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Ways to Improve Fiber Quality in Cotton Factories

Nuriddinova Rohila Pazlitdin Qizi
"Department of "Technology of textile industry product"
Namangan Institute of Engineering and Technology, Namangan Uzbekistan

Abstract

This article gives reasons why the technological process of cotton processing does not violate its natural properties. Ways to reduce impact forces during the separation of fine impurities in cotton have been analyzed. This is based on the need to carry out soft processing of cotton.

Keywords– *Quality, Cotton, Fine impurities, Impact strength, Transport, Damage, Working part, Cleaning, Seeds, Fiber, Pipeline*

1. Introduction

Today, one of the main requirements for the technological process of cotton processing is to obtain high-quality fiber by processing, while retaining the natural properties of this valuable raw material.

Violation of the natural properties of cotton during its processing occurs mainly due to damage to the seed under the influence of the working bodies of machines installed in the technological process of cotton gins. About 1.6-1.8% of cotton seeds are damaged during air transportation and cleaning of cotton from the gins to the main shops. Therefore, the main focus of researchers dealing with the processes of transporting and cleaning cotton in pipes using air is to study the damage to the seed and reduce it [1, 2].

The movement of cotton in the pipes is due to the force generated by the dynamic pressure of the air flow. Under the influence of this force, the speed of flight of the cotton inside the tube occurs. The larger the diameter of a piece of cotton, the greater its flight speed. To ensure that the velocity of the cotton is suspended in the tube, the pressure of the air flow on the raw material must be equal to its weight.

The graph in Figure 1 shows the number of passes in the cleaning machines along the U axis and the contamination of the cotton along the X axis. In this graph, line 1 shows a decrease in contaminants from the cotton content. Line 2 shows that defects in the fiber content are caused by damage to the seeds as a result of passing through the cotton gins.

At the point of intersection of these lines, it is ensured that the fiber quality and the amount of impurity are optimal.

This is done by using 3 deflection lines to lower point A. This is done by cleaning the 3 deflection lines without affecting the natural properties of the fiber. As a result, there are no additional defects in the composition of the fiber along the 2 deflection lines, ie it does not change.

In the process of cleaning the raw cotton, it is repeatedly passed through cleaning machines consisting of pile drums in order to completely separate the impurities in it. This increases the mechanical impact on the cotton, leading to additional defects in the fiber content. It is necessary to increase the efficiency of cleaning machines and change the processing process so that the cotton is less mechanically affected.

If we reduce the amount of fine contaminants in the cotton during the transportation of cotton by pneumatic transport, then the graph of the process of its cleaning will be as shown by the barcode in Figure 1. The graph remained unchanged as there was no change in the amount of defects formed in the fiber as a result of the passage through the pile drums.

The graph A, which represents the amount of impurities in the cotton, moves to point A1, which is formed at the intersection with the graph, which represents the formation of defects in the fiber content.

The difference between these points is that it reduces the defects that are formed in the fiber content during the processing of cotton. This means that cleaning the cotton from yeast contaminants without damaging it during transportation in pneumatic pipelines will reduce the formation of various defects in the fiber content.

2. A Method Of Improvıng The Qualıty Of Raw Materıals In Cotton Processıng, Stone Holdıng Equıpment

It is known that contaminants are passive and active in terms of processing cotton. Passive contaminants are easily separated from cotton when lightly shaken. Active contaminants are difficult to separate from cotton. In order to separate the active impurities from the cotton, it is necessary to make them passive before it is possible to remove the active impurities from the cotton faster by vibrating the proposed mesh surface. Theoretical research shows that when the surface of the net vibrates, the trajectory of the cotton fiber changes. This change allows the cotton piece to move on a longer uneven trajectory on the mesh surface. Today, a remote experimental device is being developed to test these ideas in practice. This device allows the net surface to vibrate, as well as increase its useful surface [3].

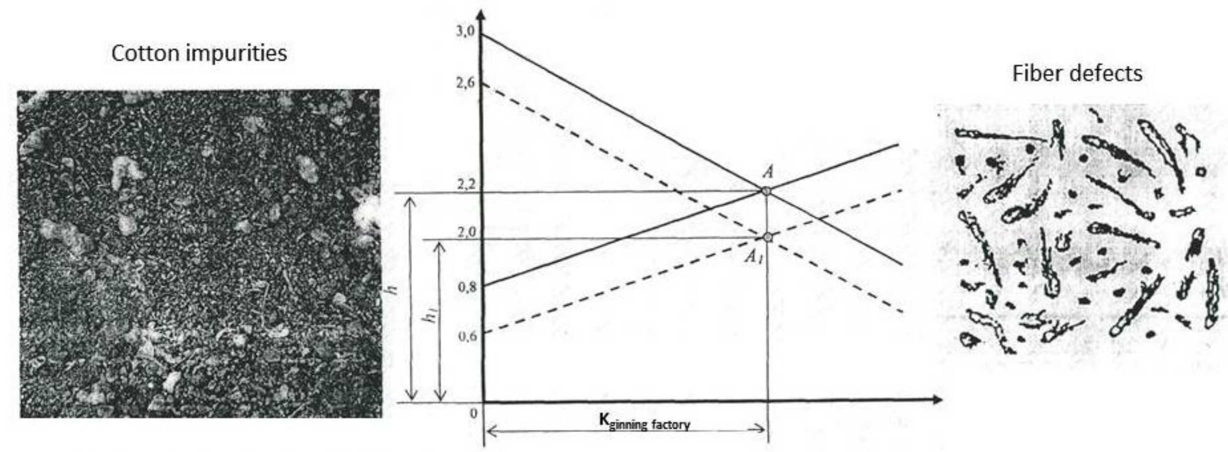

Figure 1. Scheme of dependence on defects resulting from the cleaning of impurities in the cotton

Pneumatic transport is connected to a continuous technological process in all shops of the plant, and its normal operation has a significant impact on the productivity of the plant.
It can also damage the 90^{O} angle of the cotton pipes, causing them to lose quality. To prevent this, the working chamber of the stone holder is equipped with an elastic deformable mesh drum. (Fig. 2).

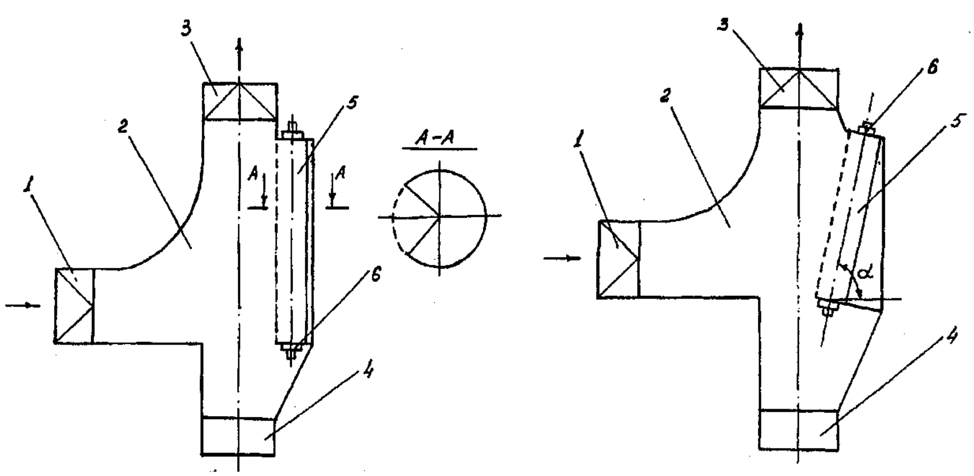

Figure 2. Stone holder for raw cotton. (Patent № IAP 02993)
1 inlet pipe, 2 separation chamber, 3 outlet pipe, 4 heavy mixture collector pocket, 5- mesh drum mounted at angle 60^{O}, 6-elastic base.

As a result of crushing the cotton and transferring it to the pipes in a flat way, the raw material begins to move under the influence of air flow, separating it from the fine impurities. Taking advantage of this situation, it is possible to separate the fine contaminants from the cotton in the mesh drum mounted on the stone holder. As the mesh drum is mounted on an elastic base, it also has the ability to rotate. The mesh drum is periodically cleaned using drive blades mounted on the inside and outside. The mesh drum is rotated by hand. This prevents various impurities from getting stuck in its holes [4].

3. Theoretıcal study of the Reductıon Of Impact Force Actıng On Cotton In Stone

Studies have shown that 1.2-1.7% of seed damage occurs as a result of impact on the walls of the device during the movement of cotton swabs inside the pipes of the air-carrying device. This, in turn, leads to the formation of defects in cotton fiber from 0.3 to 0.4%.

Therefore, in order to eliminate such a shortcoming, a supplier was created that was able to transfer cotton evenly to the air-carrying device.

In addition, seed damage occurs in the stone catcher, which cleans one of the main elements of the cotton air-carrying device from heavy impurities in the cotton tray..

This process occurs under the influence of the impact force generated by the impact of cotton on the wall of the working chamber of the cylindrical stone holder.

In this study, in order to reduce the impact force, a spring-loaded plate was placed on the cotton-beating part of the working chamber of the stone catcher (Fig. 3). This in turn makes it possible to increase the speed of air flow of cotton pieces.

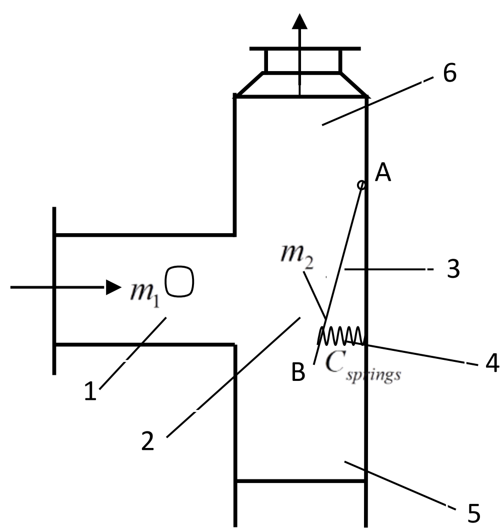

Figure 3. A spring-based plate is mounted on the working chamber cylindrical stone (Patent № M.G.-1454882).

1 - inlet pipe; 2 - working camera; 3 - plate; 4 - spring;

5 - pocket; 6 - outlet pipe.

The stone catcher works as follows: The cotton, which is transported in the air-carrying device, enters the working chamber (2) through the inlet pipe (1) of the stone catcher with air. In this case, the cotton is hit on the plate (3) mounted on the spring (4) in the working chamber. With a slight decrease in the speed of the cotton, it is passed to the next machine through the upward pipe 6 in the vertical direction. Mixtures that are heavier than cotton are separated from the cotton without being able to rise to the top and fall into the bottom pocket (5) [5, 6, 7].

A dynamic force R_{din} is created as a result of the impact of a piece of cotton of mass m_1 entering the working chamber of the stone catcher with the speed V_1 in the middle of the AB plate, and we determine it by the following formula:

$$P_{din} = kP_{st} \tag{3.1}$$

Here: k - dynamic coefficient; P_{st} - static force.

The dynamic coefficient is calculated according to the following law (3.1) according to the law of conservation of energy.

$$k = 1 + \sqrt{1 + \frac{v_n^2}{g\Delta_{st}(1 + \frac{m_2}{m_1})}} \tag{3.2}$$

In this case: v_n - speed of cotton m / s; g - free fall acceleration m / s^2; Δ_{st} - deformation under the influence of static force m; m_1 - mass of a piece of cotton in kg; m_2 - the mass of the plate, kg.

The deformation caused by static force is obtained as the sum of the corresponding deformations of the spring and the plate, that is

$$\Delta_{st} = \Delta_{\text{springs}} + \Delta_{plate} \tag{3.3}$$

In this case: Δ_{springs} - static deformation of the spring; Δ_{plate} - static deformation of the plate.

Static deformations of the spring and plate are calculated by the following formulas under the equilibrium conditions of statics:

$$\Delta_{st} = \frac{8D^3 n}{cd^4} \tag{3.4}$$

$$\Delta_{plate} = \frac{Pl^3}{48EJ_y} \tag{3.5}$$

In this case: D - the large diameter of the spring; d - the small diameter of the spring; n - the number of packages; s - the coefficient of elasticity of the spring; R - the force acting on the plate; l - the length of the plate; Jy - moment of inertia; E - modulus of elasticity.

Static force is determined using the following formula:

$$P_{st} = m_1 g + m_2 g \tag{3.6}$$

In this case: m_1 - the mass of a piece of cotton; m_2 - the specified mass of the plate; g - acceleration of free fall, m / s.

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4. Results

The resulting deformation of the spring and the change in the amount of dynamic force generated as a result of changing the small and large diameters of the spring obtained as a result of the studies are shown in Table 1.

Table 1. The effect of a change in the diameter of a spring on its deformation and a change in the amount of dynamic force

№	*D* mm	*d* mm	*n*	v_n	Δ_{st} $\Delta_{strings}$	c - the coefficient of elasticity of the spring	ΔK_g dynamic coefficient	P_g dynamic strength, H
2	30	3	12	10	0,45	1,25	2,9	33,06
1	40	4	12	10	0,35	1,6	3,1	35,34
4	16	2	12	10	0,35	1,6	3,1	35,34
3	24	2,4	12	10	0,6	0,9	2,7	30,88

Analyzing the results obtained in Table 1, we saw that the change in the large diameter and small diameters of the spring did not change the amount of dynamic force by a small amount. Therefore, when choosing it, it is possible to get a spring that is easy to install.

According to the results of the study, the change in spring deformation and the amount of dynamic force, depending on the geometric dimensions (Table 1), as well as the number of windings, are shown in Table 2.

Table 2. The effect of the number of spring windings on its deformation and the change in the amount of dynamic force

№	*D* mm	*d* mm	*n*	v_n	Δ_{st} $\Delta_{strings}$	c - the coefficient of elasticity of the spring	ΔK_g dynamic coefficient	P_g dynamic strength, H
5	30	3	10	10	0,38	1,5	3,06	35
1	30	3	15	10	0,57	1	2,7	31,79
2	30	3	8	10	0,3	1,87	3,26	37,31
3	30	3	6	10	0,22	2,5	3,57	40,85
4	30	3	20	10	0,76	0,75	2,62	29,97

According to the results obtained in Table 2, when changing the number of windings, it was found that the amount of dynamic force can change significantly. It was therefore determined that it was advisable to increase the number of packages as much as possible.

In an air-carrying device, the variation of the distance between the drying and cleaning shop and the bales causes the speed of the cotton moving in it to change. Therefore, the velocity of the air in the tube was changed. The results obtained are presented in Table 2.

Table 3. The effect of changes in air velocity on changes in the amount of dynamic force

№	*D* mm	*d* mm	*n*	v_n	Δ_{st} $\Delta_{strings}$	c - the coefficient of elasticity of the spring	ΔK_g dynamic coefficient	P_g dynamic strength, H
1	30	3	10	8	0,38	1,5	2,75	31,51
2	30	3	10	10	0,38	1,5	3,06	35
3	30	3	10	15	0,38	1,5	3,88	44,38
4	30	3	10	20	0,38	1,5	4,74	54,23

Thus, in Table 3, a speed of 15 m / s in which the cotton could move more in the stone catcher chamber was selected, and it was found that the amount of dynamic force generated in it was 1.5 times less than the amount of force that could damage the seed.

As a result of theoretical research, it was proposed to install a spring-based reflector in the stone catcher chamber, which can prevent seed damage, taking into account changes in the performance of the air-carrying device and the speed of the cotton in the pipe. The results obtained showed that the impact force was significantly reduced and that its amount did not damage the seed [8, 9, 10, 11].

Due to the proposed changes, the deterioration of the quality of cotton during its transfer to processing machines will be prevented. As a result, the raw material is not damaged, there are no defects in the fiber content. Due to the improvement of quality, the company will be able to get great economic benefits.

5. Conclusıon

As a result of theoretical research, it was proposed to install a spring-based reflector in the stone holding chamber, which can prevent seed damage, taking into account changes in the performance of the air carrier and the speed of the cotton in the pipe. The results from the theoretical studies showed that the impact force was significantly reduced. It also achieves a reduction in seed damage during cotton processing through cotton tubes. As a result, the formation of defects in the fiber content is reduced. If this new equipment is introduced into the technological process of the enterprise, there is a possibility that ordinary fiber will be better and even fiber with good performance will be higher. As a result, the economic efficiency of the enterprise will increase significantly. .

References

1. Zikriyoev E.Z. Textbooks under the general editorship. Primary processing of raw cotton, Tashkent. Mehnat, 1999, pp. 258-269.
2. R.Muradov. Ways to improve the efficiency of the cotton separator. Namangan edition, 2005, pp. 62-63.
3. R.Muradov. Cotton Basics of an air carrier to increase the effectiveness of the device. Science. Tashkent, Navuz edition, 2014, pp. 15-16.
4. Salokhiddinova Makhliyo Nurmukhammad qizi, Muradov Rustam Muradovich, Mamatkulov Arif Tursunovich. Investigation of Separating Small Impurities and Heavy Compounds Using the Cotton

Separator Equipment. American Journal of Science, Engineering and Technology. Vol. 2, No. 2, 2017, pp. 72-76. doi: 10.11648/j.ajset.20170202.13

5. A.Dzhuraev, R.Kh.Makkudov, Sh.Shukhratov “Improving the designs of the working parts of the cotton separator” J. “Problems of textiles” No. 3-4, 2013, pp.128-131.
6. Salokhiddinova Makhliyo Nurmukhammad qizi, Muradov Rustam Muradovich, Karimov Abdusamat Ismonovich, Mardonov Botir Mardanovich. The Shortfalls of the Vacuum Valve Cotton Separator. American Journal of Science and Technology. Vol. 5, No. 4, 2018, pp. 49-55.
7. M.KHAKIMOVA, A.YUSUPOV, M.SALOKHIDDINOVA, R.MURADOV, M.ABDURAKHMANOVA. Ways to Improve the Effectiveness of Cotton Cleaning Machines. INTERNATIONAL JOURNAL OF ADVANCED RESEARCH
8. IN SCIENCE, ENGINEERING AND TECHNOLOGY. Volume 7, Issue 3, March 2020. pp. 13061-13066
9. A.Karimov, O.Mamatkulov, M.Salokhiddinova. Investigating the effect of a drum in the efficient operation of the separator. STJ FerPI. 2017, No.3. pp. 160-164.
10. R.Muradov, O.Mamatkulov, M.Salokhiddinova. Separating small impurities and heavy compounds using the cotton separator. ISCIENCE.IN.UA Actual scientific research in the modern world: XV Collection of the Faculty of international scientific-practical conference, Pereyaslav-Khmelnitsky// 2016. - No. 7(15), s. 1. pp. 60-65.
11. Muradov R.M., Karimov A.I., Mardanov B.M., (2014) Theoretical and Experimental Studies of the Effect of Inclined Scraper on Removal of Raw Cottonfrom Mesh Surface. World Journal of Mechanics. 4, 371-377. http://dx.doi.org/10.4236/wjm.2014.412036
12. Ishlinsky A.Yu. Renting and Drawing in high velocity rates of deformation. Application tasks of mechanics. Book 1, M. Science, 1986, pp.263-269.