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Improvement Of Cotton Cleaning Machine Miner-Collector

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***Abstract**: **Objective.** As a research object, a cotton pick-up machine and a cleaning machine were cleaned out of a small contaminated compound. The object of the study is the mines and geometrical dimensions of the device. **Methods.** Experimentally the influence of the geometric dimensions of the shaft-storage form feed rollers, velocities, and distances between the reels of the pile, the direction of the transfer cotton drums pile on an uninterrupted within the same rules to preserve the natural quality parameters of cotton, and the efficiency of cleaning.* **Results.** *Improvement of cleaning efficiency of the equipment, while maintaining the natural quality characteristics of the raw material being recycled, with the minimization of the garbage collection device.* **Conclusions.** Improved cleaning efficiency of the improved cleaning device and its working parts increased by 5-6% and allowed to increase the quality of the products.

***Keywords:** cotton, pipe, stack, pneumatic, ventilator, air, heavy impurities, stone holder, working chamber, pocket, fiber, seed, quality, stone, weight.*

Introduction.

In recent years, comprehensive measures have been taken in the republic to develop the textile and light industries, expand the range and range of finished products, and fully support the investment and export activities of the industry's enterprises. Large-scale work is being carried out in the field to create cotton clusters, create and develop production complexes that include production stages ranging from cotton fiber, yarn and yarn, to knitwear and finished clothing products, produce a wide range of high-quality finished products and provide employment, increase the share of processing of cotton fiber grown in the country [1].

The factors influencing the change in the amount of impurities in cotton were investigated by "Paxtasanoat ilmiy markazi" JSC and TITLI scientists. In particular, the geometric dimensions and linear velocities of the pile drum, the distance between the pile drum and the pile drum, the dimensions and shapes of the holes of various surfaces, the geometric dimensions of the mine storage and feed shafts, etc. They proposed the official dimensions of the working parts of the cleaner.

One of the urgent tasks is to ensure the uninterrupted supply of cotton to the pile drums for a uniform cleaning process and full compliance with the requirements for the equipment. An increase in the geometric size of the mine leads to an increase in the volume of cotton in it and an increase in the residence time of cotton in the mine. As a result, due to the unbalanced weight of the upper layers of cotton at the bottom of the shaft, as well as the location of the rollers feeding the shaft, there is a further increase in the density of cotton passing between the rollers feeding the shaft. Also, the shape of the paddle feed rollers leads to the fact that the cotton is intermittently fed in the form of lumps, as a result of which it is processed into drums with pre-pile to the detriment of the natural quality indicators of cotton [2].

Taking into account the above data and theoretical studies, experimental studies were conducted and fiber quality indicators were determined on test laboratory equipment in accordance with the requirements of established international standards.

Methods.

The experiments were carried out on pile-plank drums of the 1XK brand cleaning equipment located in the initial part of the cleaning stream of the educational and scientific laboratory at the Department of "Technology of primary processing of Natural Fibers".

Experimentally the influence of the geometric dimensions of the shaft-storage form feed rollers, velocities, and distances between the reels of the pile, the direction of the transfer cotton drums pile on an uninterrupted within the same rules to preserve the natural quality parameters of cotton, and the efficiency of cleaning [3-4].

The experiments were performed on the following options:

– in the technological process of cleaning, available in the existing shaft-storage plank and pile feeding;

– when the rollers supplying the width of the shaft-storage are aligned with the vertical axis and in the process of cleaning existing in the rollers supplying the shovel;

– in the process of cleaning the existing shaft-storage and pile supply rollers;

– when the rollers supplying the width of the shaft-storage are placed in line with the vertical axis and in the technological process of cleaning existing in the rollers supplying the pile;

– in the proposed technological process in the existing shaft-storage and pile supply rollers;

– when the rollers supplying the width of the shaft-storage are aligned with the vertical axis and in the proposed technological process on the pile supply rollers.

The amount of contamination in the cotton was determined in the JIKM laboratory device. The cleaning efficiency of the equipment was calculated according to the amount of contaminants detected.

Results.

The productivity of the cotton gin equipment, the trouble-free and reliable operation of its working parts largely affect the quality indicators of the processed products and the efficiency of cleaning the equipment with cotton gins. Cotton feeders consist of a shaft collector, feed rollers and a variator that drives them.

The change in the content of impurities in cotton when using blade and pile solders in storage shafts with an available width of 400 mm and a rectangular width of 240 mm [5] is shown in Table 1.

Analyzing Table 1, we see the following. When using vane feed rollers in existing storage shafts, the productivity of the equipment was 1.43; 1.52 and 1.59 percent in 5, 7 and 9 tons/hour, while in the proposed storage shafts, these figures are 1.18; 1.23 and 1.33 percent, and there is a higher separation of impurities containing cotton by 0.25-0.30 percent compared to existing storage shafts.

Table 1

Removal of impurities contained in cotton when used in storage shafts with an available width of 400 mm and a rectangular width of 240 mm with plank and pile feeders

o/n	Machine productivity, tons/hour	Number of repetitions, times	Contamination indicators of cotton, %							
			Existing shaft-storage (400 mm)				The proposed shaft-storage (240 mm)			
			Plank		Pile		Plank		Pile	
			sort I	sort III	sort I	sort III	sort I	sort III	sort I	sort III
1	5	1 repetition.	1,425	4,89	1,28	4,1	1,33	4,32	1,18	3,45
		2 repetition.	1,430	4,86	1,32	4,11	1,31	4,31	1,16	3,46
		3 repetition.	1,435	4,92	1,3	4,8	1,34	4,29	1,21	3,48
		Average	1,43	4,89	1,3	4,1	1,33	4,31	1,18	3,46
2	7	1 repetition.	1,53	4,89	1,37	4,33	1,41	4,82	1,23	3,86
		2 repetition.	1,525	4,86	1,35	4,34	1,45	4,81	1,21	3,851
		3 repetition.	1,505	4,92	1,36	4,315	1,43	4,831	1,242	3,87
		Average	1.52	4.89	1.36	4.33	1.43	4.82	1.23	3.86
3	9	1 repetition.	1,58	5,22	1,429	4,56	1,48	5,06	1,35	4,1
		2 repetition.	1,599	5,2	1,44	4,533	1,47	5,02	1,33	4,2
		3 repetition.	1,59	5,17	1,452	4,58	1,46	4,96	1,31	4,0
		Average	1.59	5.22	1.44	4.56	1.47	5.02	1.33	4.1

Figure 1 graphically shows the effect of the geometric dimensions of the shaft-storage on the efficiency of cleaning the equipment from fine contaminants.

The width of the straight rectangular shaft-storage is 240 mm, the cleaning efficiency is 30.8% when the working capacity is 5 tons / hour (curve 1), and the cleaning efficiency is 7 and 9 tons / hour, respectively. 27.6 and 23.9 percent, respectively, when the efficiency of the equipment increases from 5 tons / hour to 9 tons / hour, its cleaning efficiency is reduced to 6.5-7.0 percent. When the width of the mine collector is 400 mm (curve 2), the cleaning efficiency of the equipment is 27.5% at a working capacity of 5 tons / h, while the cleaning efficiency of the equipment is 25 and 9 tons / h, respectively. Decreases were observed between 1 and 21.9 percent. When the width of the rectangular mine is 240 mm, its cleaning efficiency is 3.5-4.0% higher than the existing shaft-storage with a width of 400 mm..

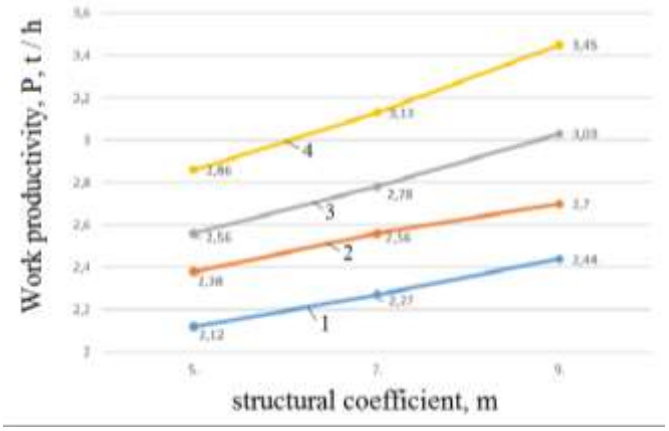

Figure 1. The effect of the geometric dimensions of the shaft-storage on the efficiency of the equipment for the treatment of fine contaminants

1- The width of a straight rectangular shaft-storage 240 mm (sort I);
2- Existing shaft-storage (sort I);
3- The width of a straight rectangular shaft-storage 240 mm (sort III);
4- Existing shaft-storage (sort III).

If we analyze the 3rd and 4th curves, the cleaning efficiency of the equipment installed in a straight rectangular mine with a width of 240 mm, as in the 1st and 2nd curves, is 3.0-3.5 percent compared to the existing shaft-storage with a width of 400 mm. is observed to be high.

Experiments were conducted to study the effect of plank and pile supply rollers on the cleaning efficiency of the equipment in the existing and rectangular shaft-storage with a width of 240 mm and 400 mm. The results from the experiments were presented in the form of a histogram [6-7].

Figure 2 shows the effect of the equipment on the cleaning efficiency of the machine at different operating efficiencies in the existing and proposed shaft-storage with plank supply rollers installed in the form of a histogram. Experiments were carried out on cotton variety C 65-24, selection variety 3, class 1, with a contamination of 4.80%.

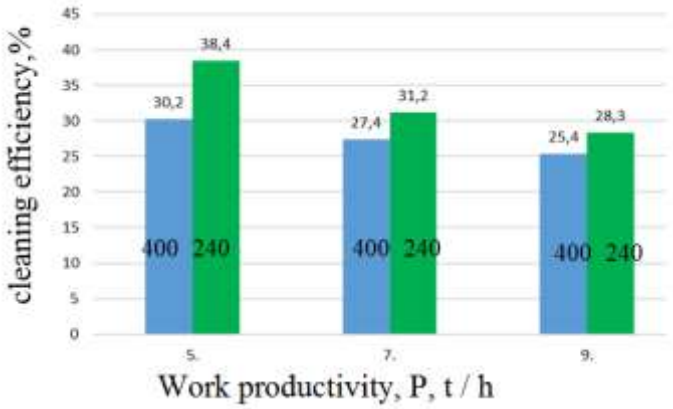

Figure 2. The results of an experimental test of a cleaner with plank supply rollers (240 mm and 400 mm, sort III)

The histogram shows that the working capacity of the machine is 5 tons / hour, the cleaning efficiency of the machine is 30.2% when the width of the shaft-storage is 400 mm, and the cleaning efficiency is 38.4% when the width of the shaft-storage is reduced to 240 mm.

The working efficiency of the machine is 7 t/h, the cleaning efficiency of the machine is 27.4% when the width of the shaft-storage is 400 mm, the cleaning efficiency is increased to 31.2% when the width of the shaft-storage is reduced to 240 mm.

The efficiency of the machine is 9 t / h, the cleaning efficiency of the machine is 25.40% when the width of the shaft-storage is 400 mm, the cleaning efficiency is increased to 28.3%, ie the cleaning efficiency is increased to 4,0-6,5 % when the width of the shaft-storage is reduced to 240 mm observed.

Figure 3 shows the histogram of the effect of the equipment on the cleaning efficiency of the machine in the III-grade cotton at different operating productivity in the existing and proposed shaft-storage with pile supply rollers..

The histogram shows that the productivity of the machine is 5 t / h, the cleaning efficiency of the machine was 34.8% when the width of the shaft-storage was 400 mm, and the cleaning efficiency was increased to 41.6% when the width of the shaft-storage was reduced to 240 mm.

The efficiency of the machine was 7 and 9 t / h, the cleaning efficiency of the machine was 30.6 and 29.9%, respectively, when the width of the shaft-storage was 400 mm, and the cleaning efficiency was reduced to 34, respectively, when the width of the shaft-storage was reduced to 240 mm. 9 and 31.4%, respectively, ie the cleaning efficiency of the machine is increased by 3.0-4.0%.

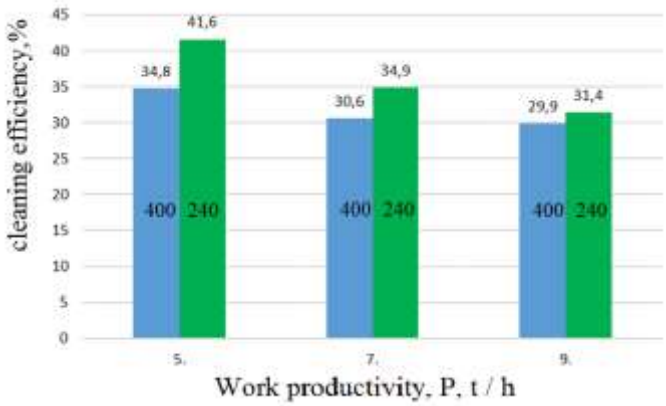

Figure 4. Results of an experimental test of a cleaner with pile supply rollers (240 mm and 400 mm, sort III)

Analyzing the histograms shown in Figures 5 and 6, it is found that when using pile supply rollers similar to the histograms in Figures 3 and 4, their cleaning efficiency is 3.0-3.5% higher than that of plank supply rollers..

Thus, the cleaning efficiency of the machine when using plank supply rollers was 28.4; 24 and 20.5 percent, respectively, when the working productivity was 5, 7 and 9 tons / hour, while when using pile supply rollers, these figures were 33.6; 28.5 and 26.5 percent, respectively, in the proposed supply rollers increase the cleaning efficiency of the machine to 3.0-4.0 percent.

In the process of processing raw cotton, it is observed that the cotton pieces are separated into single-seeded cotton pieces, and sometimes several cotton seeds are firmly connected. The efficiency of the ginning process depends not only on the uninterrupted supply of raw cotton, but also on changes in the physical and mechanical properties of cotton[8]. Changes in the coefficient of structural composition of cotton in the existing and proposed shaft-storage constructions were also studied in the experiment (Figure 7).

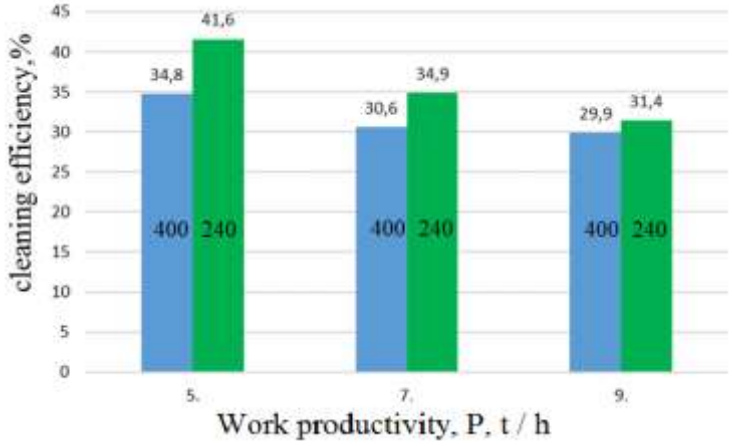

Figure 5. The results of an experimental test of a cleaner with plank supply rollers (240 mm and 400 mm, sort I)

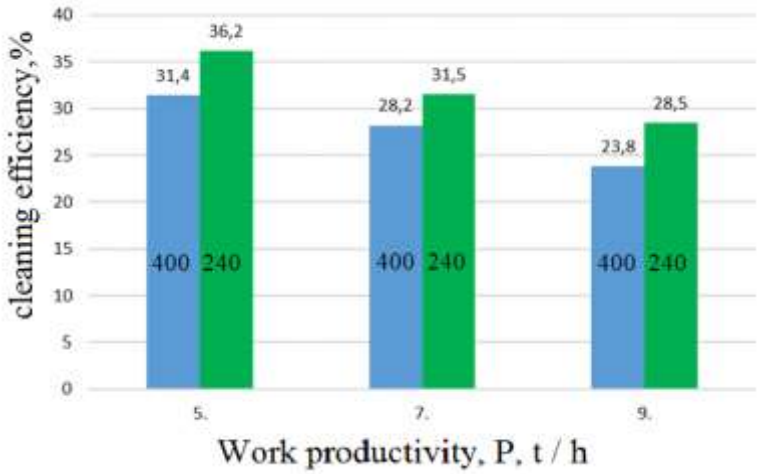

Figure 6. Results of an experimental test of a cleaner with pile supply rollers (240 mm and 400 mm, sort I)

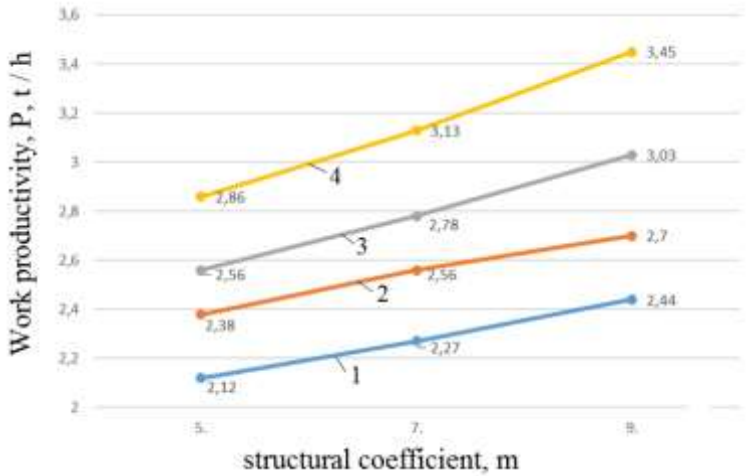

Figure 7. The effect of the size and shape of the width of the shaft-storage on the coefficient of structural composition

1- The width of a straight rectangular shaft-storage 240 mm (sort I);
2- Existing shaft-storage (sort I);
3- The width of a straight rectangular shaft-storage 240 mm (sort III);
4- Existing shaft-storage (sort III).

In the mine-collector of the existing design, the coefficient of structural composition of cotton at I, III grades of 5, 7 and 9 t / h is 2.56, 2.78; 3.03 and 2.86; 3.13; 3.45 In the mine-collector, where the rollers providing straight rectangular side walls are in line with the vertical axes, the degree of shredding of cotton at grades 5, 7 and 9 t / h, respectively, is 2.12; 2.27; 2.44 and 2.38; 2.56; 2.70.

Discussion.

The raw cotton consists of 7 ÷ 9 single-seeded cotton pieces connected to each other, and the impurities in the cotton are located on its surface and inside. The efficiency of the cleaning process is achieved due to the increase in the friction surface of the cotton with the mesh surface, which is divided into fine particles. [9-10].

The results of the above experiment show that the reduction of the width of the shaft-storage from 400 mm to 240 mm has a significant positive effect on the supply process, ie the reduction of the width of the shaft-storage (up to the vertical axis of the supply rollers) eliminates the increase of cotton density. Due to the reduction of the time and speed of splitting of cotton in the shaft, due to the reduction of the layer of cotton transferred to the cleaning machine, the cleaning efficiency of the machine is increased by 4.0-5.0% on plank rollers and 6.0-6.5% on pile rollers.

Conclusion.

Based on the analysis of the results of the conducted theoretical and practical research to improve the cleaning efficiency by improving supplier ginning equipment were made the following conclusions: reducing the angle of the wool when wool width drive 240 mm led to a decrease in the number of wadding between the supply rollers and a decrease in compressive stress with 1200 Pa to 700 Pa, this made it possible to speed up the movement of cotton in the shaft-storage and ensure an uninterrupted supply of cotton to the cleaning machine In the shaft-storage rectangular shape with a width of 240 mm, the side walls of which are located in line with the vertical axes of the supply shafts, it was recommended to use the supply shafts with pile, which allowed to increase the cleaning efficiency of the machine by 6.0-6.5 %.

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