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EFFECT OF STAGGERED SAW ARRANGEMENT ON CLEANING EFFICIENCY IN THE SECOND SAW CYLINDER OF A TWO-DRUM 2VP FIBER CLEANER

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Abstract. This article investigates the effect of the staggered arrangement of saws on the second saw cylinder of the two-drum 2VP fiber cleaner on cleaning efficiency. The influence of the relative saw arrangement on airflow dynamics and the removal of dust and short fibers was analyzed. The results showed that the staggered arrangement improves cleaning efficiency. It also enables optimal impurity separation and reduces energy consumption.

Key words: two-drum fiber cleaner, saw cylinder, staggered saw arrangement, axial offset, cleaning efficiency, cotton fiber, defective fibers, foreign matter, fiber quality, waste fiber content.

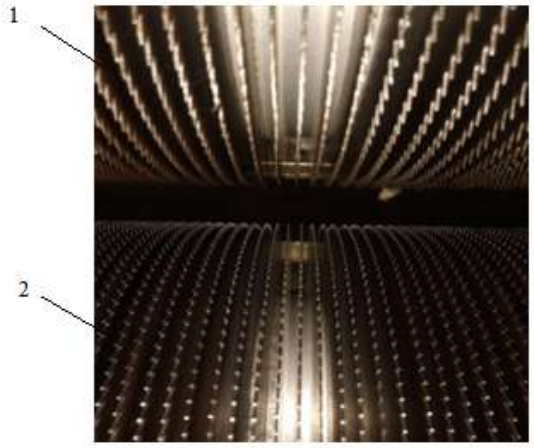
Introduction. The results of industrial-scale experimental studies conducted on a two-drum fiber cleaner showed that the axial distance between the saws on the saw cylinder was 7 mm. It was also established that, because the saw axes of the second saw cylinder were aligned with those of the first saw cylinder, the saws of the second cylinder did not have sufficient time to fully engage and capture the fibers discharged from the first saw cylinder. As a result, a portion of the fibers that was not captured by the second saw cylinder passed through in a transit state and mixed with the total cleaned fiber after the first saw cylinder, which reduced the quality of the produced fiber. In addition, the alignment of the saw axes of the first and second saw cylinders reduced the fiber opening and combing processes on the second saw cylinder, thereby decreasing the cleaning efficiency of the cleaner [1–2].

To substantially reduce the proportion of fiber remaining in the transit state after the first saw cylinder, ensure its effective transfer to the second saw cylinder, and intensify the opening and combing of the fiber on the second saw cylinder, the axial offset between the saws of the second saw cylinder and those of the first saw cylinder was varied from 2 to 4 mm and experimentally investigated (Figure 1).

The experiments were carried out on cotton fiber obtained by ginning S-6524 cotton of Grade I, Class 2. The average moisture content of the fiber was 5.8%, while the

average mass fraction of defective fibers and foreign matter was 3.21%. The experimental results are presented in Table 1.

When the axial offset between the saws of the second saw cylinder and those of the first saw cylinder was set to 2 mm, the average cleaning efficiency of the cleaner was 35.0%. The average mass fraction of defective fibers and foreign matter in the cleaned fiber was 2.1%, while the average fiber content of the waste generated during fiber cleaning was 26.7% [3]. When the axial offset between the saws of the first and second cylinders was increased to 3 mm, the average cleaning efficiency increased to 38.3%, while the average mass fraction of defective fibers and foreign matter in the produced fiber decreased to 1.98%. In this case, the average fiber content of the waste was 27.4%. At an axial offset of 4 mm, the average cleaning efficiency was 37.7%, the average mass fraction of defective fibers and foreign matter was 2.0%, and the average fiber content of the waste was 27.2%.



1 – First saw cylinder, 2 – Second saw cylinder

Figure 1. Displacement of the saws on the second saw cylinder relative to the saws on the first saw cylinder by 2–4 mm.

1- table

Effect of the Staggered Arrangement of the Saws on the Second Saw Cylinder Relative to Those on the First Saw Cylinder on Cleaning Efficiency and Fiber Quality

Name of indicators	Distance between the axes of the saws on the first and second saw cylinders, mm		
	2	3	4
Initial moisture content of the fiber, %	5,8	5,8	5,8

Mass fraction of defective fibers and foreign matter in the fiber before cleaning,%	3,21	3,21	3,21
Mass fraction of defective fibers and foreign matter in the fiber after cleaning, %	2,1	1,98	2,0
Cleaning efficiency, %	35,0	38,3	37,7
Fiber content of the waste, %	26,7	27,4	27,2

The results of the conducted experimental studies showed that, when the axial offset between the saws on the second saw cylinder relative to those on the first saw cylinder was set to 3 mm, the cleaning efficiency of the cleaner increased by 3.3%, while the quality of the produced fiber improved by 0.12%. When the axial offset was increased to 4 mm, the cleaning efficiency decreased by 0.6% compared with the 3 mm offset, and the fiber quality indicator decreased by 0.02% (Table 1).

Taking into account the increase in cleaning efficiency and the improvement in fiber quality, an axial offset of 3 mm between the saws of the first and second saw cylinders was selected [4].

In conclusion, the experimental results demonstrated that arranging the saws on the second saw cylinder in a staggered configuration relative to those on the first saw cylinder, with an axial offset of 3 mm, leads to an increase in cleaning efficiency [5]. Therefore, the implementation of this technology in cotton ginning enterprises is recommended.

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