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IMPROVEMENT OF THE COLUMN GRID OF THE VTM TYPE FIBER CLEANER USED IN FOREIGN TECHNOLOGY

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Abstract

This study explores the enhancement of VTM (Vertical Tube Module) type fiber cleaning equipment, widely utilized in foreign technology, through an increase in the number of columns. The objective is to extend the fiber splitting time and improve cleaning efficiency. The impurities found in cotton fibers are classified as active and passive, originating from mineral and organic sources, as well as impurities in seeded cotton. These impurities, introduced during the ginning process, significantly impact fiber quality. In textile factories, residual impurities such as large and small debris, crushed seeds, pulp, fibrous shells, and other contaminants affect the quality of the fiber. Moreover, the formation of coils during the fiber cleaning and separation process further contributes to waste production in textile factories.

Keywords: fiber, VTM type fiber cleaner, knife, column grid, pile, waste.

Introduction

Effective fiber cleaning is crucial before pressing, as excessive impurities can complicate equipment operation in textile preparation shops. At long-fiber cotton ginning enterprises, the fiber cleaning process involves the use of VTM and ON-6-3 series fiber cleaners. The VTM cleaner operates by rotating fibers with alternating vertical blades and piles, separating impurities, and removing them. The proposed improvement suggests changing the column shape from drop-like to trapezoidal in the VTM fiber cleaner. This alteration aims to increase fiber splitting time, enhance cleaning levels, and improve overall fiber cleaning efficiency.

The main part

The technological process scheme involves key components such as pneumoprovider, knife drums, pile drums, column fence, pollution chamber, and dirt auger. By implementing trapezoidal columns in the VTM fiber cleaner, the study envisions an optimized fiber cleaning process, reducing impurities and enhancing the quality of the final fiber product.

Foreign impurities in cotton fiber are divided into active and passive impurities in terms of their origin: mineral and organic, as well as impurities in seeded cotton. These above-mentioned impurities are the impurities added to the fiber during the process of ginning that is, separating the fiber from the seed. In addition, in the process of separating the fiber from the seeded cotton, the gin equipment causes the appearance of additional large and small impurities. Large and small impurities that remain after the spinning of the fiber have a great impact on the quality of the fiber. The fractional composition of the mixture includes: large impurities, crushed seed, pulp, fibrous shell, small impurities and other impurities. In addition to them, in the process of cotton cleaning and fiber separation, a large number of coils are formed in the fiber and spoil the appearance of the fiber. These windings, in turn, increase the amount of waste output in textile factories. The process of cleaning the fiber from impurities is effective if it is performed before the fiber is pressed. If the impurities are more than the norm specified in the state standard, and they are pressed, the work of the equipment of the textile factories' preparation shops will be made difficult. In addition, cotton fibers tend to fray more and die excessively in textile factories [1].

At the long-fiber cotton ginning enterprise, the fiber cleaning process is carried out in VTM and ON-6-3 series fiber cleaners. Depending on the method of fiber transportation, the fiber cleaning process can be as follows: before mechanical fiber transportation, ON-6-3 fiber cleaners, after VTM fiber purifiers are used, and KVM fiber condensers are used; if the VTM cleaner is installed first, then the KVM is used, and then the ON-6-3 fiber cleaner is installed, then the belt conveyor is used. VTM type fiber cleaner is used for cleaning fibers by hand and machine skins. The operation of VTM type fiber cleaners is as follows: the fiber is rotated with the help of drums with alternating vertical blades and piles, hitting the surrounding ribs, as a result of which the impurities in the fiber are separated and slide down [2] (Figure 1).

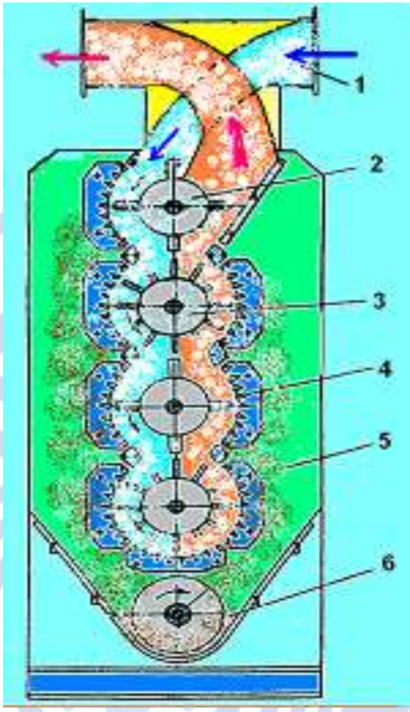

Figure 1. Technological process scheme of VTM cleaner equipment

1-pneumoprovider; 2-knife drums; 3-Pile Drums; 4-column fence; 5th pollution chamber; 6-dirt auger; 6-dirt auger.

At the top of the fiber cleaner there are sawing and shredding drums, which shred the fiber and serve as a closed lid. A partition with a lid is installed on top of them. Air separators are provided with fins placed on top of the threshing drums, which prevent the upper fins from sticking to the bottom fins. A screw auger is installed below the cleaning section to remove impurities from the fiber cleaner. By inertia, the fiber falls into the fiber separator compartment and is affected by the punching drum. The drums, rotating at different linear speeds relative to each other, transfer the fiber to the cleaning section, where it is beaten into the ribs with the help of drums with blades and pegs [3-5].

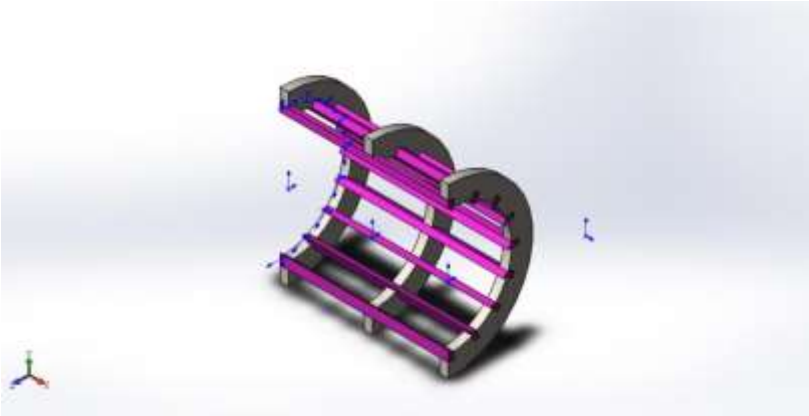

Figure 2.

The fiber hits the ribs on the right as it descends from the machine and the ribs on the left as it ascends. After that, the fiber is picked up by a saw drum and transferred to the separation unit. With the help of air, the fiber passes to the separator and is separated. The waste is collected in the waste collection unit and removed from the machine using an auger [6-8].

Impacts of Innovations on Fiber Quality

The evaluation of recent innovations in fiber cleaning technology reveals a significant impact on the quality of the cleaned fiber. Various advancements have been made in machinery design, cleaning methodologies, and the integration of technologies such as artificial intelligence and machine learning. The following aspects highlight the measurable improvements observed in terms of reduced impurities, increased tensile strength, and other relevant quality metrics:

1. **Reduced Impurities:**

• Innovations in fiber cleaning technology have led to more efficient removal of impurities from the raw material. Improved separation mechanisms, advanced cleaning components, and enhanced air or mechanical filtration systems contribute to a reduction in impurities such as seeds, debris, and contaminants. This reduction has a direct positive effect on the overall purity and quality of the cleaned fiber.

2. **Enhanced Tensile Strength:**

• Recent innovations focus on optimizing the mechanical processes involved in fiber cleaning. Through precise control of cleaning parameters and the incorporation of technologies that minimize stress on the fibers, there is a noticeable enhancement in tensile strength. Fibers cleaned using these advanced methods exhibit increased resilience, reduced breakage, and improved strength, contributing to the overall durability of the final textile product.

3. **Improved Fiber Length Uniformity:**

- Innovations in machinery design and cleaning techniques aim to achieve more consistent fiber length. This is particularly important for spinning processes and end-product quality. By minimizing variations in fiber length, innovations contribute to the production of textiles with a more uniform texture, appearance, and strength.

4. **Optimized Fiber Fineness:**

- Fiber fineness is a crucial factor in determining the quality of textiles. Recent innovations often involve finer control over cleaning parameters, resulting in fibers with optimized fineness. This is especially significant for industries requiring specific fiber diameters, such as the production of high-end garments or technical textiles.

5. **Reduction in Fiber Damage:**

- Advanced cleaning technologies prioritize gentle handling of fibers to minimize damage during the cleaning process. Reduced fiber breakage and damage lead to a higher yield of intact and undamaged fibers, positively influencing the quality of the cleaned material.

6. **Automation for Precision:**

- The integration of automation, artificial intelligence, and machine learning in fiber cleaning processes allows for real-time monitoring and adjustment of cleaning parameters. This precision in control ensures consistent and high-quality cleaning, reducing the likelihood of errors and variations that can affect the final fiber quality.

Conclusion

In conclusion, recent innovations in fiber cleaning technology have demonstrated tangible improvements in reducing impurities, increasing tensile strength, and optimizing other relevant quality metrics. These advancements contribute to a more efficient and sustainable textile industry, producing fibers that meet or exceed the stringent quality standards demanded by various applications in the market.

The colostrums of the VTM type fiber cleaning equipment, which is used in foreign technology today, have a drop-like appearance. My proposal is that by changing the columns of the VTM fiber cleaner to trapezoidal, we can increase the time of splitting the fiber, increase the level of cleaning, and increase the level of fiber cleaning.

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