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Determination Of Instant Values Of Angular Velocities Observed In The Process Of Operation Of A Feeder For Cotton-Sowing In A Two-Mesh Separator And Control Of Impacting Forces

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Abstract: Instantaneous values of angular velocities are determined during the operation of the device transporting seeded cotton in a double mesh separator. The influencing forces are checked and the ways to eliminate it are considered.

Key words: oscilloscope, separator, scraper shaft, induction signal, vacuum valve, inlet pipe.

Introduction. The world is developing cotton separators, determining the optimal parameters, improving the working chamber and developing the scientific base of existing technologies. Research work is underway to identify factors that positively affect the production process. In this regard, special attention is paid to the development of the design of the cotton separator and the justification of its parameters, the identification of factors that adversely affect the quality indicators when extracting cotton from the air, and their elimination with the help of a cotton separator of a new improved design.

The scientific novelty of the research is as follows:

in order to increase the efficiency of the separator, a new efficient design of the separator (perevalka) was created by installing an additional mesh surface on the vertical plane of the working chamber;

in the double-surface separator, the differential equation of motion is obtained for the process of separating the cotton piece stuck to the mesh surface;

it was found that the radius of the transport effect increased due to the fact that cotton does not stick to the mesh surfaces of the improved double-surface separator and air absorption is easier;

The optimal parameters of the grid surface of the double-surface separator, the slope of the inlet pipe and the speed of rotation of the scraper were determined using a regression mathematical model.

Figure 1. Recommended improved separator

In the experimental equipment, a small electromotive force generating device based on the required induction requirements was used to test the instantaneous value of the resulting angular velocity (Fig. 2).

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Figure 2. The process of checking the movement of the shafts of the equipment using an oscilloscope

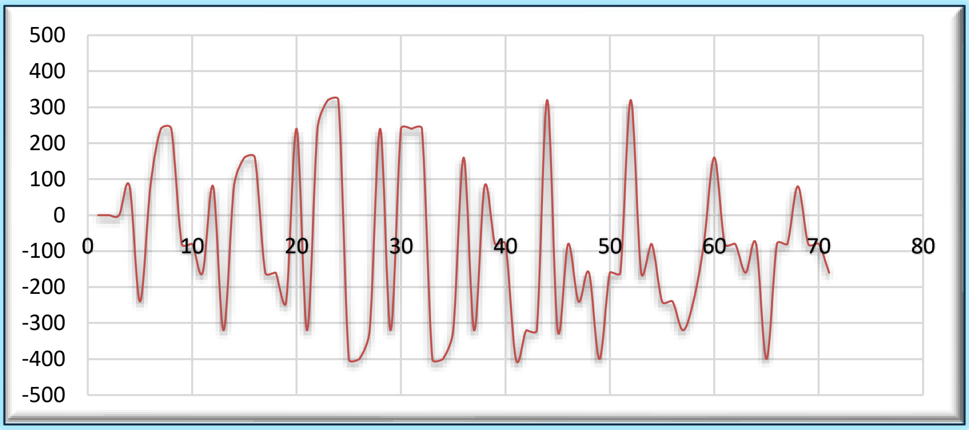

Figure 3. Oscillogram of the time dependence of the induction signal depending on the instantaneous value of the speed during the rotational movement of the separator scraper shaft.

In this oscillogram, we can see the time (in microseconds) on the x-axis, and the induced voltage on the y-axis.

$$\varepsilon = \frac{\partial \lambda}{\partial t} \qquad (1)$$

Here; $\partial \lambda = const$, $\partial t = const$. ε - we take small values as the time corresponding to the loads. Because when the load on the shaft drops, the speed of rotation of the shaft slows down and the oscillogram readings approach zero. If vice versa, then the oscillogram indicators will have large values (Fig. 3).

The following waveform shows the time dependence of vibration along the vacuum valve shaft. If we pay attention to the highest and parallel indicators on the oscillogram, it was found that the vacuum-valve shaft of the SS-15A separator in the company where we conducted the experiment was faulty. If this fault is not corrected, it will lead to excessive consumption of electricity and equipment failure (Fig. 4).

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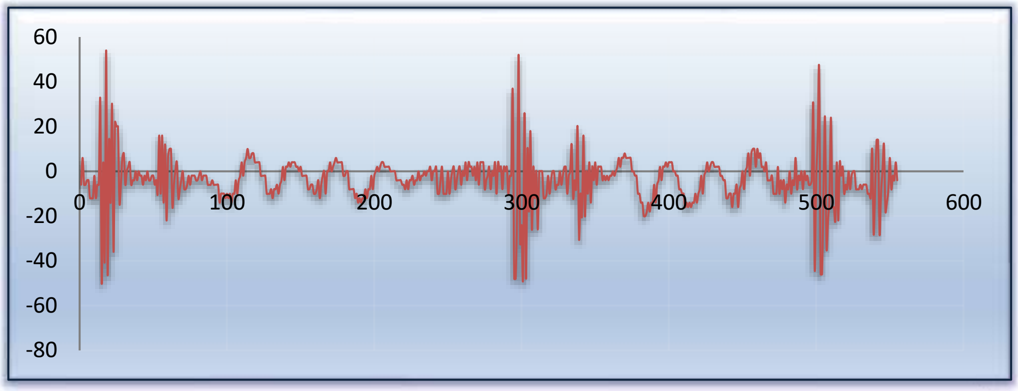

Figure 4. Vacuum valve pitching timing diagram.

Full-factorial experiments were carried out to determine the parameters that reduce the amount of fiber passing through the separator and increase the cleaning efficiency. Names of input parameters and threshold values of change are listed (Table 1).

Table 1

Name and designation of factors		Change levels			Change interval
		-1	0	+1	
Mesh surface useful surface , м^2	x_1	0,556	0,839	1,122	0,556
Inlet pipe slope , (*a*)	x_2	30	45	60	15
Cutting speed, rev/min	x_3	60	105	150	45

Y1-cleaning efficiency(%), Y2-work efficiency (tons) were selected as output factors. Y1- is evaluated according to the amount of dirt accumulated in the cyclone during one hour, and Y2- is evaluated according to the dirtiness of the cotton entering and leaving the separator.
Experiments were performed 3 times to ensure the required accuracy. Regression equations were obtained by computer processing the results of the experiments.

$$Y_1 = 12,63 + 1,19x_1 + 1,72x_3 - 2,31x_1^2 - 1,93x_2^2 - 1,73x_3^2$$
$$Y_2 = 14,63 + 1,9x_1 - 1,26x_3 + 2x_2x_3 - 1,89x_1^2 - 2,2x_2^2$$

Regression equations were solved on the basis of a special program and connection graphs were obtained and had the following appearance (Fig. 4 a, b).

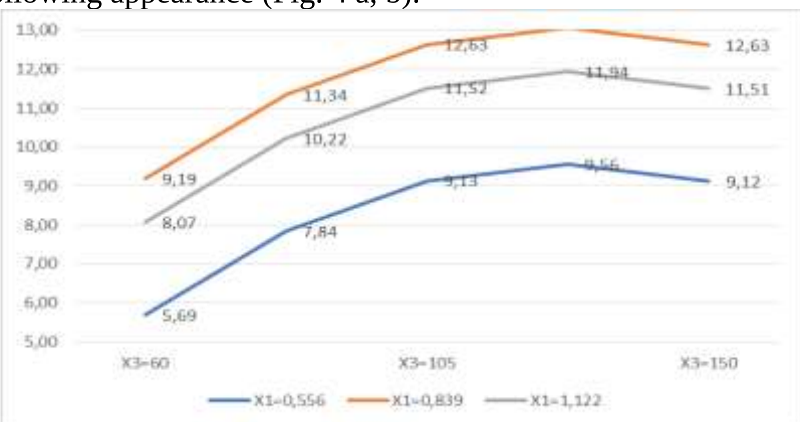

Fig. 4a. A plot of the purification efficiency of the input factor X1 versus the input factor X3.

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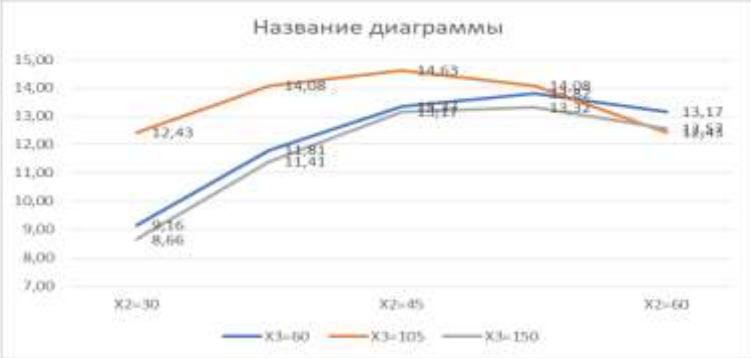

Fig. 4b. A graph of the performance of input factor X3 versus input factor X2.

The newly proposed separator device has changed the shape and size of the mesh surface located in the separator chamber and installed it on the upper part of the working chamber in order to improve the cleaning efficiency. That is, the size of the useful mesh surface is increased and the rotating mesh drum is placed in the upper part of the working chamber. Due to the increase in the size of the mesh surfaces, the dust air is quickly and easily removed, the free fiber exit to the cyclone is reduced and the cleaning efficiency is increased to a certain extent.

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