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STUDY OF THE PROCESS OF CLEANING MACHINE-HARVESTED COTTON FROM SMALL IMPURITIES IN SAW GINS

R.Sh. Sulaymanov[1], Z.J. Omonov[2], M.N. Ismatov[3], O.Q. Rayimqulov[4], U.A. Saytov[5],

[1] *"Cotton Industry Scientific Center" JSC,*

[2] *Tashkent State Technical University,*

[3] *Tashkent State Technical University,*

[4] *Tashkent State Technical University,*

[5] *Tashkent State Technical University*

Email: rustamsulaymon@mail.ru
zarshidomonov96@gmail.com
mamurjon19972505@gmail.com
oxunjon1436@gmail.com
qaraqalpaq9798@gmail.com

Abstract. The cleaning efficiency of the machine-picked S-6524 selected grade 2 cotton in the UXK unit of the technology was 80.4% on average, and it showed that it was 12 (abs)% less than the cleaning efficiency of the passport when cleaning high-grade cotton. After the UXK unit, when cotton is cleaned in the 5DP-130 type saw gin supplier-cleaner, the cleaning efficiency of the supplier is equal to 10.1% on average, and it is found that it is 4.9 (abs)% less than the cleaning efficiency in the technical characteristics. The productivity of the gin when ginned in the cleaned cotton gin was on average 1261 kg/h, which was 30% lower than the productivity in the passport. When the ginned fiber was cleaned in the post-ginning fiber cleaner, the mass fraction of defective fiber and impurity in the fiber was high, on average 2.36%. It was determined that the high mass fraction of defective fibers and dirty impurities in the fiber composition is due to the insufficient separation of small impurities from the cotton content in the UXK aggregate. It was studied that adding additional working parts to the unit is not possible from the point of view of technical requirements and causes additional consumption of electricity and spare parts.

It was determined that in order to effectively clean cotton from small impurities before the ginning process, to increase gin productivity, and to improve the quality of produced fiber and seed, it is necessary to improve the mesh surface, which is the main working part that performs the process of cleaning cotton from small impurities in the gin supplier-cleaner.

Key words: UXK aggregate, supplier-cleaner, saw gin, mesh surface, cotton, fiber, seed, dirt, performance, cleaning efficiency, quality.

Introduction. Cotton is cleaned from large and small impurities in cotton ginning enterprises in the system of cotton-textile clusters. Large impurities include dust, leaves, cotton flowers, sticks, mineral and organic impurities larger than 8 mm. Fine impurities include mineral and organic impurities smaller than 8 mm [1]. Large impurities are on the surface of the cotton, and due to the low strength of their association with the cotton, they are easily separated from the cotton content in the cotton cleaning technology. The degree of adhesion of small impurities to cotton is high, and the process of cleaning cotton from small impurities is difficult and creates its own problems. Due to the complexity of the degree of adhesion of small impurities to cotton,

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during the initial treatment of cotton, the process of cotton and fiber cleaning is carried out in the technology of transporting and separating cotton from air using air, drying cotton, cleaning cotton from small and large impurities, cotton ginning and fiber cleaning technology [2]. But despite this, it is not possible to completely clean cotton and fiber produced from it from small impurities. Therefore, the textile industry is obliged to use the technique and technology of cleaning the fiber from small impurities before producing high-quality yarn from the fiber, and it is constantly demanded by the textile industry that the process of effective cleaning of the fiber from small impurities should be carried out in the cotton ginning enterprises [3].

In cotton ginning enterprises, special attention is paid to the production of high-quality fiber with effective cleaning of cotton from small impurities. However, year after year, the increase in the production of difficult-to-purify selective cottons creates problems in cotton ginning enterprises in increasing the quality of fiber produced by effectively separating small impurities from cotton [4]. Because the degree of adhesion of small impurities to cotton in hard-to-clean selective varieties is higher than that of easy-to-clean selective varieties of cotton, it is difficult to separate such impurities from the cotton content in the technological process, and some of them remain in the cotton and fiber without being completely separated from the cotton. The remaining impurities in the cotton and fiber firstly lead to a decrease in the cleaning efficiency of the equipment during the cleaning process, and secondly, the retention of impurities in the cotton and fiber reduces the quality of the fiber and causes specific problems in the production of high-quality yarn and fabric from the fiber in the textile industry [5]. Therefore, in order to effectively clean cotton from small impurities, it is necessary to speed up the cleaning process by improving each part of the technological system on a scientific basis. The process of cleaning cotton from small impurities in cotton ginning enterprises of cotton textile clusters is mainly carried out in the cotton drying-cleaning workshop [6].However, in order to prevent sufficient separation of small impurities from cotton in the cotton drying-cleaning workshop, the process of cleaning cotton from small impurities is carried out in the supplier-cleaner of sawed gins in the cotton ginning workshop after the cleaning workshop in the technological system [7]. Today, in the ginning shop of cotton ginning enterprises, mainly 4DP-130 and 5DP-130 type gins with 130 saws are used (Fig. 1).

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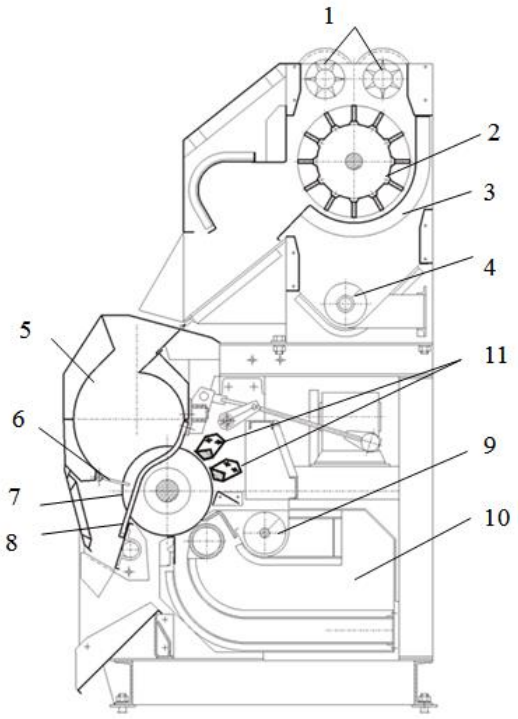
In order for the gins to work efficiently without clogging and the quality of the fiber produced from cotton is good, the cotton supplied to the gin working chamber is first cleaned and cleaned in the gin supplier-cleaner, and then transferred to the gin working chamber.Therefore, in the aforementioned 4DP-130 and 5DP-130 sawing machines, a cleaner-cleaner was used to clean cotton from small impurities [8]. The structure of the feeder-cleaner consists of feeder rollers 1, piled drum 2, mesh surface 3, dirt auger 4, tarvan 5 and magnet 6 (Fig. 2).

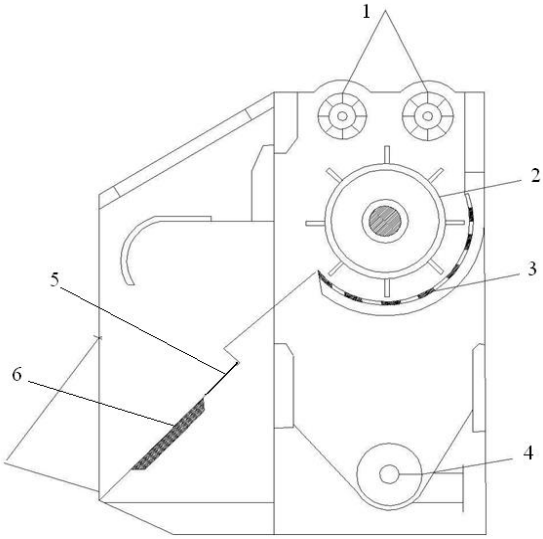
Research studies on the cleaning efficiency of the supplier-cleaner showed that the cleaning efficiency of the cleaner is 9-10% on average in cleaning high and low-grade cottons, and it is 5-8 (abs)% less than the cleaning efficiency in the passport. Due to the fact that cleaned cotton is not fed to the working chamber of the gin in an even and fully spread state, the productivity of the gin decreased, on average, 5-9 kg/saw hour per saw was 5-9 kg/saw hour, and the work productivity of the technical characteristics of the gin was on average 20-25% less compared to one saw [8].



1- supply rollers; 2- pile drum; 3- mesh surface; 4- waste auger; 5- working chamber; 6- seed comb; 7- saw cylinder; 8- Colossian; 9- large screw; 10- air chamber; 11- separator columns;

Figure 1. 5DP-130 chainsaw model scheme

Year by year, the volume of cotton picking with the help of a machine is being expanded in order to reduce manual labor, reduce additional costs, and pick the grown cotton quickly and qualitatively in a short period of time. It has been studied that the amount of small and large impurities in cotton when picking cotton by machine is on average 8-10% higher than the amount of small and large impurities in cotton when picking cotton by hand [9]. In order to effectively clean the machine-picked cotton from large and mainly small impurities, a special demand is placed on the technological system of the initial processing of cotton [10]. In this direction, research work was carried out in production to study the effectiveness of cleaning equipment in the technology for cleaning machine-picked cotton from impurities and the effectiveness of cleaning gin supplier-cleaner from small impurities.



1. supply rollers, 2. pile drum, 3. mesh surface, 4. waste auger, 5. threshing machine; 6- magnet

Figure 2. Schema of 5DP-130 chainsaw deburring-cleaner

The research work was carried out on S-6524 selection 1st grade 2nd grade cotton picked by machine at Piskent cotton ginning enterprise, Tashkent region. In this case, the moisture content

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of the cotton was 11.2%, and its dirt content was 9.3% [11-13]. After drying in the 2SB-10 drying drum of the cotton technology, the average moisture content of the cotton was 8.7%, the dirtiness was 8.2% on average, and the cleaning efficiency of the drying drum was 11.6% on average (Fig. 3). After the drum, the dried cotton was sent to the UXK unit, which cleans the cotton from small and large impurities. The average moisture content of cotton produced from the aggregate was 7.6%, and the average dirtiness was 1.61%. In this case, the cleaning efficiency of the UXK aggregate is equal to 80.4% on average, and it showed that it is 12 (abs)% less than the cleaning efficiency of the passport in cleaning high-grade cotton [14].

After the UXK aggregate, the cleaned cotton was sucked with air using a technology SS-15A separator, separated from the air and sent to the supplier through a gin mine. In this case, the average moisture content of the cotton given to the gin supplier was 7.4%, and the average dirtiness was 1.48%. This cotton saw was cleaned of fine impurities using a mesh surface with a piled drum in the gin supplier. The average moisture content of cleaned cotton was 7.4%, and the dirtiness was 1.33% on average (Figure 4). In this case, the cleaning efficiency of the cleaner is on average 10.1%, which is on average 4.9 (abs)% less than the cleaning efficiency in the technical characteristics.

Then the cleaned cotton was soaked in gin. Timing method was used to determine the efficiency of ginning in cotton ginning. The produced fiber was removed and the hourly productivity of the gin was found to be on average 9.7 kg/hour per saw and 1261 kg/hour per machine, which is on average 30% less than the productivity of the saw gin passport. The hairiness of the

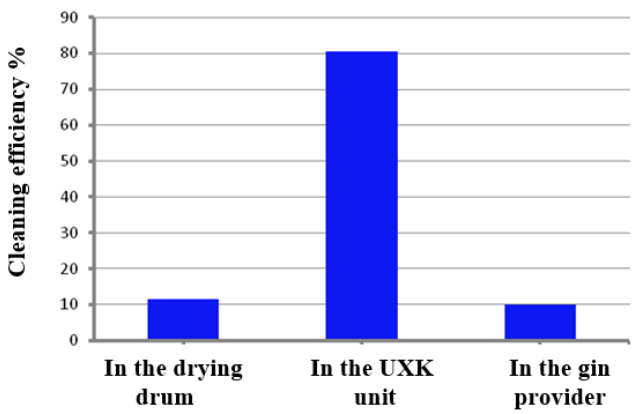

Figure 3. Cleaning efficiency of technology equipment

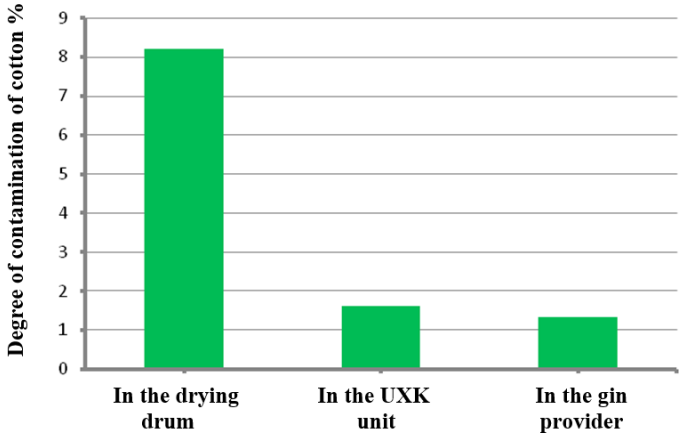

Figure 4. Impurity of cleaned cotton in technology

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seed produced from cotton ginning was 10.8% on average, damage was 3.27% on average [15, 16]. When fiber produced from sawn gin was cleaned in a post-gin fiber cleaner, the mass fraction of defective fiber and impurity in the cleaned fiber was high, on average 2.36 % [17].

It was determined that the quality indicator of the produced fiber belongs to the I grade "Good" class according to the state standard UzDst 632:2010. During the research work, it was studied that the cleaning efficiency of the UXK aggregate in the passport is less than the cleaning efficiency, so that the cotton comes to the sawmill in a condition higher than the required level of dirtiness. It was determined that it is not appropriate to add additional cleaning working parts to the unit in order to remove small impurities from the cotton content to the required level when cleaning cotton in the UXK unit. First, considering the cleaning workshop where the UXK unit is located, it was studied that it is impossible to add additional working parts to the unit from the point of view of technical requirements, and secondly, adding additional working parts causes additional consumption of electricity and spare parts. Therefore, it was determined that after ginning of cotton after ginning, it is necessary to improve the working parts of the gin supply-cleaning system to effectively clean cotton from small impurities. However, due to the defect of the construction of the mesh surface, which is one of the cleaning working parts in the gin cleaner, it was studied that cotton is not effectively cleaned due to the low impact force of the mesh surface on the cotton when cotton is moved on the surface of the mesh surface with the aid of a drum with piles, and as a result, small impurities are not separated from the cotton content to the required extent. Failure to separate small impurities from the cotton content to the required level leads to an increase in the level of contamination of the cotton and causes a decrease in the cleaning efficiency of the gin supply-cleaning system. It was observed that in the gin supply-cleaning system, the cotton is not sufficiently dried, and the cotton flow is not fully spread to the gin working chamber. As a result, the gin had to be stopped frequently due to blockages in the raw material shaft in the gin working chamber. During the research period, it was found that the frequent suspension of the gin led to a decrease in its daily productivity.

Conclusion. The cleaning efficiency of the UXK unit, which is a ginning equipment for S-6524 selection 1st grade 2nd class cotton with an initial moisture content of 11.2% and dirtiness of 9.3%, is on average 80.4%, compared to the cleaning efficiency in the passport for cleaning high grade cotton. showed an average of 12 (abs) % less. After the UXK aggregate, when cotton was cleaned in the 5DP-130 sawed gin supplier-cleaner, the supplier's cleaning efficiency was on average 10.1%, and it showed that it was 4.9 (abs)% less than the cleaning efficiency in the technical characteristics. When the fiber produced from cotton ginning was cleaned in the post-ginning fiber cleaner, the mass fraction of defective fiber and impurity in the fiber was high and averaged 2.36%. It was determined that the mass percentage of defective fibers and dirty impurities in the fiber content is insufficient to separate small impurities from the cotton content in the UHK aggregate.

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VOLUME-4, ISSUE-6

It was studied that adding additional working parts to the unit is not possible from the point of view of technical requirements and causes additional consumption of electricity and spare parts. As a result of the studies, it was determined that in order to effectively clean sawed gin cotton from small impurities, increase gin productivity, and improve the quality of produced fiber and seed, it is necessary to improve the mesh surface, which is the main working part that performs the process of cleaning cotton from small impurities in the gin supplier-cleaner.

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