УДК 677.051: 658.52.011.56

ANALYS OF MANUAL AND AUTOMATIC CONTROL OF THE FEEDER ROLL OF THE SAW GIN STAND

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ABSTRACT

COTTON, SAW GIN STAND, SEED ROLL, DENSITY OF SEED ROLL, CONTROL OF THE FEED ROLLERS, QUALITY OF FIBER AND SEED

The article presents the results of experiments of manual and automatic speed control of the feeding rollers with the aim to uniformly adjust the density of a seed roll, and to determine the dependence of fiber and seed quality on automatic feeding depending on the load of the saw cylinder in the saw gin.

The main point of primary processing of cotton is to separate the fibers from the seeds, this is a complex process consisting of several operations, dozens of transitions ensuring the quality of fibers, seeds and other components.

During ginning – the main operation of the primary processing of cotton – the quality of fiber and seed deteriorates due to uneven nutrition of cotton and insufficient improvement of the mechanism for regulating the density of the seed roll.

When researching processes in the saw gin, it becomes necessary to determine and change the speeds, loads, working hours and other indicators of the working tools during operation.

To control the density of the seed roll in the saw gin, the speed of the feed rollers is changed. In studies [1–3], it was proposed to regulate the speed of the feed rollers of the DP series saw gin (Uzbekistan) using a frequency converter. The advantage of this system is also the ability to observe the process of changing the performance of working tools over time.

In the process of ginning as a result of regulating the speed of the feed rollers in order to study the changes in the parameters, experiments were conducted under production conditions on 4ДП-130 saw gin in "Turakurgon pakhta tozalash" JSC (Uzbekistan). The experiments were carried out on manually collected cotton of Namangan-77 I – breeding varieties and V – industrial varieties.

In the experiments, a frequency converter of the Danfoss VLT series was used.

The frequency converter was connected to the laptop with a standard USB cable. The MCT 10 software program developed by Danfoss was also used.

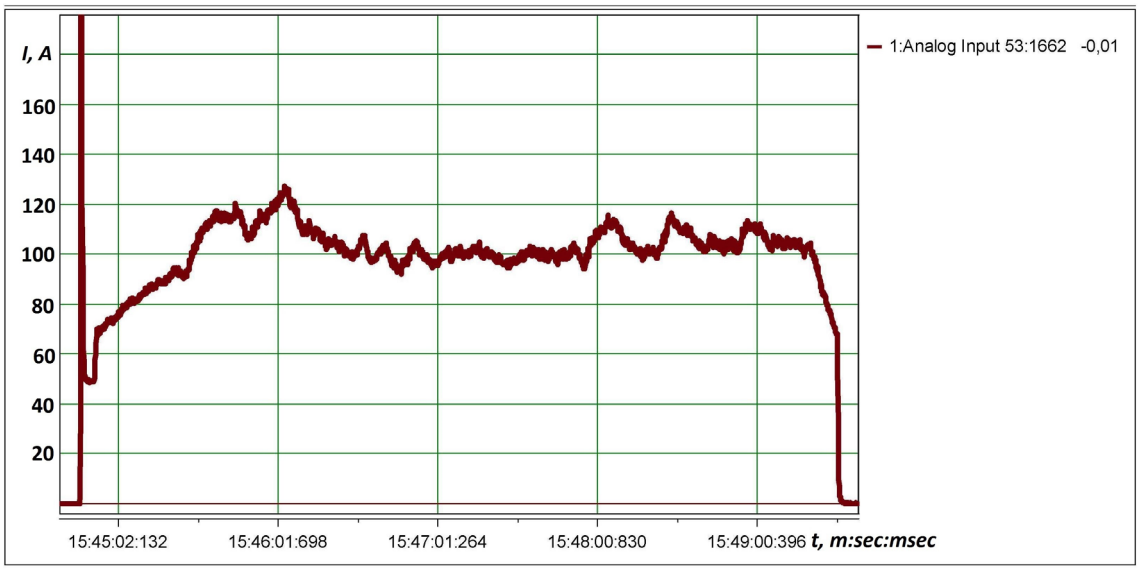
The frequency converter and the sensor for determining the load current of the saw cylinder engine were connected according to the circuit, as well as according to the requirements of their installation, and installed in an electrical panel (Fig. 1). To control the speed of the feed rollers, a control panel was installed on the saw gin (Fig. 2). The control panel consists of a switch for manual and automatic control, a potentiometer for regulating the speed of the feed rollers during manual control, as well as a switch for the motor of the feed rollers.

Figure 1 – General view of mounting the frequency converter and current transformer

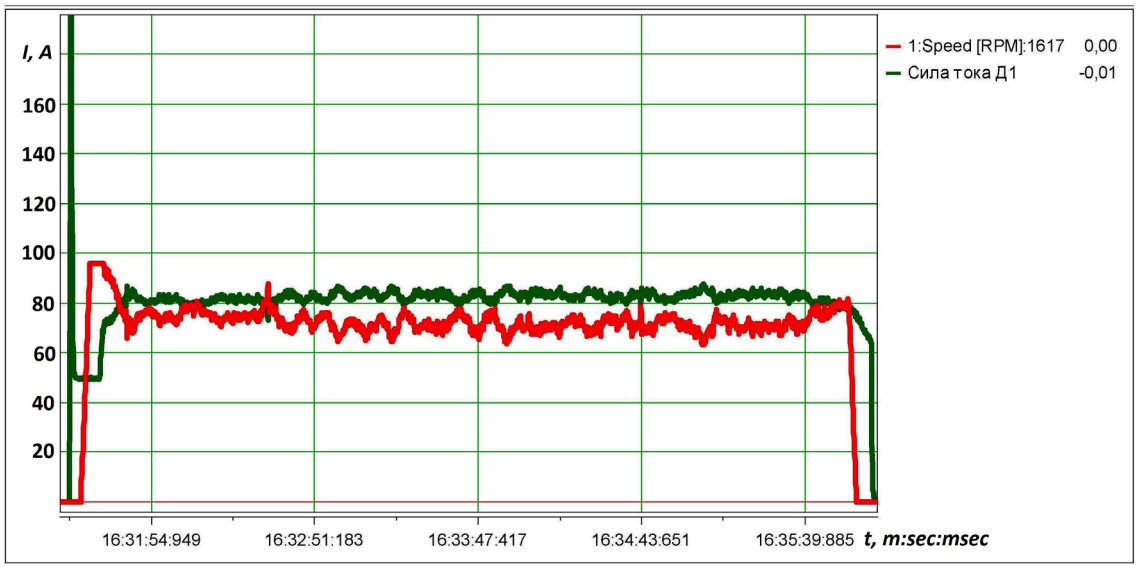
Figure 2 – Remote control of the feed rollers

Instead of the ИВА variator available on the 4ДП-130 saw gin, a 0.75 kW motor gearbox is installed.

Figure 3 shows the oscillogram of the change in the load current of the saw cylinder engine over time obtained on the MCT 10 program. As we can see in the figure (a), the load current of the saw cylinder engine varied within 80-130 A under manual control of the device. Under automatic control, this indicator (figure (b), the green line) varied within 75-85 A, and the speed of the feed rollers varies inversely alongside with it (red line). That is, we can see the operation of the speed control system of the feed rollers in automatic mode.



a



b

Figure 3 – The oscillogram of the change in the load current of the engine of the saw cylinder over time on the MST 10 software program: a. In manual mode; b. In automatic mode (green line), the corresponding change in the rotation speed of the feed rollers (red line).

The quality indicators of the fiber obtained on the saw gin with the device installed are determined in the HVI system. And the quality indicators of cotton seeds are determined in the seed laboratory.

As it can be seen from Table 1, with the use of automatic control, quality indicators of fiber, such as the Short Fiber Index (SFI) for I-grade cotton decreased from 6.3 % to 5.8 %, and for V-grade from 9.8 % to 8.8 %.

Table 1 – Qualitative indicators of cotton fiber and seed

Desig-nation	Name of indicator	For I-grade cotton		For V-grade cotton	
		Manual control	Automatic control	Manual control	Automatic control
Mic	Micronaire	4.6	4.6	3.9	3.9
Str	Strength, gs/tex	33.0	33.2	30.7	32.1
Unf	Uniformity Index, %	83.3	84.2	82.4	82.9
SFI	Short Fiber Index	6.3	5.8	9.8	8.8
Elg	Elongation, %	6.8	6.9	7.1	7.4
Cnt	Trash Code	12	8	70	61
Area	Trash Area, %	0.8	0.7	2.1	2.0

On the MCT 10 program, you can select such parameters as the maximum and minimum motor speed, current frequency, load current, incoming and outgoing signal, etc. Also using the oscilloscope mode, it is possible to create, load and save a regulated project. This mode enables to observe current changes in the values of selected parameters in real time. After recording the waveforms for analyzing the entire process, the values are saved in the form of a spreadsheet.

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