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Methods for Increasing the Efficiency of Cleaning the Transfer Device

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Abstract

The article improves the quality of raw cotton by creating a new transfer device structure for the transportation of cotton in long-distance riots, located in the main building of the ginnery. Both foreign and domestic separator cleaners have been studied. Experiments were carried out on prototype transfer device and the results were obtained. The cleaning efficiency was determined by sampling the cotton entering the separator in the moving device and exiting after the inclined vibrating mesh surface installed after the separator.

Keywords

Cotton, Cotton Seeds, Fiber, Separation, Separator, Transfer Device Fine Impurities, Scraper, Vacuum Valve, Mesh Surface, Cotton Cleaning

1. Introduction

In ginneries, a pneumatic conveyor system designed to transport cotton raw materials over long distances to the main building is used to separate the cotton from the air, allowing it to quickly separate the cotton stuck to the surface of the inclined mesh from its main working parts. The seeds are damaged during the separation process. As a result, various defects are formed in the fiber structure. These defects lead to the rapid rupture of the fiber during spinning in the textile industry and the formation of spots on its surface when the material is woven. Today, the aforementioned injuries sustained in the processing of raw cotton are a very pressing problem [1] [2] [3].

In order to improve the quality of products in the ginning industry, it is necessary to improve the design of machines in the technological process of cotton processing. In solving this problem, the device of air transport of cotton is of

great importance. In ginneries, raw materials are transported from the gins to the cleaning and drying shops in the pipes of the air-descending device. Its simplicity and the fact that the product can be delivered to destinations without destination on any complex routes make the air-carrying device very popular in the ginning industry. The distance between the gins located on the territory of ginneries and the main buildings is 200 - 250 meters and more. The impact zone of the pneumatic transport device is 100 - 110 meters. Therefore, in order to increase the impact zone of the pneumatic transport device at ginneries, a propulsion device consisting of a centrifugal fan VTs-12 and a separator SS-15A will be installed. Its main purpose is to improve the design of the propulsion device operating in the pneumatic transport in order to reduce fiber loss and electricity consumption while maintaining the natural properties of cotton. Therefore, the design and operation processes of the existing moving devices were studied in the study [4] [5] [6] [7] [8].

On the territory of ginneries, it is not possible to transport cotton in gins located far from the main building with a single air-transport device.

Therefore, in factories, an air-powered device is installed in addition to the air-powered device. Analysis of scientific research on improving the performance of airborne devices has shown that its installation increases the amount of energy used to transport cotton and leads to a deterioration in the quality of cotton. To solve this problem, a mechanical conveyor was tried in some factories. But this has led to an increase in transportation costs. It also cannot deliver cotton in a rhythmic, guaranteed manner, like an air-carrying device. There are a number of problems with the conveyor belt when moving cotton from one batch to the second batch when it is raining in the winter [9].

Also, the issues of maintaining the initial quality of cotton products and improving the efficiency of cleaning through the development of a rational design of the moving device remain relevant.

2. Methodology

Separation of fine impurities from the cotton is carried out mainly by means of a pile drum and a mesh surface (**Figure 1**).

The blue line in **Figure 1** shows the reduction of fine contaminants from the cotton as a result of passing through each pile drum (on the x axis 1 - 8) of the 1XK type cleaning device. The red line indicates the degree of damage to the seed under the influence of pile drums.

Around 60% of cotton is cleaned of fine contaminants during the transfer of cotton from 1XK ginners at ginneries. Cotton raw material has been proven to be about 2.0% of seed damage as a result of being pushed and dragged along the surface of the net. This damage causes various defects in the fiber structure. As a result, the amount of dirty and defective impurities in the fiber exceeds the standard, the quality of the fiber is at least 1st class, and the selling price is reduced by 100 - 120 thousand sums per ton of product.

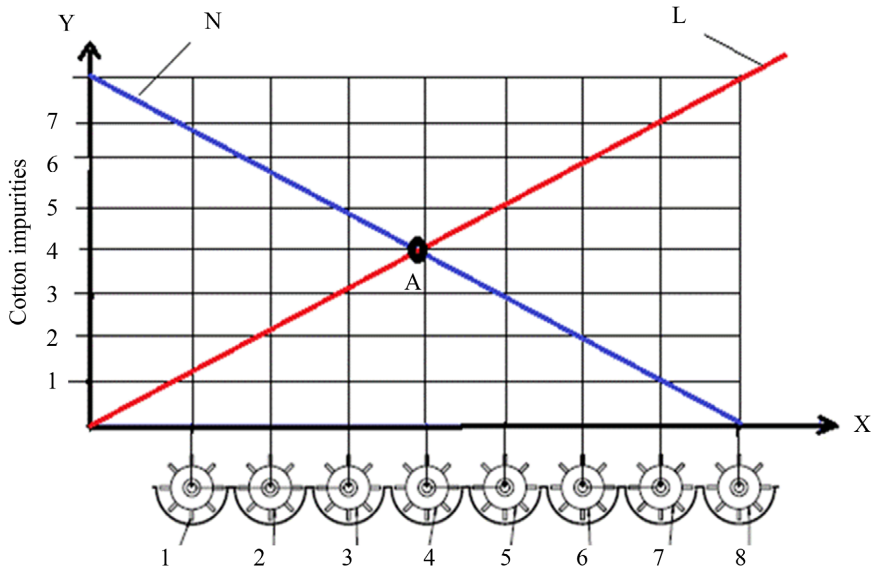

Figure 1. Scheme of the process of cleaning fine impurities from cotton.

Separators of the cleaning type are widely used in foreign countries. For example, a multi-section separator (**Figure 2**). Through the inlet pipe (1), the cotton is sifted on a threshing drum (2) for better separation of contaminants, and then cleaned of fine contaminants using 3 pile drums (3) and a mesh surface (4). The separated fine contaminants fall into the hopper (5). The cleaned cotton falls into the vacuum valve (6) and is transferred to the next process.

The crushed and controlled cotton flow ensures efficient operation of the drying and cleaning equipment and reduces cotton congestion in the system.

Multi-section and section separator (**Figure 3**). Designed to prevent frequent clogging and better cleaning of the raw cotton and to remove impurities, this separator works as follows: the raw cotton enters the separation chamber through the pipe (1) and the air is sucked through the suction air pipe (2).

The cotton is blocked by the mesh surface (3) and, together with the air, the cotton attached to the mesh surface is sucked out by means of a bristle drum (4) and the fine impurities are removed as a result of the raw material being crushed. The cotton separated from the air falls into a vacuum valve (5) and is transferred to the next process [10].

As a result of the increased efficiency of the separator operation and the moisture content of the cotton, a state of clogging often occurs in the nets, which creates a great resistance in the suction net.

In order to overcome the above shortcoming, the authors propose to clean the raw cotton after the separator through a vibrating bevel surface. It is clear that the purpose of carrying out the cleaning process after the separator in the moving device is to clean the impurities in the cotton when it has not passed from the passive to the active state.

Taking into account the lack of research on improving the design of the working bodies of the separators, screens, cleaners, fans, working bodies of

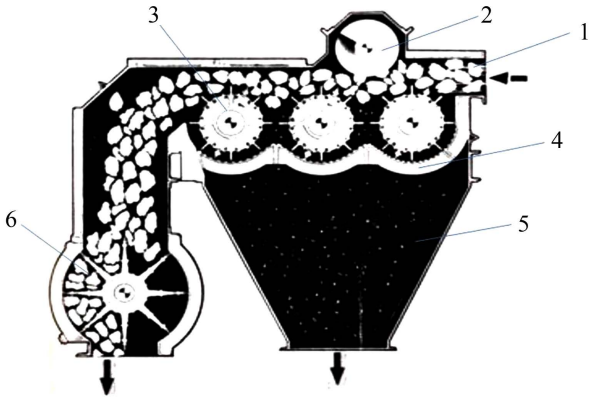

Figure 2. Multi-section separator (Murray-Piratinina firm). 1-inlet pipe, 2-thrust drum, 3-pile drum, 4-mesh surface suction short pipe, 5-vacuum valve.

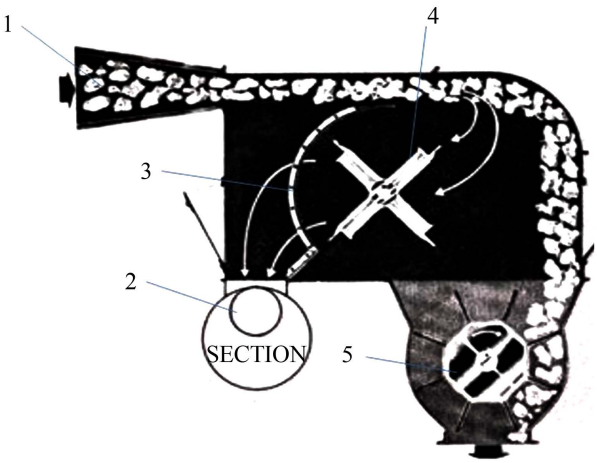

Figure 3. Multi-section and section separator (Murray-Piratinina firm). 1-inlet short pipe, 2-suction air pipe, 3-mesh, 4-flap drum, 5-vacuum valve.

cyclones, maintaining the natural properties of fiber and seeds in high performance, it is planned to improve and introduce the elements of the moving device (**Figure 4**).

In ginneries, a moving device in the pneumatic transport system for air transportation of raw cotton from large distances to the main building is used to separate the cotton from the air and is carried out using its main elements (screens, separators, fine cleaners, fans, cyclones).

Heavy contaminants in the cotton moving by pneumatic transport fall through the grater (1). Separation of cotton from the air is then carried out in the working chamber of the separator (2) (patent N˚ IAP 06367) [11]. In order to reduce the impact force of cotton on the walls of the working chamber at the entrance of the inlet pipe, to increase the cleaning efficiency, the surface of the net and the seed mounted on an elastic base are damaged, and the surface of the net mounted on the side of the working chamber is parobolized. For efficient cleaning, a pocket-mounted optional separator is offered in front of the separator inlet pipe.

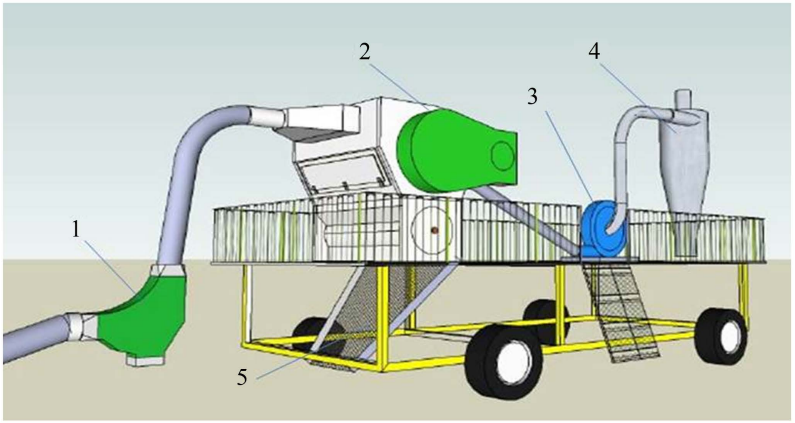

Figure 4. Appearance of the moving device (patent No. IAP 06367) (patent No. IAP 06459). 1-stone, 2-separator, 3-fan, 4-cyclone, 5-may.

The air sucked from the separator is carried out by means of a fan (3). Through the efficient use of this exhaust air, the energy consumption in the propulsion device is halved.

The sucked air enters the cyclone (4) and in order to increase the efficiency of the device, an additional working chamber is installed in the working chamber, which traps the dust air, as well as a device that traps the fibers in the dust air.

The cotton raw material separated from the air by the separator is installed after the vacuum valve.

The cotton raw material separated from the air by the separator is installed after the vacuum valve, the pile drum serves to ensure efficient cleaning of fine dirt (5) (patent No. IAP06459) [12], which allows to further grind the cotton.

As a result, there are no defects in the fiber content, damage is reduced, and the release of dust into the environment during air transportation of raw cotton does not worsen the environment and does not adversely affect the health of workers [13] [14] [15].

3. Results

At the Uychi Pakhta Tozalash enterprise, research was conducted to test the effectiveness of cleaning on a sloping vibrating mesh surface mounted on a moving device.

The cleaning efficiency was determined by sampling the cotton entering the separator in the moving device and exiting after the inclined vibrating mesh surface installed after the separator.

The results of studies to determine the efficiency of a moving device are presented in release of dust into (Figure 5).

For the experiment, the Namangan-77 industrial variety was identified by repeatedly passing the cotton through a moving device when the contamination was 4.9%.

Based on the results obtained, the change in cotton pollution and its dependence on the number of passes and cotton moisture was obtained (Table 1).

Figure 5. An experimental version of a moving device. 1 inlet pipe, 2 inlets, 3 separators, 4 inclined vibrating mesh surfaces, 5 cyclones, 6 suction blowers.

Table 1. The effect of cotton moisture on changes in its contamination.

Number of passes	Moisture content of cotton,%			
	8.6	11.4	14.7	19.6
1	4.980	5.060	5.100	5.210
2	4.650	4.670	4.710	4.890
3	4.310	4.340	4.410	4.600
4	4.023	4.080	4.130	4.280

The results show that as the moisture content of the cotton increases, the amount of contaminants retained in the cotton also increases, and as the number of transitions increases, the contamination decreases. This means that the moisture content of the cotton has a negative effect on the performance of the cotton cleaning process.

Therefore, the cleaning efficiency of the separator is low when transporting high-moisture cotton in cotton separators and, conversely, the cleaning efficiency of the separator is high in low-moisture cotton. Therefore, the presence of the recommended cleaning section in the cotton separator installed after the drying equipment provides a significant increase in the cleaning efficiency of the cotton.

4. Conclusion

Today, given the widespread use of a moving device in ginneries within textile clusters, the introduction of an improved moving device has prevented the negative impact on the natural properties of cotton in the ginning process. According to the results of the experiment, 40% - 45% of small contaminants were removed.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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