DEVELOPMENT OF MODERN TECHNOLOGY FOR COTTON CLEANING MACHINES

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Annotation: This article presents practical and experimental research on improving the 1XK machine designed for removing fine impurities from cotton. In the improvement project, the installation angle and mechanical structure of the pegged drums were revised, and mounting the drums at a specific inclination was found to increase cleaning efficiency. In addition, the design of the machine's mesh surface, feed rollers, and impurity hopper was optimized, simplifying the process of separating fine contaminants. Experimental results show that the improved 1XK machine ensures high cleaning efficiency and low energy consumption in cotton cleaning, thereby reducing costs and improving economic profitability.

Keywords: Cotton, fine impurities, 1XK machine, pegged drums, cleaning, mesh surface, feed rollers, impurity hopper.

Scientific research is being conducted worldwide to modernize the equipment and technologies used in cotton cleaning enterprises and to implement them into production processes. In this direction, priority is being given to the development of new equipment and technologies based on mathematical models that positively influence fiber quality indicators—specifically in cotton drying, cleaning, ginning, fiber purification, pneumatic transport, dust collection, and the retention of free fibers. Additionally, targeted scientific studies are being carried out to improve the durability of technological components in factory machinery and to introduce reliable modifications through the creation of new designs with alternative performance characteristics.

Global demand for cotton fiber continues to grow year by year. According to the International Cotton Advisory Committee (ICAC), approximately 23.0 million tons of cotton fiber are produced annually worldwide, while consumption has reached 24.55 million tons. Due to the rapidly increasing global population, cotton fiber consumption and demand are expected to continue rising in the future. At the global level, improving the quality and reducing the cost of cotton products remains a critical objective. This includes identifying and eliminating factors that negatively affect product quality during all stages of cotton processing—such as drying, cleaning from fine impurities, separating fiber from seeds, and moistening raw cotton and fiber. It is also essential to develop automated, resource-efficient technologies that reduce production costs. To this end, working schemes have been developed for the partial improvement of the

1XK equipment used for cleaning cotton from fine impurities. This experimental device operates as follows. Its working principle is partially similar to the currently used 1XK equipment in cotton cleaning facilities. Specifically, seed cotton discharged from drying drums and prepared for cleaning is fed into a chute mounted above the feed rollers. These feed rollers rotate in opposite directions and transfer the seed cotton to the spiked drum. The spiked drum agitates the seed cotton, passing it over a mesh surface to separate fine impurities. As the drum rotates, the cotton strikes the mesh surface, and part of it is lifted upward, increasing its free-fall acceleration. As a result, fine impurities fall through the mesh screen below and pass through openings beneath the drum into a screw conveyor. The screw mechanism then reliably transports the separated impurities out of the system, while the cleaned cotton is directed through a pipe to the next technological stage.

The drum's rotation maintains continuous agitation of the cotton, enhancing its contact with the mesh surface. This improves the passage of particles and fine impurities through the mesh. The cotton's partial vertical movement increases controlled free-fall acceleration, which improves separation efficiency compared to horizontal or flat transitions. The diameter and placement of the mesh screen holes are key parameters in the separation process. Optimizing these features ensures effective direction of impurities into the screw conveyor. The screw mechanism continuously and reliably removes collected impurities, maintaining uninterrupted operation. By tilting the spiked drums from a horizontal position to a specific angle, the vertical component of the cotton's movement increases, enhancing free-fall acceleration and separation through the mesh. Optimizing the drum's tilt angle and rotation speed based on experimental data reduces energy consumption while simultaneously improving cleaning efficiency.

Improving the material of the mesh surface, the geometry of the holes, and the mechanical properties of the feed rollers helps prevent damage to the raw cotton and preserves product quality. Installing the spiked drums at a specific tilt angle in the 1XK equipment allows for both energy savings and enhanced cleaning performance.

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