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ANALYSIS OF TECHNOLOGICAL PARAMETERS OF THE IMPROVED CONSTRUCTION OF COTTON SEPARATORS.

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Abstract: In this article, the influence of separation blanks exposed to fiber in the process of separating cotton from the carrier air on the initial indicators of product quality is studied. A theoretical analysis based on existing patterns was carried out on it. In real conditions, theoretical studies of the problems of transferring existing technology to pneumatic transport and their practical solutions have been carried out. Conclusions and suggestions based on the results of theoretical studies of the effect of separation of cotton from air on the process are given.

Keywords: cotton raw materials, separator, working surfaces, pneumatic conveying equipment, impact force, friction force, frequency, elongation at break, microneuron, quality indicator.

INTRODUCTION

Every year, 23-24 mln. tons of cotton fiber is produced, and its annual consumption is 0.5-1.0 million tons more, and the insufficient amount of fiber is covered by raw material reserves. Therefore, cotton cultivation has become one of the promising branches of agriculture on a global scale, and not only the main production, but also the improvement of auxiliary technological processes in the initial processing of raw materials, in particular, the issues of ensuring the efficiency of production of cotton products by improving processes such as separation of cotton from the carrier air have risen to the level of issues that determine the current state and prospects of the industry.

The process of initial processing of cotton includes preparation, storage, transportation, drying, cleaning, separation of fibers and seeds, and the processes of packing the finished product. The performance and quality of each piece of equipment and process in this chain is closely related to the performance and quality of work of the preceding machines. The supply of cotton raw materials to the entire technological process is carried out by means of air transport equipment.

Bunts are used in cotton ginning enterprises, and pneumatic transporters of suction type are mainly used to transport cotton between workshops. The advantage of the suction pneumatic transport equipment is that the working air pipe system can be easily changed depending on the location of the storage areas of the cotton ginning enterprises, and its length can be extended or shortened by connecting additional pipes to the primary air pipes, depending on the need. The productivity of the pneumatic transport equipment depends on the total production capacity of the cotton ginning enterprise, the amount of raw cotton processed per hour, and in most enterprises it is an average of 10 tons of raw cotton per hour.

METHODS

Initially, some changes were made to the "SS-15A" and "SS-15M" brand separators developed in 1956, but the basic structures of the construction were preserved [1].

In many literatures on the transportation of cotton by air, in particular, V.A. Schwab, F.G. Zuev, A.M. Korn, A.M. Dzyadzio, A.S. In chamber work, it was shown that the resistance of the air mixture movement depends on the air flow rate.

In particular, in [2], the author proposed to install a squeegee tilted at 45 degrees relative to the radial axis in order to reduce cotton sticking to the mesh surface and ensure faster separation from it. In this case, issues such as compression of cotton between the mesh surface and the strainer, damage to the seed were not taken into account.

Amirov R. in his work [3] showed that it depends not only on the magnitudes of the flow velocity components and the initial velocity, but also on the coefficient "k" and the concentration of the object being separated.

A number of scientists [4,5,6,7,8] engaged in improving the work of the separator tried to carry out the process of separating cotton from air using the force of inertia generated by the movement of cotton, by changing the direction of the air flow.

The main part of the separator is the separation zone, where the product is divided. Due to the mass of the material, it was shown that a large chamber is needed to provide it during the process of separation from the air, as described in [9].

N. E. Avdiev's work [10] on the separation of spilled materials has theoretically and experimentally studied the process of separation of small particles through a mesh surface. Particles in constant contact with the mesh surface were more likely to become airborne.

Ya.Urban [11] studied the process of air movement of particles of different sizes. The basic laws of mechanics were used to determine the change in particle movement and pressure loss, and the relationship between air flow velocity and material transport speed was studied in the process of conveying material by air flow.

As a result of P.V.Baydyuk [12] theoretical-experimental study of the process of transporting raw cotton by air, a number of regularities were determined.

Academician of the Academy of Sciences of the Republic of Uzbekistan Kha.A. Rakhmatullin [13], taking into account the aerodynamic resistance of air to the transverse movement of a piece of cotton, determined the law of movement of cotton in a pipe and put forward the idea that cotton can be separated from air using the force of inertia. Based on the results of the research, it was scientifically proven that cotton separation occurs at an angle of 1350, while the flow speed is 16 m/s.

Muradov R. In [14], the behavior of cotton on cone-shaped mesh surfaces was studied. According to the author, one of the main disadvantages of the transport device with the help of air flow is the high energy consumption in the cotton transportation process.

In the work of R. Muradov [15], the main causes of cotton being squeezed between the blades of the vacuum valve and the walls of the chamber were studied.

General analyzes show that the physical-mechanical and aerodynamic properties of cotton affect the process of separating it from air, and it is necessary to take them into account when creating new constructions of the separator.

Cotton enters the working chamber of the separator with an air stream. The main part moves correctly in the working chamber of the separator, hits its walls, falls under the influence of its own weight to the vacuum valve. The rest will hit the mesh surface. Circular mesh surfaces are installed on the sides of the separator working chamber in the air flow path. A certain amount of cotton sticks to these surfaces. The rotation of the mesh surface makes it difficult for the cotton to settle on its surface. Also, the coefficient of friction between the moving support surface and the object on its surface is lower than that of the stationary surface. Therefore, when the cotton mesh surface rotates, it is forced to move outwards from the surface due to gravity and centrifugal forces. A part of the cotton falls off the mesh surface under the influence of these two forces. The remaining part is separated using a fixed extractor.

The equation of motion of a piece of cotton in the polar coordinate system looks like this:

$$\left.\begin{aligned} m\ddot{r} &= -G\sin\varphi - F_i\cos\varphi + F_m \\ \varphi &= \omega t \end{aligned}\right\} \quad (1)$$

Here, G = mg is the weight of cotton, N; m is mass, kg; Fi is the force of friction, N; F_m- centrifugal force,N; φ-angle of rotation of the surface, rad; ω-angular velocity, rad/s; t-time, s

The equation of motion of a piece of cotton in the polar coordinate system looks like this:

$$\left.\begin{aligned} m\ddot{r} &= -G\sin\varphi - F_i\cos\varphi - F_{is}\cos\varphi + F_m\sin\beta \\ \varphi &= \omega t \end{aligned}\right\} \quad (2)$$

here, F_{is}- coefficient of friction of cotton with the absorbent surface. It is found as follows:

$$F_{is} = fN$$

We determine the force N of the cotton hitting the wick:

$$N = mg\cos(\omega t + \phi) f_1 P_x \frac{r\omega}{\sqrt{\dot{r}^2 + r^2\dot{\phi}^2}} \geq 0 \quad (3)$$

Putting the result in (2.39) and after some transformations, we get:

$$\left.\begin{aligned} m\ddot{r} &= -mg\sin\varphi - \left[mfkvx + fmg\cos(\varphi - \beta) f_1 \frac{r\omega}{\sqrt{\dot{r} + r^2\dot{\varphi}^2}} \right]\cos\varphi + mr^2\varphi\sin\beta \\ \varphi &= \omega t \end{aligned}\right\}$$

The theoretical analysis of the process of extracting a piece of cotton from the mesh surface from the analysis of the literature shows that under the influence of the cotton squeegee, the cotton moves radially from the center to the periphery along the mesh surface, and its movement trajectory has a spiral appearance. It can also be concluded from these trajectory lines that if the holes on the surface are formed in the form of grooves corresponding to these trajectories, the resistance to their movement will decrease sharply. From this point of view, the idea of forming the mesh surface of the separator from steel wire or tape in the form of a spiral expanding radially from the center was born, and a technical solution based on this was developed.

RESULTS

Experiments were conducted in the proposed separator, and the release of impurities and defects in the technological process was determined, and samples were taken from the fibers after the filter, the existing SS-15A separator, and the proposed separator, and the cotton was separated from the seed, and the results of the research are shown in Table 4.3. Experiments are carried out in the HVI 900 SA instrumental laboratory system designed to determine the fiber quality indicators according to the international universal cotton fiber standard. The terms and quality indicators in the HVI 900 SA instrumental laboratory system are given based on the international universal cotton standard.

When the experiment was carried out after installing the inclined mesh surface installed in the working chamber of the separator machine, it was found that positive results were obtained based on the results of testing the fiber samples in the HVI-900SA laboratory system of the laboratory center of the Namangan region branch of the "Agrasanoat complex service center" DUK.

For example, the Mic - Microneur indicators of the fiber have not changed, Str - the relative breaking strength decreased from 38.9 gs/tex in the existing separator to 36.5 and 38.8 gs/tex in the new one, SFI - the amount of short fibers increased from 2.6 to 3.4 in the existing separator and 2.7% in the new one, Elg - the relative elongation at break is 6.9 to 6.0 in the existing separator ha, decreased to 6.7 in the new one, Cnt - the amount of dirty mixtures decreased from 18 units in the existing separator to 15 in the new one to 14 units.

The positive results obtained are the result of a reduction in impact forces applied to the cotton in the new separator, the possibility of additional cleaning of the cotton, and the elimination of the compression of the cotton between the vacuum-valve wings and the wall.

The quality parameters of cotton fiber samples obtained after ginning and separator were determined in HVI 900 – SA laboratory system.

Table 1

№		S 65-24 selection grade cotton fiber

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	The name of quality indicators in the international universal standard system of cotton fiber	Natural quality indicators of cotton fiber	Fiber from the existing SS-15A separator	Fiber from advanced separator equipment
1	Mic Microneur	4,4	4,1	4,4
2	Str Relative breaking strength, gs/tex	38,9	36,5	38,8
3	Len Upper average length, inches, mm	1,18	1,15	1,18
4	Unf. Length uniformity index, %	83,6	83,1	83,5
5	SFI- Content of short fibers, %	2,6	3,4	2,7
6	Elg - Relative elongation at break, %	6,9	6,0	6,7
7	Trash Dirty code	4	2	2
8	Cnt Amount of impurities	18	15	14
9	Area The area of contaminated compounds	0,9	0,8	0,8
10	CG Sort by color	31 – 4	31 - 4	31-4
11	Rd- fiber reflection coefficient, %	75,1	75,1	75,1
12	+b The degree of yellowness of the fiber	8,6	8,6	8,6

Debate

The analysis of relevant scientific literature showed the need to identify a number of shortcomings of the existing separators and conduct research on additional cleaning of cotton in the separator, reduction of mechanical damage to cotton and fiber loss.

Based on theoretical studies, the laws of air parameters change in the pneumotransport system depending on the diameter of the pipe, different constructions of the transition parts of the pipe, and different initial parameters of the fan have been determined. As a result of studies of the movement of cotton along the surface of the moving mesh of the separator, the effect of the speed of rotation of the surface, the angle of deviation of the fixed strainer in the vertical plane on the speed of cotton leaving the mesh surface was determined.

As a result of theoretical and practical studies, a design of a separator with a rotating mesh surface and a fixed wiper was created, and as a result of studying the dynamics of cotton interaction with a moving mesh surface, the cotton movement trajectories, the time of its interaction with the mesh surface, and the rational value of the angle of deviation of the fixed wiper with respect to the vertical axis of the mesh surface were determined.

When the production sample of the new separator equipment was tested in production conditions at the "Kosonsoy cotton ginning" enterprise, it was found that the amount of impurities in cotton was reduced by 1.2%, and seed damage was reduced by 1.7% (in absolute value).

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