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STUDY OF THE IMPACT OF IMPROVED SUPPLIER ON PRODUCT QUALITY AND GRAIN EFFICIENCY

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Abstract. A pilot version of a combed screen was manufactured for effective cleaning and ginning of cotton in a saw gin. The pilot version was installed on a 30-saw gin feeder model 5DP-130 in the technological laboratory of the Research Institute of Fiber Crops, the gin was improved, and comparative research was conducted with a 30-saw gin 5DP-130 with a mesh surface feeder in the laboratory. The research work was carried out based on theoretical and practical results, with a combed screen selected with a coverage angle of 180 ^{0} and a comb spacing of 8 mm. During the experimental work, it was found that when cleaning cotton picked by the Namangan-77 selection machine in a feeder with a grid, the cleaning efficiency of the feeder was on average 18.6-15.7%, which is on average 2.9-1.9 (abs)% higher than that of a gin with a mesh surface. The damage to the seed produced during cotton ginning was on average 3.01-2.84, which, in turn, decreased by 0.3-0.14 (abs)% compared to that produced by a 30-saw gin with a mesh surface feeder. In this case, the productivity of the gin changed from an average of 324 kg/h to 344 kg/h, which is on average 23-32 kg/h higher than that of the gin with a mesh surface feeder. When the fiber after ginning was cleaned in a 5VP fiber cleaner, the average fiber impurity was 2.11-1.96%, and the quality index was studied, which corresponds to the I grade "High" and "Good" classes according to the state standard UzSst 604:2016.

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Key words: saw gin, feeder, mesh surface, grate with grate, pile drum, working chamber, cotton, fiber, seed, cleaning efficiency, work productivity, quality indicator.

Annotatsiya. Arrali jinda paxtani samarali tozalash va jinlash uchun kolosnikli panjarani tajriba nusxasi ishlab chiqarildi. Ishlab chiqarilgan tajriba nusxa Tolali ekinlar ilmiy- tadqiqot institutining texnologik laboratoriyasidagi 30 arrali 5DP-130 rusumli jin ta'minlagichiga o'rnatilib, jin takomillashtirildi va laboratoriyadagi to'rli yuzali ta'minlagichga ega bo'lgan 30 arrali 5DP-130 rusumli jin bilan taqqoslash-tadqiqot ishlari o'tkazildi. Tadqiqot ishlari nazariy va amaliy natijalar asosida tanlab olingan kolosnikli panjara qamrov burchagini 180^0 va kolosniklar oraliq masofasini 8 mm kattaligida olib borildi. Tajriba ishlari davrida Namangan-77 seleksiyali mashinada terilgan paxtani kolosnikli panjaraga ega bo'lgan ta'minlagichda tozalashda ta'minlagichning tozalash samaradorligi o'rtacha 18.6-15.7% ni tashkil etib, to'rli yuzali jin ta'minlagichiga qaraganda o'rtacha 2.9-1.9 (abs)% ga yuqori ekanligi aniqlandi. Paxtani jinlashda ishlab chiqarilgan chigitning shikastlanishi o'rtacha 3.01- 2.84 ni tashkil etib, to'rli yuzali ta'minlagichli 30 arrali jindan ishlab chiqarilgan chigitga qaraganda shikastlanishi o'z navbatida 0.3-0.14 (abs)% ga kamaydi. Bunda jinning ish unumdorligi o'rtacha 324 kg/soatdan 344 kg/soatga o'zgarib, to'rli yuzali ta'minlagichli jin ish unumdorligiga qaraganda o'rtacha 23-32 kg/soatga yuqori ekanligi aniqlandi. Jindan keyingi tola 5VP rusumli tola tozalagichda tozalanganda tolaning iflosligi o'rtacha 2.11-1.96 % ga teng bo'lib, sifat ko'rsatkichi O'zDst 604:2016 davlat standarti bo'yicha I nav "Oliy" va "Yaxshi" sinflarga mansubligi o'rganildi.

Kalit so'zlar: arrali jin, ta'minlagich, to'rli yuza, kolosnikli panjara, qoziqli baraban, ishchi kamera, paxta, tola, chigit, tozalash samaradorlik, ish unumdorlik, sifat ko'rsatkich.

Аннотация. Был изготовлен экспериментальный экземпляр колосниковой решетки для эффективной очистки и демонтажа пилы. Произведенный опыт был установлен на 30-пилочном подающем Джине 5VP-130 в технологической лаборатории УХК копировально-волокнистых культур, Джин был усовершенствован, и были проведены сравнительные исследования с 30-пилочным подающим джином 5VP-130 в лаборатории с подающим с сетчатой поверхностью.ыл изготовлен экспериментальный экземпляр колосниковой решетки для эффективной очистки и демонтажа пилы. Произведенный опыт был установлен на 30-пилочном подающем Джине 5VP-130 в технологической лаборатории УХК копировально-волокнистых культур, Джин был усовершенствован, и были проведены сравнительные исследования с 30-пилочным подающим джином 5VP-130 в

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лаборатории с подающим с сетчатой поверхностью. Исследовательская работа проводилась на основе теоретических и практических результатов, отобранных колосниковой решеткой с углом охвата 180º и расстоянием между колосниками 8 мм. В ходе опытных работ было установлено, что при очистке хлопка, собранного машиной селекции Наманган-77, на снабженном колосниковой решеткой снабженце, эффективность очистки снабженца в среднем на 18,6-15,7% выше, чем у снабженца джина с сетчатой поверхностью, в среднем на 2,9-1,9% (абс). ходе опытных работ было установлено, что при очистке хлопка, собранного машиной селекции Наманган -77, на снабженном колосниковой решеткой снабженце, эффективность очистки снабженца в среднем на 18,6-15,7% выше, чем у снабженца джина с сетчатой поверхностью, в среднем на 2,9-1,9% (абс). Повреждение семян, произведенных при джиновании хлопка, в среднем составляло 3,01-2,84, что на 0,3-0,14% меньше, чем повреждение семян, произведенных из джинов с 30 пилами с сетчатой поверхностью. При этом производительность Джина варьировалась в среднем от 324 кг/ч до 344 кг/ч, что в среднем на 23-32 кг/ч выше, чем производительность джина с сетчатой поверхностью.ри этом производительность Джина варьировалась в среднем от 324 кг/ч до 344 кг/ч, что в среднем на 23-32 кг выше, чем производительность джина с сетчатой поверхностью Волокно после джина при очистке в очистителе волокна 5VP-130 загря.

Ключевые слова: пильный джин, поставщик, сетчатая поверхность, колосниковая решетка, колышковый барабан, рабочая камера, хлопок, волокно, дерн, очистка эффективность, работа производительность, качество индикатор.

INTRODUCTION.

The economic efficiency of cotton ginning plants depends on several factors, the main of which is determined by the quality and quantity of the fiber produced. The quality of the fiber is mainly related to the amount of impurities in its composition, which determine the quality of the cotton during the process of ginning.

Cotton ginning plants use a UXK unit to clean cotton from small and large impurities. Due to the shortcomings of the unit design, it was found that it cannot separate small impurities from the cotton content in the required amount during cotton cleaning [1]. According to the sequence of the technological system, after the UXK unit, cotton is cleaned of small impurities in the gin feeder before ginning. However, due to the shortcomings of the mesh surface design in the feeder, small impurities are not separated from the cotton in the required amount during cotton

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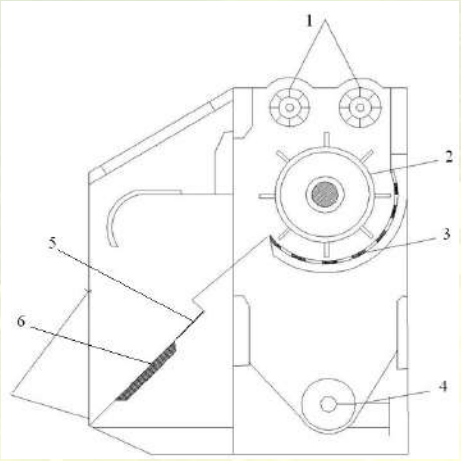
cleaning [2]. The large amount of small impurities remaining in the cotton content leads to an increase in the impurity level of the fiber produced during ginning and fiber cleaning, and fibers of the “High” and “Good” classes are not produced in the required amount from high and low-grade cotton.

The results of research conducted in production showed that the cleaning efficiency of the UXK unit in cleaning high and low selection varieties of cotton is on average 60-70%, which is on average 15 (abs)% less than the cleaning efficiency in the passport [3]. It was found that a large amount of small impurities remained in the cleaned cotton. It was shown that in order to effectively clean cotton from small impurities, it is necessary to add additional working parts to the UXK unit, which in turn leads to the consumption of additional spare parts and electricity, and problems in the operation of the unit [4]. In addition, it was studied that the addition of additional rotating and fixed working parts leads to an increase in the impact forces on cotton and its products when beating and cleaning cotton from small and large impurities, which negatively affects the quality of cotton fiber and seed, and it was found that adding additional working parts to the UXK unit is not purposeful.

It was studied whether it would be useful to improve the saw gin feeder to effectively clean cotton from small impurities before the ginning process.

The feeders of the 5DP-130, DPZ-180 and 8DP-90 saw gins used today in cotton ginning plants consist of a feeder roller, a pile drum and a mesh surface, and the cleaning efficiency in cleaning cotton from small impurities is low and does not exceed 8-10% on average when cleaning high and low-selection cotton (Fig. 1). It was studied that one of the main reasons for this is the design of the mesh surface, which is one of the main working parts of the feeder. When moving cotton on the mesh surface using a pile drum, the cotton is not well shaken due to the smoothness of the surface, and the acceleration of the separation of small impurities from cotton is low, and it was shown that when transporting cotton at a certain speed in the arc of the mesh surface, small impurities do not have time to separate from cotton. As a result, it was studied that a large amount of small impurities are retained in the cotton composition and are transferred to the working chamber of the gin. In addition, it has been studied that the smoothness of the mesh surface prevents the cotton from being spread out evenly between the pile and the surface by the pile drum, which results in uneven feeding of the cotton from the feeder to the working chamber, which in turn causes jams in the raw material shaft and stops the gin [5]. Frequent jams in the gin lead to reduced gin productivity and reduced quality of the fiber and gin produced.

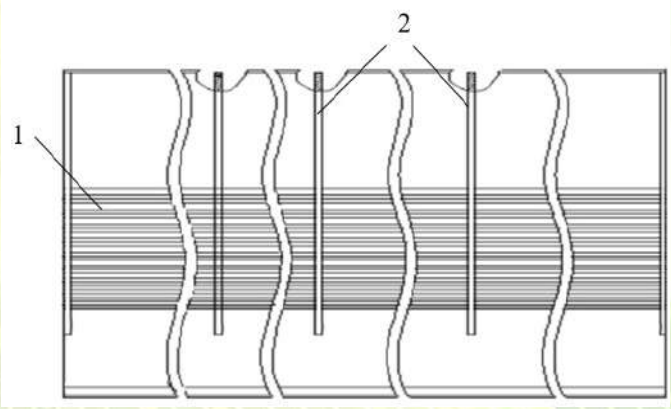
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1-feed rollers, 2-pile drum, 3-mesh surface, 4-waste auger, 5-sluice; 6-magnet

Figure 1. Diagram of a 5DP-130 saw blade feeder-cleaner

Scientific research was conducted to improve the separation of small impurities from cotton by improving the cotton shaker in the feeder and to increase the efficiency of the gin, improve the quality of fiber and seed by ensuring that it is fed into the working chamber in a uniformly spread state. Based on the research, a scheme of an improved design of a comb grate for the feeder was created (Fig. 2). Based on the scheme, theoretical studies were conducted on the movement of cotton on the surface of the comb grate using drum piles with a pile.



1-rails, 2-ribs.

Figure 2. Scheme of a grid with an improved structure

The drum with a pile in the feeder receives the cotton from the feeder rollers and strikes it against the surface of the grate located on the side, which shakes the cotton during transportation and separates small impurities from its contents.

To increase the separation of fine impurities from cotton, it is possible to increase the time and duration of interaction of the cotton in the flow with the combed grid. The rack performs a complex movement when passing between the drum with a pile and the combed grid [6]. Taking this into account, the process of

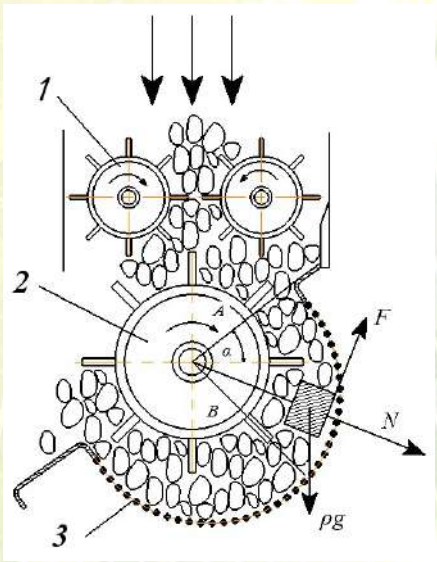
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separation of fine impurities from cotton when the cotton moves on the surface of the combed grid under the influence of the pile drum piles was theoretically studied.

Same as the supply rollers Q_0 To implement the cleaning process of a cotton stream in a productive manner, the cotton in the stream interacts with the arc length of the combed grid as it moves from top to bottom, resulting in the separation of fine impurities from the cotton.

We express the arc length of the grid with a grid grid through the coverage angle, dividing the cleaning zone into the first and second sections.

In the first section, we assume that the cotton flow is partially compressed and that the cotton flow in motion is ds we separate the element (Fig. 3).



1-feed rollers, 2- drum with a groove, 3-Improved kolosniki grill.

Figure 3. Scheme of the movement of cotton flow under the influence of a grid with a pile drum in the cleaning section

For this case, we formulate the equation of motion based on the Euler form [7]. In this case, we assume that the flow motion is stationary and write the following expression for the separated element based on the Euler equation:

$$v\rho\frac{dv}{ds} = -\frac{dp}{ds} + \rho g\sin\alpha - Nf \qquad (1)$$

where $N = \rho\frac{v^2}{R} - \rho g\cos\alpha$, s - the length of the arc of impact of the cotton with the grid relative to point A, v - the speed of the cotton piece, p, ρ - the density and pressure, R - drum radius, N - normal compressive force, f - coefficient of friction between the cotton and the grate.

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Substituting the expression into $\rho(s)$ equation (1), N we obtain an equation expressing the relationship between density, pressure $p(s)$, and velocity : $v(s)$

$$v\rho\frac{dv}{ds} = -\frac{dp}{ds} + \rho g(\sin\alpha + f\cos\alpha) - \rho\frac{v^2}{R}f \qquad (2)$$

Equation (2) has three unknowns, namely p, ρ and v To find these unknowns, consider a body of mass in a state of compression, ρ with a density of pressure p We use the equation that expresses the relationship between:

$$\rho = \rho_c[1 + A(p - p_c)] \qquad (3)$$

In this case, we consider the mass conservation condition for the stationary motion of the flow [8]:

$$\rho v S_0 = Q_0 \qquad (4)$$

where: $S_0 = k_0 Lh$ - cross-sectional area of the layer in the flow, h - layer thickness, L - drum length, k_0 - coefficient characterizing the reduction of the contact surface of the product with the pile surface, Q_0 - cleaner efficiency, ρ_c - p_c pressure and density of the product in contact with the pile surface, A - a constant quantity characterizing the shrinkage of cotton. $A << 1$ We determine the speed from equation (4) when:

$$v = v_c[1 - A(p - p_c)] \qquad (5)$$

the cotton stream is affected by the impact of the piles, the beaten cotton piece gains $v_c = \beta v_k$ speed.

where v_k - linear velocity of the pile, $\beta < 1$ - velocity reduction coefficient [9]. We take the average flow velocity in the cleaning zone as: $v_{cp} = 0{,}5v_k$. Taking into account from equation (5) $v = v_c$, we determine the density of the product in contact with the pile surface:

$$\rho_c S_0 v_c = Q_0$$

Knowing that the initial density p_c and pressure p_0 of the cotton fed to the cleaning zone are known ρ_0, we determine the product density in the cleaning zone. In this case, based on formula (3) , we accept $p = p_0$ and $\rho = \rho_0$, then

$$p_c = p_0 - (\rho_0 / \rho_c - 1)/A \qquad (6)$$

Equation 6 describes the change in product density as cotton is moved through the cleaning zone under the influence of a drum with a pile and a grate, separating small impurities from the cotton.

During the theoretical research, the efficiency of cleaning the grate was studied, taking into account the degree of contamination of the cotton fed to the cleaning zone and after cleaning.

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Based on theoretical studies, drawings of a pilot version of the lattice fence were prepared in the design department of the “Fiber Crops Research Institute”. Based on the prepared drawings, pilot versions of the lattice fence were manufactured at the “RIM Workshop” LLC enterprise (Fig. 4). In order to select the optimal variant of the manufactured pilot versions, they were installed on a 30-saw 5DP-130 sawmill in the technological laboratory of the research institute and research work was carried out.



Figure 4. Experimental copy of the grid with a grid

During the research work, an optimal variant of the combed grid was selected. Based on this, °it was found that the optimal size of the combed grid with a coverage angle of 180 degrees and a distance between the combs on the grid of 8 mm provided a higher cleaning efficiency than the others. At the same time, with this optimal size, the cotton was better combed in the cleaning zone and was fed into the gin working chamber in a more evenly spread state. As a result, an increase in the rotation speed of the raw material shaft was observed in the working chamber, and the exit of the ginned seeds from the working chamber was accelerated.

Considering the increase in cleaning efficiency and productivity when cleaning and ginning cotton of the selected optimal size, the laboratory A comparative study was conducted with a 30-saw 5DP-130 model with a mesh surface feeder under operating conditions.

The research work was carried out on the mesh surface with a pile drum in the feeder, and the pile drum with a grid with a grid within the range of 15-18 mm specified in the technical specifications of the saw mill [10].

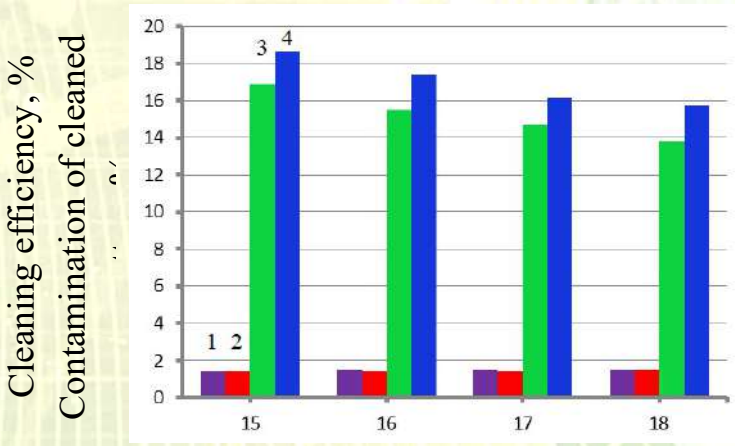
In order to facilitate manual labor and drastically reduce additional costs, cotton picking is being expanded from year to year in order to quickly and in a short time pick cotton. Special attention is paid to the technological system at cotton ginning enterprises to improve the quality of fiber produced from machine-picked cotton. Taking this into account, experimental work was carried out to study the

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efficiency of the proposed saw gin with a grid feeder with a grid. Experimental work was carried out on the Namangan-77 selected grade I 2nd class, which was picked by machine. In this case, the moisture content of the cotton fed to the saw gin feeder was on average 8.6%, the dirt content was on average 1.72%, and the damage to the seed in the cotton was on average 1.92% [11-13].

Initially, the experimental work was carried out on a 30-saw mill with an existing mesh surface feeder.

After cleaning the Namangan-77 cotton with a moisture content of 8.6% and an impurity of 1.72% in the existing gin feeder with a pile drum at a mesh surface spacing of 15-18 mm, the impurity of the cotton was on average 1.43-1.49%. During the cleaning of cotton, the damage to the cleaned cotton seeds did not change much and was on average 1.92%. At the same time, the cleaning efficiency of the feeder was on average 16.9-13.8% at the above-mentioned spacing sizes (Fig. 5).



1, 3-mesh surface, 2, 4-mesh grid

Figure 5. The dependence of the cotton contamination after cleaning and the change in the cleaning efficiency of the feeder on the distance between the pile drum and the separator in the Namangan-77 selective grade I and grade 2 cotton feeder

The cleaned cotton was fed into the gin working chamber and ginned. In cotton ginning, the degree of hairiness of the seed after ginning was almost the same when the distance between the pile drum and the mesh surface was changed from 15 mm to 18 mm, and was on average 10.4% [14]. In this case, the degree of damage to the seed was on average 3.31-2.98%. When the impurity of the fiber after ginning was studied, it was on average 3.34-3.28%. During ginning, the weight of the fiber produced during a certain period of time was measured and calculated hourly, and the efficiency of the gin was determined. In this case, when

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the distance between the pile drum and the mesh surface was changed from 15 mm to 18 mm, the efficiency of the gin with 30 saws changed from 301 kg/h to 312 kg/h on average.

The fiber produced from cotton gin was cleaned in a small-sized two-drum 5VP fiber cleaner installed after the gin. The average impurity of the cleaned fiber was 2.38-2.21%, and the quality index of the produced fiber was I grade “Good” according to the state standard UzDst 604:2016 [15]. Then, experimental work was carried out in a 30-saw gin with an improved feeder with a grate.

Namangan-77 selected cotton with a moisture content of 8.6% and impurities of 1.72% is fed into a gin feeder with a grid grid with a pile drum and a grid grid with a spacing of 15-18 mm. After cleaning at distances, the average cotton impurity was 1.4-1.45%. During cleaning, the damage to the cleaned cotton seed did not change much and was 1.92% on average. It was found that the cleaning efficiency of the feeder was 18.6-15.7% on average at the above-mentioned distances, and the cleaning efficiency was 2.9-1.9 (abs)% higher than that of the gin feeder with a mesh surface. When this cotton was fed to the gin and ginned, the hairiness of the seed produced by the gin was 10.4% on average when the diameter of the gin was changed from 15 mm to 18 mm with a pile drum and a comb grid. In this case, the average damage to the seed was 3.01-2.84, which was reduced by 0.3-0.14 (abs)% compared to the seed produced from a 30-saw mill with a mesh surface feeder.

The efficiency of the gin in cotton ginning was determined by the chronometry method and, when calculated hourly, it was found that when the distance between the pile drum and the grate with a grate was changed from 15 mm to 18 mm, the efficiency of the gin changed from 324 kg/h to 344 kg/h on average, which was 23-32 kg/h higher than the efficiency of the gin with a mesh surface feeder. The impurity of the fiber after ginning was studied, and it was 3.16-3.12% on average. The fiber produced from cotton ginning was cleaned in a small-sized two-drum 5VP fiber cleaner. In this case, the average impurity content of the cleaned fiber was 2.11-1.96%, and the quality index of the produced fiber was studied, according to the state standard UzDst 604:2016, belonging to the I grade "High" and "Good" classes.

CONCLUSION. It was found that the cleaning efficiency of the UXK unit in the technological system for cleaning cotton from small and large impurities is on average 15 (abs)% lower than the cleaning efficiency in the passport when cleaning high and low-selection cotton, which means that a large amount of small impurities remain in the cleaned cotton. It was shown that adding additional

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working parts to the unit to increase the cleaning efficiency of the UXK leads to the consumption of additional spare parts and electricity.

The feasibility of improving the saw gin feeder to effectively clean cotton from small impurities before the ginning process was studied, and a grid grid scheme for the feeder was created.

Based on preliminary theoretical studies, equations were derived that describe the change in product density during the separation of fine impurities from cotton as the cotton moves through a drum with piles and a grid with combs, as well as the interaction of the piles and combs on the grid with the cotton in the flow.

Based on the results of theoretical studies, a pilot sample of the combed screen was prepared and installed in a 30-shear 5DP-130 model gin in laboratory conditions. Tests were conducted on the combed screen, and the optimal sizes of the screen were determined, with a coverage angle of 180^0 and a combed screen spacing of 8 mm. To determine the efficiency of the combed screen, comparative research was conducted in laboratory conditions with a 30-shear 5DP-130 model gin with a mesh surface feeder. The results of the comparative studies showed that the feeder cleaning efficiency of the combed screen with a pile drum at 15-18 mm spacing was on average 18.6-15.7%, which is on average 2.9-1.9 (abs)% higher than that of the mesh surface gin feeder. The damage of the cotton produced during ginning was on average 3.01-2.84, which was reduced by 0.3-0.14 (abs)% compared to the damage of the gin produced by the 30-saw gin with a mesh surface feeder. In this case, the productivity of the gin changed from an average of 324 kg/h to 344 kg/h, which was found to be on average 23-32 kg/h higher than the productivity of the gin with a mesh surface feeder. When the fiber after ginning was cleaned in a small-sized two-drum 5VP fiber cleaner, the fiber impurities were on average 2.11-1.96%, and the quality index was studied to belong to the I grade “High” and “Good” classes according to the state standard UzDst 604:2016.

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