabric Surface

Abdumalikova Zulfiya Ismatullaevna,
Fergana Polytechnic Institute

Madmarova Umida Abdukarimovna
Fergana Polytechnic Institute

ABSTRACT

The current problem of controlling the technological parameters of the fabric during their primary processing is highlighted. The structural diagrams and the principle of operation of visual-optical and radiation methods and devices for controlling the intraspot of the tissue shell are presented. It has been established that optoelectronic methods and devices for monitoring technological parameters of co-cones are more promising.

Keywords: reflections, tissues, defects, photodetector, size, pulse, multichannel scheme.

Photoelectric methods for detecting fabric surface defects (stains, dirt, banding, integrity violations, etc.) are based on the fact that the reflection coefficient of the fabric surface in the area of the defect, as a rule, differs from the reflection coefficient of the tissue surface without defects.

Denoting the radiation flux incident on the tissue surface, Ph and the reflection coefficients of the tissue surface without defects and with a defect, respectively, ρo and ρd, it is possible to represent tissues, when moving from a tissue surface area without defects to a surface area with a defect as

$\Phi=\Phi_0 (1- \rho_{д}/ \rho_0) \rho_0.$

Thus, the appearance of a sufficiently significant defect in the field of view of the photodetector is accompanied by a change in the illumination of the photodetector, and, consequently, a change in the voltage level at the output of the latter circuit.

The level of this voltage, like that of a photodetector illuminated by a stream passing through a moving tissue, cannot remain strictly constant even in the case of the complete absence of defects on the controlled tissue segment, since when the tissue moves, the conditions for reflecting the radiation flux from its surface periodically change due to the fact that the tissue is a more or less complex periodic structure consisting of many threads, the spectral composition of the variable component of the output voltage of the photodetector circuit in the absence of defects in the tissue, which can be considered as noise, determined by the speed of tissue movement and its structure.

The movement of the tissue in the X direction can be controlled by installing a series of photovoltaic sensors located on a straight line perpendicular to the X axis and parallel to the plane of the tissue. In this case, each photoelectric converter scans a relatively narrow strip of tissue moving in front of it. Such a multichannel scheme, despite the large number of primary transducers used, is quite simple, does not contain moving elements, and its application to control tissue of any width is not associated with any special difficulties.

The simplest multi-channel device for detecting holes in tissue is a device consisting of an illuminator and a number of photodetectors. The controlled tissue moves between them so that the radiation flux from the illuminator, having passed through the tissue, enters the photodetector. Therefore, the illumination of the photodetectors periodically changes depending on how many filaments and gaps between the filaments are currently in front of the entrance slit of the photodetector. When a hole in the tissue appears in front of this slit, the illumination of the corresponding photodetector sharply increases and the device gives a signal. To reduce the noise level at the output of the photodetector, due to the structure of the fabric, the entrance slits of the photodetectors are oriented at an angle to the direction of the weft threads of the fabric.

This setup uses a series of germanium photodiodes arranged in a straight line perpendicular to the direction of tissue movement. Each of them, taking the stream of light reflected from the fabric, controls a narrow strip of its surface. An electroluminescent lamp is used as an illuminator, which evenly illuminates the fabric across its entire width.

Defects in the controlled tissue differ in size and reflectivity. To assign tissue to one or another group, it is necessary to take into account the number and type of detected defects, therefore, 4 different output signal processing channels are connected to the output of each photodiode to detect defects of a certain type.

To detect defects that give pulses of large amplitude, a discriminator followed by a pulse shaper. To detect defects that give weak, periodically repeating pulses, an optimal filter is connected to the photodetector, followed by a threshold device that produces a standard output pulse at a certain voltage at its input.

To detect defects that give pulses of small amplitude, but of considerable duration (defects with a large area, but with a slightly changed reflection coefficient), an integrator is connected to the output of the photodetector, followed by an amplitude discriminator and a pulse shaper.

To detect defects that give scattered pulses (randomly scattered small spots, a certain number of which are considered acceptable at a certain segment of the tissue length), an amplitude discriminator is connected to the output of the photodetector, followed by an accumulative counter NS and a pulse shaper.

By combining the signals at the outputs of these four channels, it is possible in principle to evaluate the quality of the fabric using the appropriate logic circuit.

For simultaneous monitoring of violations of the integrity of the tissue and surface defects, a number of photodetectors are installed on both sides of it and in a direction perpendicular to the direction of tissue movement. Across the entire width of the tissue, a radiation flux from the emitter is directed to it, the length of which is equal to the width of the tissue. The beams reflected from the flow fall respectively on a group of photodetectors, one of which serves to detect integrity, and the other to detect surface defects in the tissue.

Within each of the two groups, the photodetectors are divided into pairs, and a difference signal is taken from the output of each of these pairs. When a defect appears in the field of view of one of the photodetectors, the difference signal takes on a value other than zero at the output of the corresponding pair. Deviation from the zero value of the output signal of any pair of photodetectors leads to the action of a relay signaling a defect. The greatest extent of the defect is determined by the distance between the photodetectors that form a pair, at the output of which a signal appears due to this defect; therefore, the pairs are not made up of neighboring photodetectors, but of those spaced at a sufficient distance from each other.

The device consists of a number of identical channels located one after the other across the width of the tissue to be tested. Each channel has a radiation source 4, from which three radiation fluxes are directed to the controlled tissue 5. The first of them, on the area of the fabric in the place where it slips, bending over the support 10, forms an illuminated loop 1 mm long in the direction of fabric movement. The radiation reflected by this area of tissue enters the photodetector 2, which is used as a cadmium-selenium photocell. This photodetector is used to measure the tissue rejection coefficient.

The second radiation flux from source 4 is directed to mirror 6, from which it is reflected onto mirror 12, which casts it onto photodetector 1. On the way between mirrors 6 and 12, this radiation flux passes through a narrow gap between support 10 and partition 3, along the normal to the plane this slit, partially covered by the tissue 11 by the value of its thickness, so the output signal of the photodetector 1 can be used to measure the thickness of the tissue.

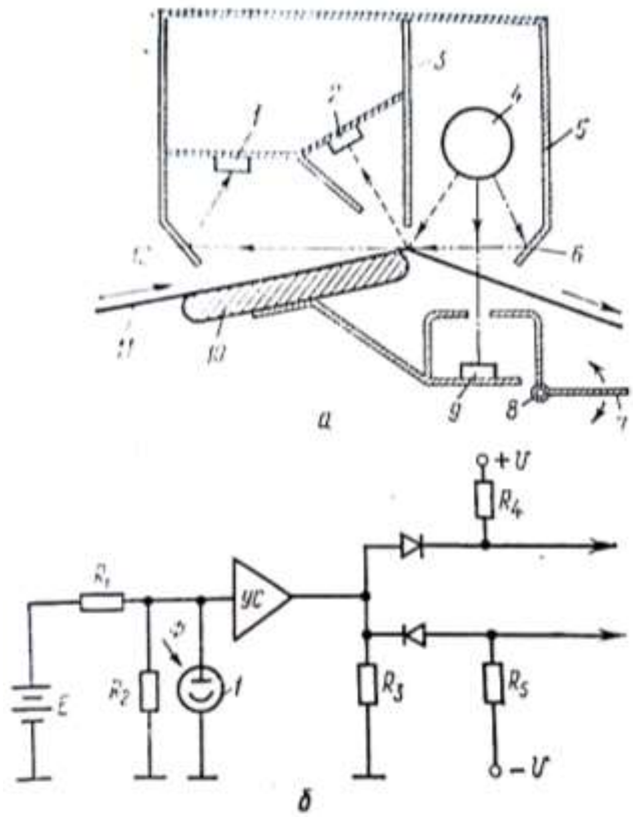

Fig.1. Structural diagram of a multichannel device for monitoring defects in the tissue surface.

The third radiation flux from source 4 passes through the tissue and enters through the slit to the photodetector. The screen can be set obliquely to the plane of the radiation flux at different angles by turning it around point 8 using the control knob 7. By measuring the effective area of the slit in the screen in this way, it is possible to adjust the equipment for monitoring tissues with very different transparency.

Identical circuits are connected to the output of each of the photodetectors. Photocell 1 is powered by direct current through a divider of resistances R1 and R2. The output signal from the resistance R2 is fed to the input of the US amplifier. A load resistance R3 is connected to the output of the amplifier, followed by two branches, which are an anti-parallel connection of two diodes, a mixture is supplied to the circuit of each of which allows, by changing the values of the resistances R4 and R5, to set the threshold for its unlocking.

This scheme allows you to set the limits of the tolerance field for the tissue parameter.

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