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Improving the retention of free fibers in raw cotton and the separation of cotton from the air

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Abstract: The article describes a research work on reducing the amount of free fiber coming out of a separator installed in the technological process of ginneries, and a device for determining the content of free fiber in raw cotton is proposed.

To reduce the sticking of cotton to the surface of the separator mesh, trapezoidal guides mounted on the separator device and tested in the lengths of the guides 15 cm and 20 cm 40 cm were proposed and the results were obtained.

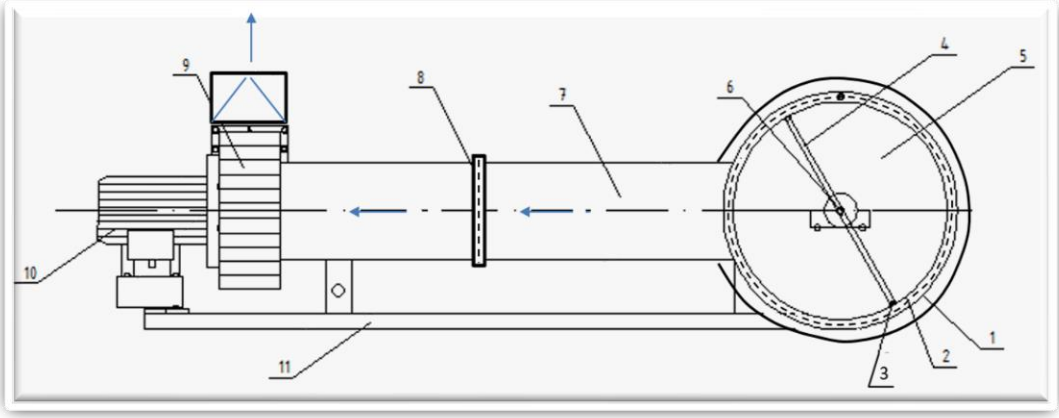
Key words: cotton, seed, fiber, air, separator, free fiber, suction, vacuum valve, mesh surface, guide.

Introduction. Today, as in all industries of the world, special attention is paid to improving the quality of products through the introduction of highly effective innovations in textile clusters, the creation of resource-saving technologies, and the improvement of existing techniques and technologies.

Significant results are achieved at the cotton-cleaning enterprises of the country's textile clusters in obtaining high-quality cotton products while maintaining the initial parameters of raw materials, improving methods and technologies for processing cotton. The relevance of the topic lies in the fact that in textile clusters it is important to preserve its natural properties, starting with the processing of cotton, in order to obtain high-quality yarn, high-quality fabrics and high-quality finished products. For this purpose, the existing design of the separator is being studied and improved to increase the efficiency of air separation of cotton [1].

Methodology. During the operation of machines installed in the technological process of cotton ginning plants, a certain part of the fiber suitable for production is added to the waste.

To capture free fibers that are added to waste, the authors created a device that detects free fibers (Fig. 1).



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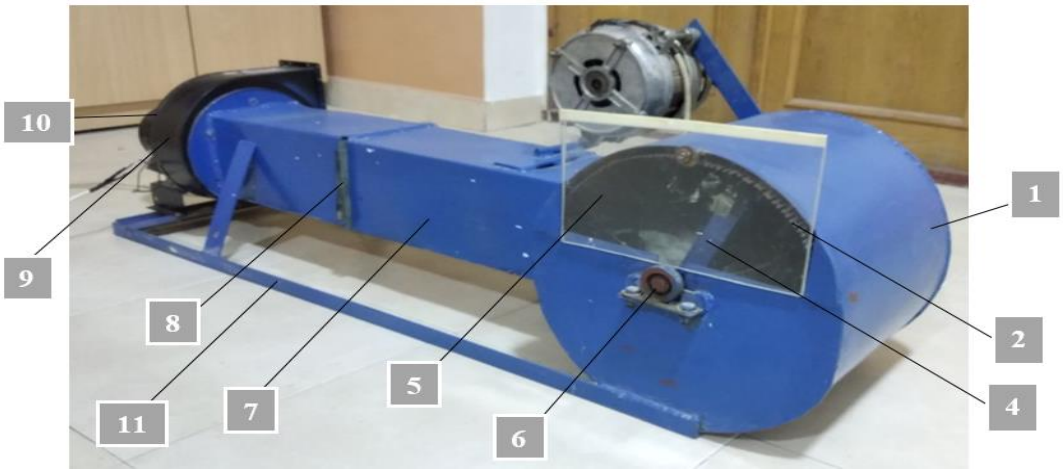

Figure 1. Device for detecting loose fibers in cotton (IAP 20190460)
a) scheme, b) appearance

1-case; 2 mesh surface; 3 stitches; 4 scraper; 5 working chamber; 6-shaft; 7 air and single fiber suction pipe; 8 mesh surface holding a single fiber; 9-fan; 10-electric motor; 11-base.

The amount of free fiber is not the same in different breeding and industrial grades of cotton. In addition, the lower open branches of the pods at the cotton boll open first, increasing the chance that the fibers will ripen and separate from the seeds due to greater exposure to sunlight. It is important to quantify this free fiber and reduce its waste in cotton processing technology. The quality of the remaining free fibers must be checked.

Loose fiber detection device proposed in Figure 1.Works as follows: a cotton sample is placed in a drum with 1 grid (1). When the fan (5) is running, the intake air is sucked in through the mesh drum (3). The suction air separates the loose fibers from the cotton seeds inside the mesh drum. The fibers moving through the tube (3) are held in place by a small perforated plate (4). Pieces of cotton stuck to the holes of the mesh drum are cleaned with a scraper (2) [5].

When determining free fibers in cotton, the authors conducted experiments at the Zarbdor cotton cleaner enterprise of the Pakhtakor Tekstile JV, located in the Zarbdor district of the Jizzakh region, the results of which are presented in Table 1. When accepting cotton grown by farmers, it will be necessary to determine its variety, humidity and pollution. After determining the moisture and contamination of the sample, samples weighing 50, 100, 150, 200, 250, 300 grams were weighed on a cotton balance and placed in a mesh drum for 1 minute using equipment.

Experimental results of laboratory equipment for the detection of free fibers

Table 1

№	Selection view	Industrial view	Contamination	Moisture	Weight of sample	Weight after unloading	Number of free fibers g
1	Sultan	1/2	4.5%	9%	50 g	48,7 g	1.3
2	Sultan	1/2	4.5%	9%	50 g	48,9	1.1
3	Sultan	1/2	4.5%	9%	50 g	48,5	1.5
4	Sultan	1/2	4.5%	9%	50 g	48,8	1.2
Total					**200**	**194.9**	**5.1**
6	Sultan	1/2	4.5%	9%	100 g	98,3	1.7
7	Sultan	1/2	4.5%	9%	100 g	97,4	2.6
8	Sultan	1/2	4.5%	9%	100 g	97,8	2.2
9	Sultan	1/2	4.5%	9%	100 g	97,8	2.2
Total					**400**	**391.3**	**8.7**

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According to preliminary experiments, the amount of free fiber exposed to the sucked air within 1 minute after sampling 50 g of cotton was about 1.3 g. When sampling 100 g of the sample, the amount of free fiber was 2.2 g.

The presence of such a large amount of free fiber in cotton indicates the need to determine the amount of free fiber in the production of cotton.

To prevent loose fibers from entering the waste, a directional separator SS 15 A, which is available at our ginneries in the Republic was chosen.

Studies conducted by scientists in this field have revealed that one of the causes of fiber loss is the transportation of cotton in air transport pipelines, as well as in the process of cotton ginning, ginning, and fiber cleaning [2].

To preserve the natural properties of cotton, a theoretical study of the movement of the newly created separator in the working chamber was carried out [3-4].

The novelty of this design lies in the fact that a trapezoidal guide is inserted into the separation chamber, mounted on the side wall of the inlet pipe, and the vacuum valve consists of a trapezoidal guide in the direction of the guide. These guides reduce the movement of the exposed cotton to the surface of the mesh. During operation, part of the cotton entering the separator's working chamber is captured by these guides and directed to the vacuum valve.

The new proposed cotton separator will have a distribution chamber mounted on the side wall with mesh surfaces, inlet and outlet pipes, cotton scrapers attached to the mesh surfaces, and a vacuum valve. The side walls of the inlet pipe were made in the form of trapezoidal guides inserted into the distribution chamber and bent towards the vacuum valve. In the form of a trapezoid, the gap between the guides is 50 mm. (Figure 2.3)

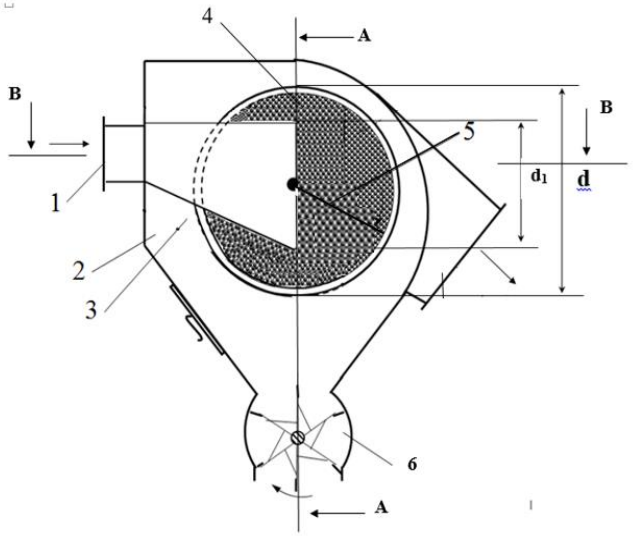

Figure 2. Router separator diagram (No. FAP 20190205)
1 inlet pipe; 2 working chambers;
3 trapezoidal guides; 4 mesh surface; 5- suction; 6- air intake pipe; 7-vacuum valve.

Figure 3. The working chamber of the separator with a trapezoidal guide.
1- trapezoidal guide; 2- mesh surface; 3-screw, 4-shaft.

On fig. 2 shows a diagram of an improved separator [7], including an inlet pipe - 1, a separation chamber - 2, a vacuum valve - 3, a scraper - 4, a trapezoidal guide in the form of a guide - 5, a mesh surface - 6 and an outlet pipe - Consists of 7 from. During the operation of the separation unit, the raw material from the inlet - 1 is sent to the separation chamber - 2 along the guides - 5. At the same time, the air velocity in the chamber decreases. The main part of the raw cotton hits the rear wall of the separator chamber and falls down to the vacuum valve - 3 under the influence of its own weight. Fine impurities in the air and its contents exit through the mesh surfaces - 6 and the outlet pipe - 7.

A small part of raw cotton is glued by air flow to the surface of the grid - 6 and scraped off with a scraper - 4. The guides for raw cotton are made in the form of trapezoidal guides. When installing the

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guides, their direction is bent towards the vacuum valve, which directs the bulk of the raw cotton towards the vacuum valve, and the efficiency of the process of separating cotton from the air increases.

After installing the trapezoidal guide, reducing the amount of cotton adhering to the surface of the mesh 3 allows the scraper-4 to work efficiently. For practical research, an experimental design of this device was developed (Fig. 3) and an experiment was carried out.

The determination of the amount of cotton fiber released by air onto the mesh surface is carried out in a cyclone connected to the discharge pipe next to the separator. The bag in which the bottom of the cyclone is installed is inspected every hour.

To determine the amount of cotton adhering to the mesh surface, the mesh surfaces from the side of the working chamber were conditionally divided into four equal parts. To stop the scraper, it is necessary to remove the belt located on the pulley attached to its shaft. As a result, it will be possible to determine the amount of cotton adhering to the surface of the mesh.

Results. Studies have shown that the cotton pieces mainly stick to the surface of the mesh at a distance from the inlet pipe. After installing a trapezoidal guide in the working chamber, the amount of cotton adhering to the surface of the mesh decreased.

Therefore, during the study, guides were installed in the inlet pipe of the new experimental sample. The following table shows the results of experiments carried out with the proposed design. Table 2 is given.

Check the efficiency of air separation in the separator

Table 2

№	Трапеция шакилда йўналтиргич эни, см	Amount of various compounds released by dusty air, kg / h	The proportion of raw cotton falling directly into the vacuum valve,%
1	15	3.9	90
2	20	3.7	92
3	40	3.5	94

As can be seen from the table, when installing a trapezoidal guide, the impact of pops on the mesh surface is reduced by 35-40%, which ensures that the main part of the pops entering the separator working chamber enters the correct vacuum valve. This, in turn, improves the absorption of air from the surface of the mesh, allowing the transport distance of raw cotton from the bale up to 10-15 meters.[6]

Conclusion. Research has been done to reduce the amount of free fiber coming out of machines installed in the ginning process. To reduce the sticking of cotton to the surface of the separator mesh, trapezoidal guides mounted on the separator device were proposed and tested in 15cm, 20cm and 40cm guides. Also, the most efficient operation was observed in the variant with the largest number of sets of routers in the form of a rope trapezoid.

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