Study of the influence of the performance of a raw cotton cleaner on changes in the rotation speed of the peg drum

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Abstract. The optical sensors used have their own internal resistance, the extinction of which leads to the fact that the sensor gives a certain signal. When a beam of light hits the optical sensor, the internal resistance of the sensor decreases. For the reliability of the results obtained, each experiment was carried out in four repetitions. All experiments were carried out under the same conditions at a constant set rotation speed peg drum.

1 Introduction

In the process of cleaning cotton from fine litter when using elastic plates in a mesh surface, changing the speed of rotation of the peg drum sufficiently affects the cleaning effect. An increase in cleaning performance leads to an increase in the load on the elastic plates, as well as an increase in the average values of its displacements. Therefore, one of the tasks set before us is to study the effect of the cleaner's performance on the change in the speed of the peg drum, as well as on the cleaning efficiency of raw cotton. To study this process, the following experiment was carried out, where the change in the speed of the peg drum was considered depending on the cleaning mode.

It should be noted that earlier in the experiments, the speed of the peg drum was assumed to be constant. It is known that in the rotating organs of the raw cotton purifier, the speed of their rotation varies depending on the nature of the load. Changing the speed of rotation of the peg drum directly affects the nature of oscillations of the elastic plate of the mesh surface.

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2 Materials and methods

During experimental studies using an optical sensor, the influence of the performance of the cleaner on the change in the speed of the peg drum was studied [1-7]. The optical sensors used have their own internal resistance, but the suppression of this resistance leads to the fact that the sensor gives a certain signal. When a beam of light hits the optical sensor, the internal resistance of the sensor decreases. The sensor detects light and gives a signal. Note that various vibrations and noises that occur do not affect the accuracy of the optical sensor. The sensor captures each light modulation and transmits the corresponding signals to the PC. On a computer, using a special program, signals are processed, which are presented in the form of graphs. At the same time, to verify the reliability of the results obtained, using an electronic tachometer, the frequency of the peg drum was measured at idle. Then these speeds were measured using an optical sensor. These indicators coincided to a sufficient extent. The graph obtained at idle speed of the peg drum is a straight line.

3 Results and discussion

Experimental studies were carried out at different performance values of the raw cotton cleaner (5.0-7.0 t/h). For the reliability of the results obtained, each experiment was carried out in four repetitions. All experiments were carried out under the same conditions at a constant set speed of rotation of the peg drum. When studying the process of cleaning raw cotton, a special role is given to the speed of the peg drum. All these three stages of operation of the peg drum can be clearly seen on the graphs obtained using an optical sensor [3, 4].
It should be noted that "Start time", "Set mode" and "Stop time" in all cases had different indicators. The obtained values of the start and stop times of the peg drum are shown in Table 1.

The first line corresponds to the idling of the peg drum. In this case, the machine was running without load. As can be seen from the histogram (Fig. 2), the minimum start time will be in idle mode. It should also be noted that an increase in productivity increases the start-up time of the peg drum. The next four columns of the results obtained correspond to different performance values. With an increase in productivity from 5 t/h to 7 t/h, the time to start the peg drum increases accordingly: from 0.255 s to 0.322 s.

Table 1. Changes in the speed of rotation of the peg drum, start and stop times at different capacities

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<tr>
<th>No</th>
<th>Start time, $10^{-1}$ sec.</th>
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<th>Changes in rotation speed, $\text{min}^{-1}$</th>
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The closer the start time of the peg drum under load to the start time of the electric motor at idle, the longer the useful time of the machine.

4 Discussion
Fig. 2. Histograms showing the change in the start and stop time of the peg drum depending on the loading of raw cotton.

Fig. 3. Graphic dependences of the change in the swing of the frequency of rotation per minute of the peg drum depending on the performance of the cleaner.

5 Conclusion

As the capacity increases, the start time increases and the stop time decreases. This is due to the fact that the braking of the peg drum with a larger mass (with cotton) occurs faster, and the launch is delayed. [8].

Analysis of the data in Table 1 shows that at different capacities of the purifier of raw cotton from fine litter, the range of rotational speed per minute of the peg drum is different.

On fig. 3. Comparative graphical dependences of the deviation (range) of the speed of the pinning drum on productivity are given. So, at a productivity of 5 t/h, the deviations from the nominal value of the speed on average reach ±(3÷5) min⁻¹, and at a productivity of 6 t/h and 7 t/h, these deviations are, respectively, ±(5÷6) min⁻¹ and ±(10÷13) min⁻¹. In fact, these speed deviations lead to an impulsive action of the drum pins on the raw cotton, which in turn interacts with the elastic plates of the mesh surface. Due to the fluctuations of the latter with the frequency of disturbance from the cotton, that is, with the frequency of the oscillation of the speed of the peg drum, the cotton is subjected to additional shaking, which makes it possible to increase the cleaning effect.

References

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