Improvement of the Lattice Grate in the 1VPU Fiber Cleaning Technology During Cotton Fiber Cleaning

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The competitiveness of cotton fiber in the global market is primarily determined by its appearance, fiber length, and the level of impurities and defects in its composition.

After ginning, cotton fiber contains impurities and waste in the form of trash and debris, exceeding the norms established by the O'zDST standard. If such fibers are further processed without proper cleaning, impurities, debris, and other defects embed into the fibers, complicating the operations of textile factories. For instance, ginned cotton fibers often contain curls that distort the appearance of the final product. Research by both domestic and international scientists has concluded that the most effective method for cleaning fibers of impurities and debris is immediately upon exiting the gin. At this stage, fibers are cohesive, with individual fragments weighing 15-20 mg. Requirements for Fiber Cleaners: - The impact of fiber cleaners' working mechanisms should not damage the physical and mechanicalproperties of the fibers. - Machines must remove maximum amounts of impurities and debris according to standard norms. - Fiber cleaning should enhance the appearance of the final product. - The quantity of fibers in the waste should be minimal. - The machine's design should include mechanisms for adjusting cleaning efficiency and fibercontent in the waste. The flow layout of the fiber cleaner (Figure 1) must match the productivity of the gin. The waste separation area of the fiber cleaners, along with the serrated cylinder, removes impurities and defects from the fibers. The separation of impurities and defects should be maximized while minimizing the loss of usable fibers. Researchers have investigated various constructions of waste separation surfaces: wire structures with varying diameters and mesh sizes, toothed, circular, and oval stamped surfaces, and lattices made of circular, rectangular, triangular, and trapezoidal materials. Among them, triangular, trapezoidal, and blade-shaped lattices yielded the best cleaning results. Blade-shaped lattices are widely used due to their simplicity in manufacturing, installation, and adjustment. The cleaning efficiency of lattice-grid machines depends on the cleaning surface, number of lattices, their spacing and installation angle, the gap between the lattices and the serrated cylinder, and the speed and direction of airflow during the fiber's movement along the lattice grid. The size of the lattice grid surface is determined by the cleaning arc and the length of the fiber cleaner's working mechanism. The length of the working mechanism is usually defined by the working section of the serrated cylinder in the gin. The cleaning arc is determined by the designer and is located between the receiving and discharging mechanisms, whose positioning affects the cleaning arc's dimensions. In flow machines, the length of the cleaning arc is equal to 1/4 of the serrated cylinder's circumference and is determined by the aerodynamic regime of the serrated cylinder. In this regime, the air volume transmitted from the gin (Q), the static pressure in the exhaust pipe (H), and the rotary effect of the serrated cylinder impact the operation. According to A.N. Krigin, due to the small spacing and high complexity of serrated cylinder teeth, the airflow between the serrations is turbulent.

References:

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