

IMPROVING THE REUSABILITY OF SAW DISKS IN 5LP LINTER MACHINES BY MODERNIZING THE AIR CHAMBER SYSTEM

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Linter machines play an important role in the fiber processing stage of the cotton industry. They are used to remove residual fibers remaining on the surface of cotton seeds after ginning. However, some 5LP type linter machines currently in operation have several disadvantages, including non-uniform distribution of airflow, excessive friction on the surface of saw disks, rapid wear of the disks, and increased energy consumption. These issues reduce production efficiency and increase maintenance and operating costs. Therefore, improving the air chamber design of 5LP linter machines is a relevant and important task. [1].

In this study, the working chamber and air distribution system of the 5LP linter machine were analyzed. The following research methods were applied:

- Analytical analysis – calculation of airflow pressure and velocity parameters.
- Experimental testing – measurement of air pressure stability in the modernized chamber model.
- Comparative analysis – comparison of performance indicators before and after modernization.

The modernization was implemented in the following directions:

1. The air inlet channel was redirected at an angle of 15°.
2. Aerodynamic guide vanes were installed on the chamber walls.
3. An automatic air pressure stabilization system with control sensors was introduced.
4. Additional openings were created to optimize the circular airflow movement around the saw disks.

Table 1

Indicator	Before Modernization	After Modernization	Difference (%)
Saw disk wear	100%	70–75%	↓ 25–30%
Air flow uniformity	82%	96%	↑ 14%
Chamber temperature	65°C	55–57°C	↓ 8–10°C
Energy consumption	100%	87%	↓ 13%
Machine efficiency	100%	112%	↑ 12%

Aerodynamic redistribution of airflow has a significant impact on the operating conditions of linter machines. Due to the new chamber structure, pressure is evenly distributed across the surface of the saw disks, which reduces mechanical friction and overheating. This extends maintenance intervals, reduces the frequency of disk replacement, improves operational stability, and enhances fiber cleanliness [2].

The research results may serve as a basis for the modernization of currently operating 5LP linter machines in industrial production.

Based on the conducted research, the following conclusions were drawn:

1. Improvement of the air chamber structure makes it possible to reduce saw disk wear by 25–30%.
2. The automatic air pressure control system ensures temperature stabilization within the chamber.
3. Energy consumption decreased by 13%, reducing production costs.
4. The overall efficiency of the proposed modernization of 5LP linter machines increased by 10–12%.

As a result of theoretical and practical studies, further improvement of the linter air chamber design is recommended. Enhancing the nozzle (soplo) configuration of the linter air chamber is expected to create optimal operating

conditions for saw disks with diameters reduced from 320 mm to 264 mm, potentially increasing their service life by up to 1.7 times.

When using saw disks with diameters below 290 mm, it is necessary to ensure that the clearance between the air chamber nozzle and the saw tooth remains within the required range (1.0–2.5 mm). This is expected to reduce fiber losses in the exhaust airflow, improve fiber quality, and increase torque efficiency.

References

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