M.Khodjiev, A.Rakhimov.

TECHNOLOGY THAT PRESERVES ITS NATURAL CHARACTERISTICS IN THE PROCESS OF SEPARATION OF COTTON FROM AIR

Monograph

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Cover design by Amazon.com

First ediGon ISBN: 9798393590529

UOC: 677.21.021.152

In the monograph, as a result of theoretical research, it was shown that a sudden change in speed at the border of variable and constant cross-section surfaces can create an additional aerodynamic force in the separator, and such a situation can lead to a change in the speed and density of cotton raw material moving along the axis of the separator. From the analysis of the calculation results, it was observed that the friction coefficient can sufficiently affect the external tension force. This effect $f > 0.4$ was explained by the relatively high values of the friction coefficient. Thus, it was found that the main reason for fiber breakage on the mesh surface is the friction coefficient of the fibers in the pores of the mesh surface.

An improved mesh surface separator was developed, the opening diameter of its entrance part was $d_1 = 6$ mm, and the rear part was enlarged to $d_2 = 10$ mm. The main purpose of this is to prevent the fibers passing through the mesh surface holes by making the expanded mesh surface hole at 45° to the horizontal plane.

It was published based on the decision of Gulistan State University Council No. 8 ; March 29 , 2023 .

INTRODUCTION

Relevance and necessity of the topic of the monograph. In the conditions of Uzbekistan, one of the main tasks in this direction is to protect the environment and eliminate the release of waste from enterprises into the air, as well as to create waste-free technologies in the field of processing [1].

Nowadays, in the rapidly growing development of the volume of modern scientific and scientific and technical information, together with the sectors of the national economy, cotton ginning enterprises are also newly created.It is important to pay special attention to re-equipment with techniques and technologies. Uzbekistan is of great importance in the process of entering the international trade layer, increasing the export and import of products and goods, modernization by implementing the development programs of leading developed countries, re-equipment of economic sectors with new equipment and technologies. One such industry is the cotton processing industry. Every year, 24-25 mln. tons of cotton fiber is produced, but its annual consumption is 0.12-0.25% more.

Review of foreign research on the topic of the monograph. Currently, more than 80 countries are engaged in cotton cultivation and production. Today, China, USA, Brazil, India, Uzbekistan, Pakistan and Mexico are the main cotton growing countries.

Reduction of labor and energy consumption in the initial processing of cotton in our republic, modernization of cotton ginning enterprises, technical re-equipment, development of resource-efficient techniques and technologies Comprehensive measures have been implemented and certain results have been achieved is being achieved. In the new development strategy of Uzbekistan for 2022-2026, important tasks such as "Increasing the production volume of industrial products by 1.4 times by continuing the industrial policy aimed at ensuring the stability of the national economy and increasing the share of industry in the gross domestic product..." are defined [1]. In the implementation of these tasks, among other things, effective and full use of local raw materials and the production of high, value-added, competitive, high-quality textile products are becoming important.

This dissertation research is based on the Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. PD-4947 "Strategy of Actions on the Five Priority Areas of Development of the Republic of Uzbekistan in 2017-2021", No. PD-3408 dated November 28, 2017 "Measures to Fundamentally Improve the Management System of the Cotton Industry Decision of the Cabinet of Ministers dated March 31, 2018 No. 253 "On additional measures to organize the activities of cotton-textile industries and clusters", PD-4633-con dated March 6, 2020 PD-4633-con "Market principles in cotton production" "Decision on wide implementation measures", Decree PD-5989-con dated May 5, 2020 "On measures that cannot be delayed to support the textile and sewing-knitting industry", Cabinet of Ministers of the Republic of Uzbekistan dated June 22, 2020 Decision VM-398-con on "On measures to organize the activities of cotton raw material cultivation and processing cooperatives", Decision PD 16 on "On measures to regulate the activities of cotton-textile clusters" dated November 16, 2021, This dissertation research serves to a certain extent the implementation of the tasks defined in the Decree PD-60 of the President of the Republic of Uzbekistan on January 28, 2022 "On the new development strategy of Uzbekistan for 2022-2026" and other regulatory and legal documents related to this activity [2-4].

In the process of cotton processing, the most urgent problem is to avoid spoilage of cotton raw materials and to preserve its natural properties. In order to achieve this main goal, it is important to create a technology that distributes cotton equally [5].

Creating a technology that evenly distributes the flow of cotton in the process of separating cotton from air leads to the preservation of its

[1] Decree of the President of the Republic of Uzbekistan dated January 28, 2022 No. PF-60 "On the development strategy of the new Uzbekistan for 2022-2026".

natural properties, especially to the reduction of the level of mechanical damage to the cotton seed and to the prevention of cotton fiber breakage.

Today, in the process of separating the existing cotton from the air, it causes the loss of the cotton fiber and causes mechanical damage to the cotton seed. An in-depth analysis of the work carried out in this area requires solving the above-mentioned issue of the introduction of equal distribution technology.

Therefore, to overcome the above-mentioned shortcomings and to create a new improved technology is the main goal of this thesis work.

Level of study of the problem . MDBuser, DIMisyulya, DPWhitelock, JKGreen, Van Dorn, K.Wise, D.Richard and other scientists conducted researches in foreign countries to create an equal distribution technology in the separator that separates cotton from air, to preserve the natural properties of cotton and to improve it.

In our country, R. G. Makhkamov, K. A. Ziyaev, R. M. Murodov, B. M. Mardonov, K. T. Akhmadkhojaev, Yu. D.Yangiboev, S.Kadirkhojaev, M.T.Khodjiev, Z.O.Shodiev and other scientists conducted research.

The carried out scientific analyzes show that during the movement of cotton in the existing separator, the flow of cotton entering the working chamber mainly hits the mesh surface. As a result, the cotton fiber comes out with the help of the air flow through the hole of the mesh surface, and the cotton is cut off during the scraping process. As a result, the amount of short fibers increases and the amount of fibers decreases.

Taking into account the above, it is known that there are still a number of problems in scientific research aimed at preserving the natural properties of cotton.

The purpose of the research is to preserve the natural properties of cotton based on the study of the existing separator construction in cotton gins, the development of a new guide device and a separator with an improved mesh surface.

Tasks of the research:

- determine the impact of the separator, which is the main part of the pneumatic transport device, on the natural properties of cotton;
- study of analytical separator constructions and analysis of the operation of working parts;
- analysis of the performance of foreign separators used in the process of separating cotton from air;
- theoretical and practical study of the effect of mesh surface on cotton in the process of separating cotton from the air stream;
- to determine the degree of influence of the organic connection of the mesh surface with cotton on the working condition and to create a new construction of the mesh surface;
- to study the situation affecting the surface of the rear wall of the separator and to create a diverter structure in order to preserve its natural properties;
- to create and develop a new improved separator design and to determine its rational parameters.

The scientific novelty of the research is as follows:

The construction of a flat-shaped guide with a slope of 25 degrees and an improved mesh surface separator with a hole opened at a slope of 45 degrees, which reduces the mechanical damage of the seed, prevents the formation of the amount of free fiber in the dirt, by means of the process of separating cotton from the carrier air and targeted management of the factors affecting it developed;

study of the influence of the angle of deviation of the cotton layer on the process, as a result of which the relationship between the angle of deviation and the parameters of the mesh surface in different performance of the separator was theoretically determined;

In relation to the mechanical damage of the seed obtained according to the experimental plan, the percentage of moisture in the cotton and the optimal values of the parameters of the deviation angle of the router were determined.

CHAPTER I. ANALYSIS OF THE TECHNOLOGICAL PROCESS OF SEPARATORS AVAILABLE IN OUR COUNTRY AND ABROAD.

§1.1. The process of separating the cotton from the air is its natural to study the effect on the properties.

The initial processing of cotton consists of the process of transporting cotton and its products in the territory of the enterprise by means of air transport. Air transport is one of the main means of transferring cotton from warehouses and warehouses to production, from one department to another.

Air transport differs from other devices in the reliability of the system, the ease of installation in small-sized areas, the high possibility of moving cotton in unfavorable conditions, compactness, and finally the simplicity of the repair process.

In addition, the transportation of cotton with the help of an air flow helps to dry it, as a result, the cotton is first cleaned of small impurities in the separator.

It is known that suction air transport is used to transport cotton in cotton ginning enterprises. In this case, the cotton is separated from the air and transferred to the belt conveyor with the help of a vacuum valve and moved to the required land. As a result, a separator is the main device in its composition, which separates cotton from air and transfers it to technological machines. The average productivity of separators is 15 t/h. The widespread use of machine harvesting and the rapid harvesting of cotton raw materials have put the cotton ginning industry in a position to increase production capacity, equipment productivity and, at the same time, to improve the quality of the finished product. Solving these issues also depends on the performance of air transport carrying cotton, as it is considered the first and main step in the technological process of initial processing of cotton [6; 110 pp.].

An additional, serial, re-transmission unit-type aerial device is installed to transfer cotton from distant gins to production. As a result, the operating radius of the retransmission aerial device is 50-60 meters, which leads to an increase in the number of devices and an increase in power consumption.

The dependence of the productivity of transmission on cotton production on the length of the air transportation system has been studied. According to the obtained results, it was shown that the increase in moisture content of cotton and the introduction of additional re-transmission devices cause a decrease in raw material productivity by 10-15% [7; pp. 14-17].

This, in turn, causes an increase in the unplanned downtime of the company's technological equipment. Changes in the natural properties of the fiber are observed during the initial processing of cotton using technological equipment. From this point of view, the natural properties of the fiber change and have a negative effect on its quality during the transfer of cotton in air equipment used in cotton ginning enterprises [8; 9-10 pp.].

In order to solve the problems of improvement of air transportation devices, consideration of the works dedicated to the study of the effect of air transportation on the quality of cotton will be highly effective. In this case, maintaining the natural properties of cotton is an important issue.

One of the main requirements in the transportation of cotton is to preserve the natural properties of cotton. Therefore, many researchers involved in the study of air transport have focused on the study of seed damage. Because it affects the quality of the finished product, resulting in a deterioration of fiber spinning properties, and in transplanting the seed material, it reduces growth energy and seed germination.

The critical velocity value of seed damage as a result of a direct impact of a piece of cotton on a metal surface was studied, and it was determined to be 15.5 m/s. The influence of the change of the direction of hitting the cotton boll, seed damage, and the value of the critical speed was studied. It was found that the mechanical damage of the seed decreases with the increase of the fall angle during impact. As a result, it is possible to create a fan that rotates through the blades for the air transport system of the cotton picker. This fan does not damage the cotton seed under certain conditions when the exit angle b = 25° on the outer diameter and the rotation speed on the wheel diameter does not exceed 37 m/s [9; 5-6 p., 10; pp. 51-58].

According to similar studies, the higher the speed of movement and the greater the relative angle of the material with the pipe wall, the greater the damage to the seed. For example, at a speed of 50 m/s, the mechanical damage of the seed is 70-80% [11; 4-5 pp.]. Also, the influence of the surface material on which the piece of cotton is struck on seed damage was studied. It was found that the amount of seed damage when a piece of cotton is struck against a rubber surface is much less than when it is struck against a metal surface.

K. A. Ziyoev studied the effect of cotton on seed damage when it is moved by air [12; 15-16 pp.]. As a result, it is proposed to increase the angle of impact of the cotton piece on the outer wall of the pipe in order to reduce the seed damage when the cotton moves in the air pipes. It is proposed to determine the approximate value of the impact angle of the undamaged state by the following formula [12; 176-179 p.] :

$$\alpha = \arccos\frac{V_{\kappa p}}{V_{м}} \quad (1.1)$$

here:

a – the angle of impact of a piece of cotton on the outer wall of the pipe;

B $_{xp}$ is the critical speed in damage, equal to 15.5 m/s in the conditions of direct impact on the metal surface;

V_m is the movement speed of seed and cotton particles, m/s.

Based on the dependence of the radius of curvature of the cotton pipe on the impact angle of the cotton pieces on the outer wall of the pipe, it is recommended that the average radius of curvature in its bent parts is not less than 30 ⁰ In that case, there is no significant increase in mechanical damage to seeds up to the air flow speed of 28.4 m/s. "Cotton Cleaning Scientific Center" JSC has conducted a number of studies aimed at studying the effect of air transport on the formation of technological defects in fiber and seed damage. Mechanical damage to the seed increases significantly with the increase in the number of retransmission air conditioners connected in series. As a result, after cotton ginning process, seed husks and broken seed pieces in the fiber increase up to 0.2% in high-grade cotton and 0.6% in low-grade cotton. The length and grade of the cotton fiber remain unchanged when the cotton is passed through the air conveyor many times. Also, the total amount of fiber defects and impurities decreases with the increase in the number of cotton passes through the air machine, where the lower the moisture content of the cotton, the greater the reduction of the total amount of impurities and fiber defects. For example, after passing cotton through air transport 8 times, the sum of fiber defects increases by 0.7%. Repeated airing of cotton also increases seed damage. For example, when cotton with a moisture content of 8.2% is passed through an air conditioner 8 times, seed damage increases by 0.85%, and when the moisture content of cotton increases to 25.0%, seed damage increases by 1.91% [13; 38 p., 14; 153 p.].

It was found that when cotton is transported in polymer pipes, the total number of defects is reduced due to the reduction in the amount of seed hulls and broken seeds in the fiber compared to steel pipes. For example, when the humidity of cotton is 8.5% and the air speed is 23.7 m/s, respectively, these indicators are 0.09-0.17 and 0.14-0.22%, the humidity is 24%, and at the same speeds these indicators It decreases by 0.14-0.26 and 0.11-0.30%.

In the research conducted by Kh.T.Akhmedkhodzhaev, the effect of metal-polymer pipes on the number of fiber defects and seed damage in the air transport of raw cotton was studied [15; pp. 84-86]. It was found that when cotton is transported through metal-polymer pipelines, compared to steel-material pipelines, the amount of total defects is significantly reduced due to the reduction in the amount of seed pods and broken seeds in the fiber. In the research work, when the moisture content of cotton is 8.5% and the air speed is 23.7-28.2 m/s, respectively, these indicators are 0.09-0.17 and 0.14-0.22%, the moisture content of cotton is 24% and at the same speeds, these indicators were found to decrease to 0.14-0.26 and 0.11-0.30%.

S.A. Samandarov and S.A. Libster studied the effect of pneumotransport on the formation of defects in long fiber cotton by other researchers [16; 10-11 p.]. Defects in the fiber in the pneumatic transport system are formed during the transportation of raw cotton with high moisture content and at the bends of the pipe and separators.

Problems of mechanical damage of seeds and formation of various technological defects as a result of impact with the working parts of the separator in the process of transporting cotton with the help of air flow R. Deeply studied by Muradov [17; 31 p., 18; pp. 79-81].

According to the results of the research conducted by Z.O. Shodiev, during the separation of cotton from the air flow in the SS-15A cotton separator, the state of the distribution of the cotton flow along the working length of the vacuum valve of the separated cotton raw material was studied [19; 105 p., 20; pp. 71-73, 21; 427 pp., 22 pp. 15-17, 23 pp. 64-67]. In the analysis of the results of experiments carried out by the researcher on the I, II and 1U-industrial varieties of the S 65-24 breeding variety, the state of distribution of the cotton flow according to the working length of the vacuum valve was studied.

Research has shown that seed damage increases with increasing cotton moisture, number of passes through the device, as well as with increasing air flow rate and decreasing aeromix concentrate.

The results of the experiment also showed that the length of the pipe does not affect the formation of fiber defects. The conducted analyzes showed that all the authors who studied the effect of air transport on the quality of cotton come to the same conclusion, that is, cotton is damaged in the turning points of the air duct and in the separator.

Therefore, it is important to study the dynamics of the movement of cotton in each section of the air plant and to determine the process of influencing the natural properties of cotton by the number of twists in the main sections of the main network, and on this basis to determine the rational values of the number of twists. Finding a solution to this problem is extremely urgent. Until now, the negative state of turning points has been identified, but the effect of their number has not been clearly studied.

In addition, the conducted analyzes show that one of the main factors that negatively affect the natural properties of cotton is the separators installed in the network. A number of scientific studies have been conducted to solve this problem. But the movement of cotton in all joints of the separator has not been studied separately. For example, the movement factor of the cotton stream entering the separator chamber has not been studied at all. Therefore, an in-depth analysis of the separator operation technology is an important issue.

Of course, it is necessary to create a technology aimed at preserving the natural properties of cotton.

§ 1.2. Existing separators used in cotton gins and their analysis.

The efficiency of the cotton air transport device depends in many ways on the performance indicators of the separator.

The main requirements for the separator are to separate the cotton from the air flow while maintaining its natural parameters and to ensure the smooth operation of the air device with minimal pressure loss.

In our country, the SS-15A separator is widely used in the transportation of cotton by air transport device (Fig. 1.1). It is made up of the following parts: chamber 1, vacuum valve 6, electric drive 5 attached to the frame 10. The rear wall of the separation chamber 1 is made of a solid steel sheet, and the side walls are made of mesh with a diameter of 6 mm for air passage.

Cotton cleaning of the mesh surface is carried out with the help of 2 scrapers 7 mounted on the shaft 9. The outer surface of the mesh surface is cleaned of fiber dust using a scraper-cleaner 8.

During operation, the mixture of cotton and air enters the separation chamber through the inlet pipe. Due to the large size of the chamber, the flow rate in it decreases sharply. The main part of the cotton continues to move by the force of inertia and passes to the back wall, slips from its surface and exits with the help of the blades of the vacuum valve, and the remaining part hits the mesh surface. The cotton is separated from the mesh surface using elastic scrapers, and they are also lowered into the vacuum valve [24; 98-100 p.]. The pattern of movement of the cotton falling into the vacuum valve and the distribution of the cotton along the working length of the vacuum valve have not been fully studied. In addition, the movement of cotton on the working parts of the separator has not been studied.

Unfortunately, in the SS-15A separator, most of the cotton entering the chamber is stuck to the mesh surfaces by the suction force from the two side air deflectors and then scraped off by scrapers. Of course, in such a case, it is wrong to think about the equal distribution of cotton along the working length of the vacuum valve. This condition causes uneven wear of the rubber blades of the vacuum valve. A piece of cotton is cleaned with a scraper, and they are also lowered into a vacuum valve [65; 228-233 p.] .

During cleaning, as a result of the cotton piece being squeezed between the scraper and the mesh surface, the seed is broken and the cotton fiber is separated from the seed, i.e., "false" ginning is observed, which leads to the appearance and loss of free fiber. Thus, during the technological process of separating cotton from the air stream in the SS-15A separator, it causes deterioration of its natural properties and loss of fiber content [66; pp. 57-61]

The data show that the fiber losses in cotton re-moving using the separator average 0.0285% for high grades and 0.052% for low grades. Losses in subsequent retransmissions increase by approximately the same amount [67; pp. 39-42]

Today's scientific research shows that the reasons for the loss of fiber in industrial varieties of cotton have not been clearly indicated. During the maximum operation of the air conditioner or when moving cotton in high humidity, sometimes a certain amount of cotton sticks to the mesh surface, and the elastic scraper cannot clean the mesh surface effectively, resulting in a clogging situation. Clogging also occurs when the scraper becomes bent and bent. A number of researchers recommended modern ways of improving the technological process of separation by changing the separation equipment of the SS-15A separator.

It can be said that the SS-15A separator has a large aerodynamic resistance. When the air consumption is 5-6 m^3/s (this indicator corresponds to the normal operating conditions of the air equipment at the cotton gin), the pressure loss is 1180-1370 Pa.

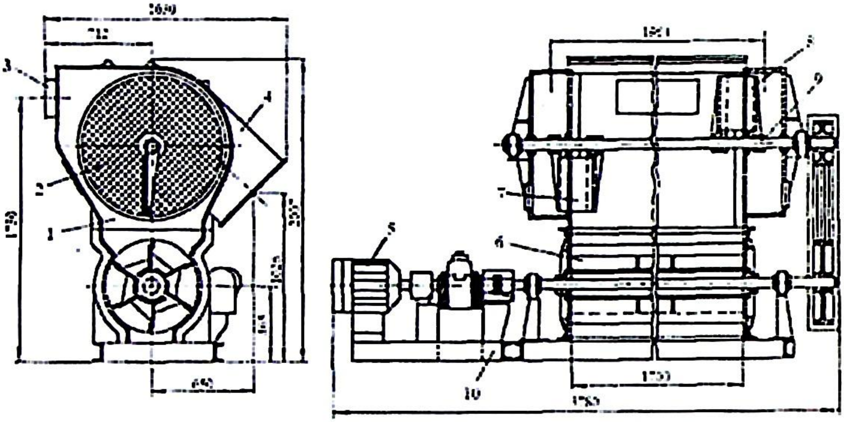


Figure 1.1. Schematic overview of the SS-15A separator.

1st camera; 6- vacuum valve; 2-mesh surface; 7-scissors; 3- air inlet pipe with cotton; 8- scraper-cleaner; 4-input and output pipe; 9-shaft; 5-electroconduction; frame 10;

A large amount of pressure loss in the separator is expressed on the basis of a change in the cross-section of the flow section and the direction of air movement. Connection of the SS-15A separator to the system of air transportation devices at the cotton ginning plant is connected to the air outlet devices with the collector and then the air pipe through the manifold. According to the experimental results, the air consumption is 6.1 When m ^{3}/s, the aerodynamic resistance of the separator is 1610 Pa. Therefore, most of the pressure delivered by the fan is spent overcoming the resistance of the SS-15A separator, which in turn reduces the operating radius of the air transport equipment. That's why I 'm from faraway places re-transfer devices are installed in the air transport system when transferring cotton to production. This causes an increase in excess energy consumption, resulting in an increase in costs [25; 91-92 p.].

As mentioned above, the repeated transportation of cotton by means of aerial devices leads to changes in its natural properties and increased fiber loss.

In the SS-15A separator, which is used in production, cotton is separated from air, and the state of distribution of cotton flow according to the working length of the vacuum valve is studied. Based on the analysis of the results of the I, II and IV industrial varieties of the "Sultan" breeding variety, the state of distribution of the cotton flow according to the working length of the vacuum valve is presented graphically (Fig. 1.2).

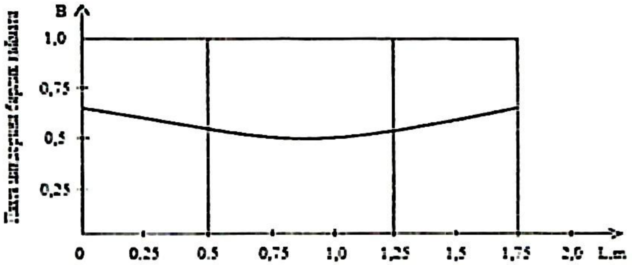


Figure 1.2. Vacuum - the distribution of cotton flow along the working

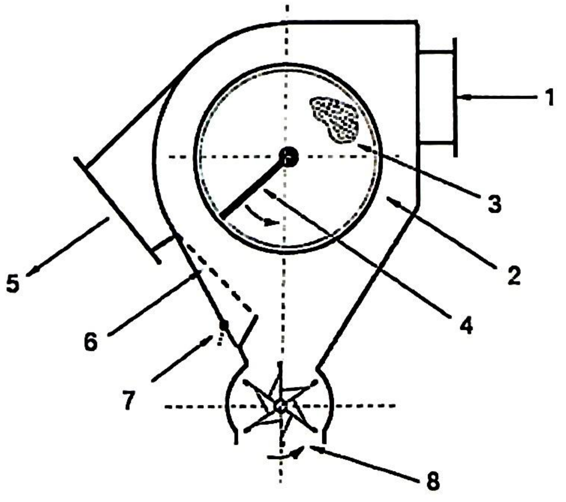


Figure 1.3. Separator with a small cleaning chamber .

1-inlet pipe; 2nd working chamber; 3-mesh surface; 4-squeegee;

5-air outlet pipe; 6-slanted mesh surface; 7th cover; 8-vacuum valve

In the study, defects in the seed were studied depending on the number of passes through the separator. It was also studied that increasing the number of passes in the separator resulted in fiber loss in the device. The researcher proposed to change the design of the separator in SS-15A cotton separator to reduce fiber loss and seed damage [29; pp. 93-94, 30; pp. 185-187, 31; pp. 213-215, 32; pp. 106-109]. In addition, the author studied the effect of the increase in the number of passes, seed damage and fiber loss in the device of the SS-15A separator and analyzed the obtained results, and made appropriate graphs on the effect of the separator on the quality of cotton (Fig. 1.4).

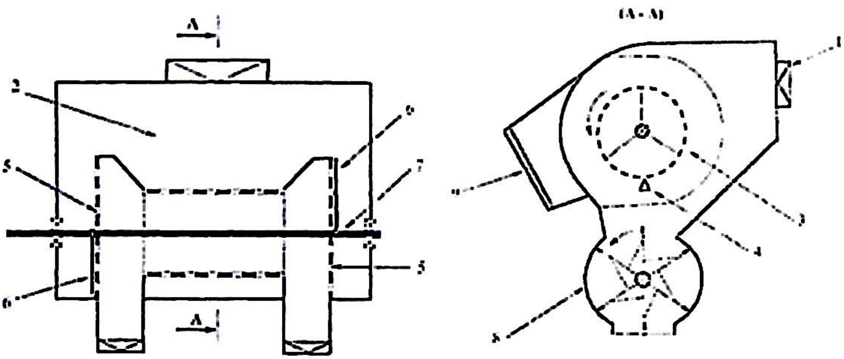


Figure 1.4. Mesh drum cotton separator .

1-inlet pipe, 2-separation chamber, 3-net drum, 4-net drum screener, 5-screen disc, 6-screener, 7-screener shaft, 8-vacuum-valve, 9-air outlet pipe

In this separator, the impurities in the cotton are effectively separated and the fiber is eliminated by the dusty air. However, the condition of replacement and operation was not taken into account when the device's bearings were repaired.

It is a separator with a spiral structure with additional air channels improved by R. Murodov, which is connected with the outlet pipe and the inlet pipe at an angle of 20-25° relative to the horizontal plane in the form of holes [18; pp. 79-81]. It works as follows: the cotton comes to the separation chamber through the nozzle through the air flow and is pressed against the wall of the nozzle by the force of inertia, after which it is transferred to the desired place through the wall 1 and the vacuum valve under the influence of its own weight and centrifugal force. Air spiral plate 5 is transferred to the suction nozzle, from which it is directed to the flow. Some pieces of cotton hit the glass wall 6 and go to the vacuum valve .

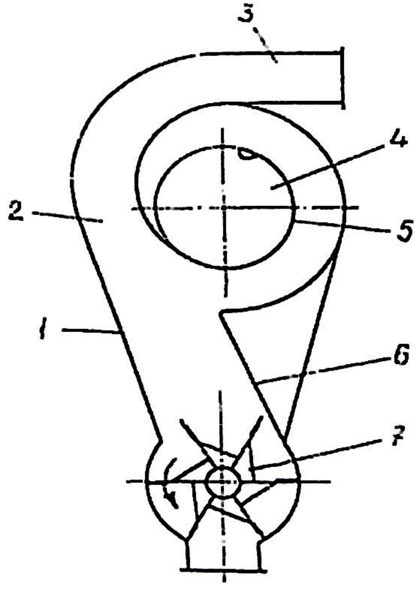


Figure 1.5. General view of the spiral separator.

1st wall; 2nd camera; 3 - air inlet pipe with cotton; 4-air outlet pipe; 5-spiral plate; 6- fixed wall ; 7-vacuum - valve.

In the air separator, the cotton is effectively separated from the air flow. However, it is also observed that cotton pieces are thrown into the waste without achieving full separation [33; pp. 35-36].

1. Figure 6 shows the separator proposed by TTESI scientists . When the separator is working, the cotton working chamber 2 is supplied with air flow through the inlet pipe 3 , and it is released through the outlet pipe 8 attached to the vacuum valve 1. A part of the wax remains on the side-shaped surface 4, it is lowered into the vacuum valve with the help of the flapper 5 installed on the sides of the longitudinal plates .

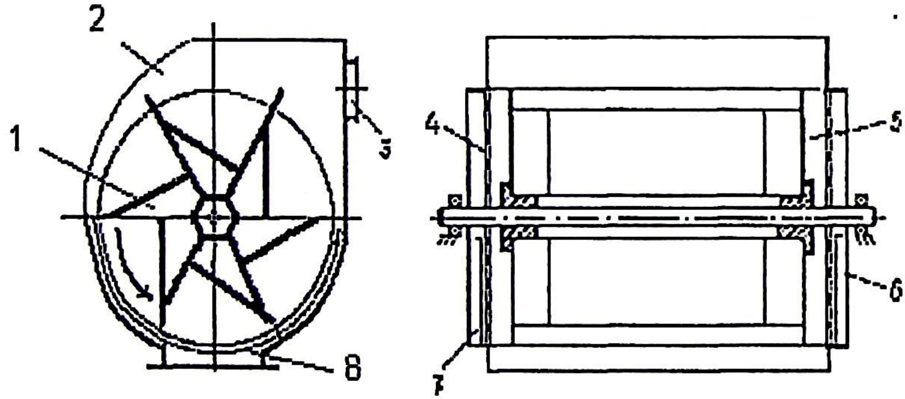


Figure 1.6. Schematic overview of the separator proposed by TTESI.

1 - vacuum valve; 5- feathers; 2 - working chamber; 6 - fixed coupling;

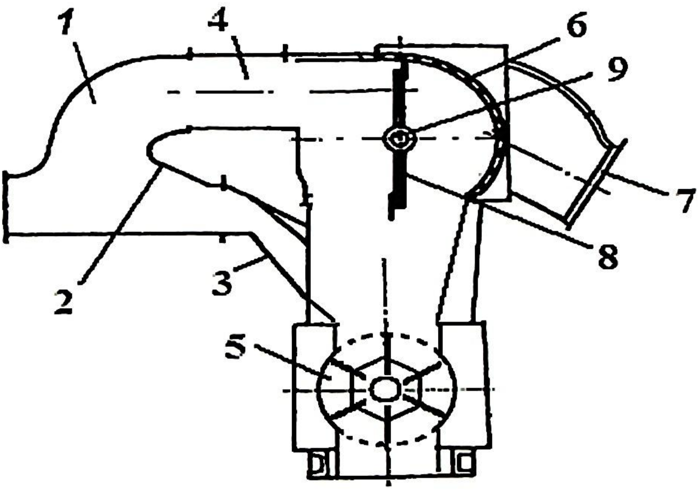
3 - inlet pipe; 7-air outlet nozzle; 4 - side mesh surface; 8 - outlet pipe.

The fixed cover 6 is installed in such a way that the air pressure is zero during the discharge of the cotton adjacent to the mesh surface. This allows you to easily clean the mesh surface with cotton. Air containing fine impurities is sucked in through the mesh surface and the outlet nozzle and sent to the stream. However, these innovations of separators are not used in the cotton ginning industry.

An analysis of the SX separator shows that fiber is lost in the process of air separation of cotton, that is, it decreases by 0.23 kg/h for high grades and 0.83 kg/h for low grades [34; pp. 30-32, 35; 40-41 p.].

The cylindrical mesh surface and the separation drum are installed at a fixed distance (70-100 mm) from the separation chamber.

The good contact of the scrapers of the separation drum with the cotton to be separated from the air prevents the cotton from accumulating in the separation chamber. The principle of operation of the SX type separator is based on the principle of operation of the pneumatic separator.



1. 7 . Schematic overview of the SX separator .

1st separation chamber; 2nd return wall; 3-inertial separation section; 4. Breathable environment with cotton; 5-vacuum - valve; 6-mesh surface; 7-fighter and outgoing pipes; 8th blade; 9- separation shaft.

The main part of the cotton that entered the air flow separating chamber 1 is separated from the air flow as a result of hitting the return wall 2 and falls directly into the vacuum valve with its own inertia. A part of the cotton moves along with the air stream sucked through the mesh surface by the fan and stays on the cylindrical mesh surface and is cleaned by the scrapers of the separator drum and thrown into the vacuum valve.

Due to the use of the SX type separator, cotton is not allowed to fall directly onto the cylindrical mesh surface.

In this case, entanglement of cotton and reduction of seed damage is achieved. The plane of the mesh surface is always clean and thus the aerodynamic resistance of the separator is constantly ensured.

Another advantage of the separator is that it consumes less energy.

Thus, a thorough analysis of the modern state of the technique and technology of pneumatic cotton moving and a review of the contents of the literature showed that the issues in this regard have not yet been fully resolved and require improvement.

Similar to the SS-15A separator, the condition of equal distribution of cotton flow along the working length of the vacuum valve was studied in the SX separator.

I, II and III industrial varieties of the Sultan breeding variety were also used in this experiment. The obtained results are presented graphically in Figure 1.8.

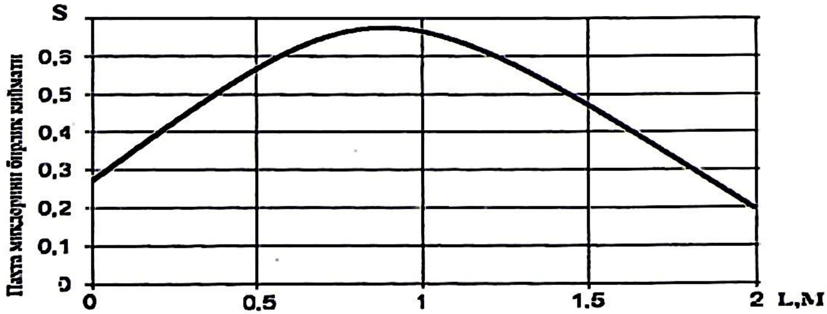


Figure 1.8. Vacuum is the distribution of cotton flow along the working length of the valve.

As can be seen from the resulting graph, in fact, in the SX separator, the distribution of the cotton flow along the working length of the vacuum valve is uneven, and the situation in it is the opposite compared to the SS-15A separator, that is, the amount of cotton decreases on both sides, and it increases in the middle. In both cases, the vacuum-valve is not evenly distributed over the working length. This, of course, causes mechanical damage to the seed, an increase in free fiber [36; 27 pp.].

Currently, SS-15A and SX separators are widely used. During operation, the mixture of cotton and air enters the separation chamber through the inlet pipe. Due to the large size of the chamber, the flow rate in it decreases sharply [37 ; 60-62 p. , 38 ; 67-70 p. , 39 ; 57-67 b.] . The main part of the cotton or fiber continues to move by the force of inertia and moves to the back wall, slides off its surface with the help of the vacuum valve blades, and the remaining part hits the mesh surface. The cotton or fiber is separated from the mesh surface with the help of elastic scrapers, and they are also lowered into the vacuum valve. Research on debris passing through mesh surfaces has not been completed.

An isolation-type scraper construction creates a cavity region before the inlet region. The force of air suction and pressure in the cavity area is equal to 0, and the amount of force pressing the cotton against the mesh surface is equal to 0 [40; pp. 94-96].

Zeroing this force reduces the frictional force F_2 between the fiber and the mesh surface. This in turn leads to a reduction in the force F_1, which is the force to separate the cotton from the mesh surface.

This situation was confirmed by the conducted theoretical research. It can be seen that the implementation of these new devices leads to the preservation of the natural properties of cotton and the increase of fiber output.

Increasing fiber output is at the expense of preventing short fiber formation and loss.

1.9 shows a schematic diagram of the new device installed on the SS-15A separator.

1.10 shows a cross-sectional view of an isolation chamber.

Figure 1.11 shows an axonometric longitudinal section of the isolation chamber.

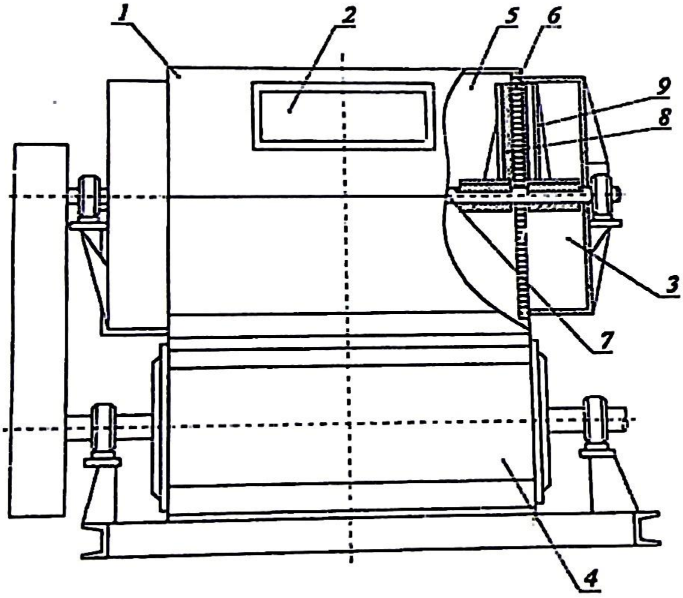


Figure 1.9 . Overview of the new device installed on the improved SS-15A separator.

As can be seen from Figure 1.9, the main new device consists of a separation chamber 1, an inlet 2 and an outlet 3 pipe, an isolation type scraper 8 and a mesh surface 6, an isolation chamber 9 and a vacuum valve 4.

The separator works as follows: seeded cotton enters the separation chamber 1 through the inlet manifold 2 along with the air flow. As soon as the main amount of cotton enters the separation chamber, it is directed to the vacuum valve 4 by reducing its speed and is removed from the separator using the vacuum valve .

The remaining amount of cotton moves towards the mesh surface together with the air flow and sticks to it with the help of air force. Adhered cottons are separated from the mesh surface using an insulating scraper and transferred to a vacuum valve. During the separation of the cotton from the mesh surface, the effect of the air force acting on the previously attached cotton disappears [41; pp. 179-182].

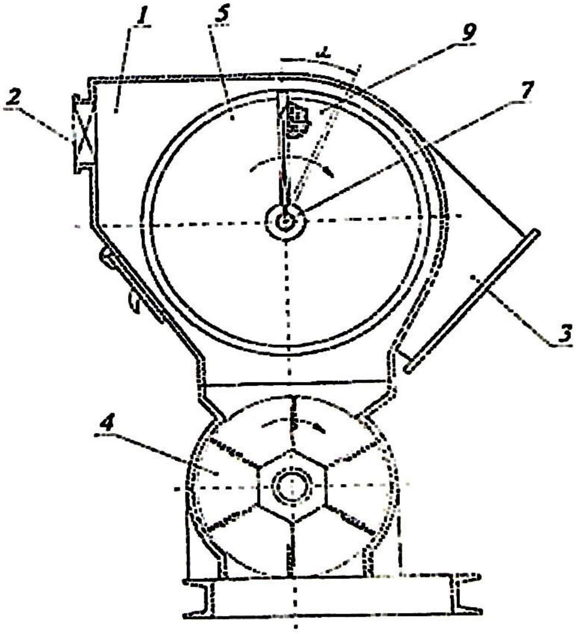


Figure 1.10. A cross-sectional view of an isolation chamber.

This situation is realized by reducing the air pressure at the expense of the insulating chamber 9 installed on the outside of the mesh surface. That is, relative to the main scraper 8 installed by the inner chamber of the separator 5, the insulating chamber 9 is set forward by a certain degree depending on the direction of its movement, that is, in our case, the angle of deviation is 25-30°.

As a result, when the scraper 8 separates the cotton from the mesh surface, the insulating chamber 9 installed on the back side of the mesh surface closes the air pressure and reduces the force of the air pressing the cotton on the mesh surface to 0, that is, it closes the process of air absorption. At the same time, the scraper separates the cotton from the 8-mesh surface without fire [68; pp. 143-146].

Due to this situation, the cotton stuck to the mesh surface is separated only by its own gravity and falls into the vacuum valve. As a result, the force of friction formed between the cotton and mesh surface is sharply reduced, it does not cause an increase in the level of mechanical friction of the seed, and fiber breakage is prevented, and the amount of short fiber is sharply reduced [42; pp. 369-373].

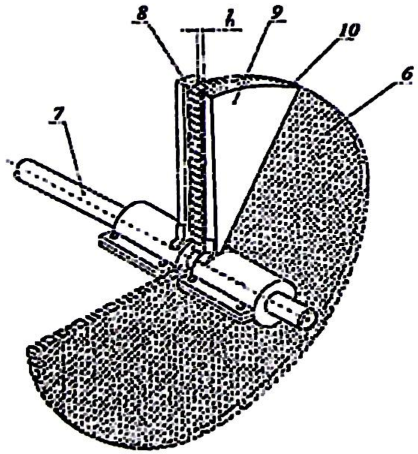


Figure 1.11 . Axonometric view of the isolation chamber.

This situation was established at the Chelak cotton ginning enterprise of Samarkand region, and on this basis, an improved SS-15A separator was created.

But this construction, despite its relative originality, has a number of shortcomings. The main disadvantage is that the cotton bar is designed to meet the mesh surface after entering the separator working chamber. This is due to the fact that in the process of hitting the cotton on the mesh surface, as a result of the impact, the fiber particles will definitely pass through the holes of the mesh surface and be firmly attached to it.

Of course, the isolation chamber installed on the back of the mesh surface does not allow the settled fiber particles to completely separate.

§ 1.3. There are foreign separators and their types in the process of separating cotton from air.

When analyzing foreign technology, the most common method in this regard is the US module system, the module is brought directly to the cotton processing plant and transferred to organic technology [43; 53-56]. The transmission of this module is carried out based on the technological process presented in Figure 1.12.

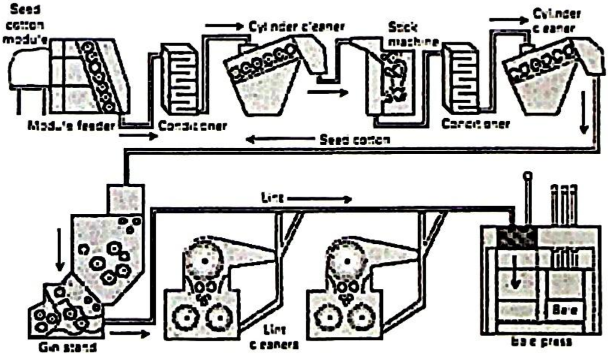


Figure 1.12. Modern foreign technological process in cotton processing.

Figure 1.12 shows the system (diagram) of the technological process of drying and cleaning seeded cotton at the cotton ginning plant.

Technological process supply starts from module (1) (Fig. 1.13). The main working bodies of this supply module consist of a breaker section and a roller platform made up of seven pile drums.

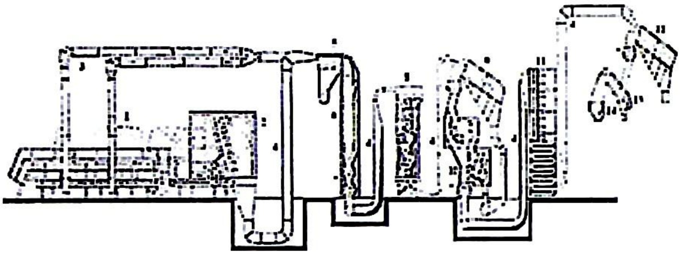


Figure 1.13. Technological process system of drying and cleaning seed cotton

1. Cotton module; 2. Modular breaker section made of piled drums; 3. Kusak connector; 4. Pneumatic pipes; 5. Separator; 6. Auto-tuning-provider; 7. Cotton discharge vacuum valve; 8. Vertical flow drying device; 9. Pile drum cleaner; 10. Saw drum cleaner; 11. Tower-type dryer; 12. Slope cleaner with a drum; 13. Cleaner from imaginary small and large impurities; 14. Distribution screw conveyor;

Pile drums pull seeded cotton from one side of the module and feed it to the air pipe in a straight direction. The moving speed of the cotton module is adjusted by the operator from the main control panel. Depending on the amount of cotton, the light flux (light beam) changes, that is, it is transferred to an electrical signal and the speed of the conveyor is changed. Then the seeded cotton supplied to the air pipe is transferred to the auto-adjustment-supplier using the separator (5).

Auto-adjustment-provider (6) is a box (yashchik) made up of vacuum-valves (7) with two seeded cottons on the top of which there is a drum separator with three piles, and it works in automatic mode [44].

The seeded cotton is first dried in a vertical flow dryer (8) and then a pile drum gravity cleaner (9) is used to separate fine impurities from the cotton. Hot air from the cotton dryer is added to the cleaner. These scrubbers act as simple air-powered separators. After the cotton is cleaned of small impurities, it goes to the cleaner of large impurities (10). Two-section cleaners with a sawed drum with colosniks installed at the bottom are used to clean seeded cotton from large impurities. This cleaner is also equipped with a regeneration barb to recover the fiber seed that has passed through with large impurities. After that, seeded cotton is dried in a tower type dryer (11) with 23 or 24 blades.

Big "J" separator (Fig. 1.14). This separator, which has an automatic cotton supply, consists of 3 pile drums (2), which partially cleans the cotton and transfers it to the collecting hopper (6). The cotton falls freely into the hopper.

Trapped air is discharged from the hopper through a vertical discharge pipe (10).

A stream of cotton falls continuously into the hopper. The width of the hopper widens above the toothed rollers, allowing the cotton to pass freely through the toothed spreader rollers. Gear spreading rollers (7) move at variable speed and have a remote control system. Seeded cotton inside the hopper is removed from the supply hopper with the help of vacuum valves (8) and transferred to the drying system with the help of hot air. A controlled and controlled flow of cotton ensures efficient operation of drying and cleaning equipment and reduces cotton jamming in the system [45].

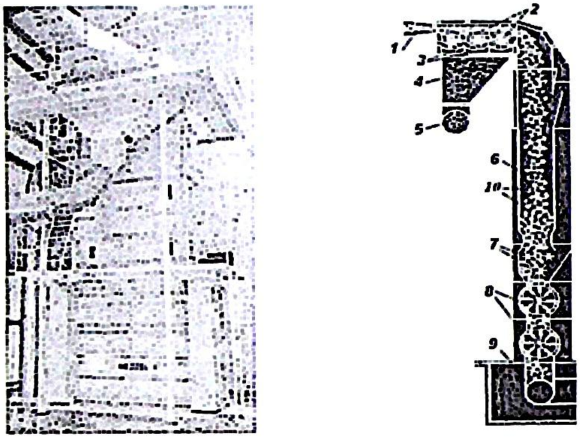


Figure 1.14. Technological scheme and appearance of Separator Big "J".

1. Access hole; 2. Pile drums; 3. Mesh surface; 4. Filth bunker; 5. Dirt removal pipe; 6. Collector-bunker; 7. Toothed spreading rollers; 8. Vacuum valve; 9. Pneumopipe carrying cotton; 10. Air intake pipe;.

Technical parameters of Big "J" separator

1. Productivity, toy/hour (by fiber).................................... 45

2. Required power, kW...7,4

3. Number of pile drums, pcs. 3

4. Diameter of pile drum, mm.............................. ....393.7

Guide rollers (drums) system:

1. Required power, kW..2,2

2. Diameter of the leading roller (drum) with 6 blades, mm......................260.3

3. Geared drum diameter, mm.................................... ....393.7

Vacuum sealer:

1. Width, mm... 2438

2. Diameter of the rotor with 9 rubber blades, mm....................................609.6

3. Gear drum and vacuum valve transmission requirement

power output, kW....................................... 14,8

4. Vacuum valve diameter, mm................................ ....914.8

5. Air pipe diameter, mm 55.5

6. Overall dimensions: B x E x H, mm............................6996 x 2388 x 3505

MZF-15 cotton separator (Fig. 1.15). The structure of the separator consists of the following parts and details: inlet pipe (1), barrier (2), drum with mesh surface (3), separating brush (4), vacuum valve (5), separation chamber (6) and base (7)..

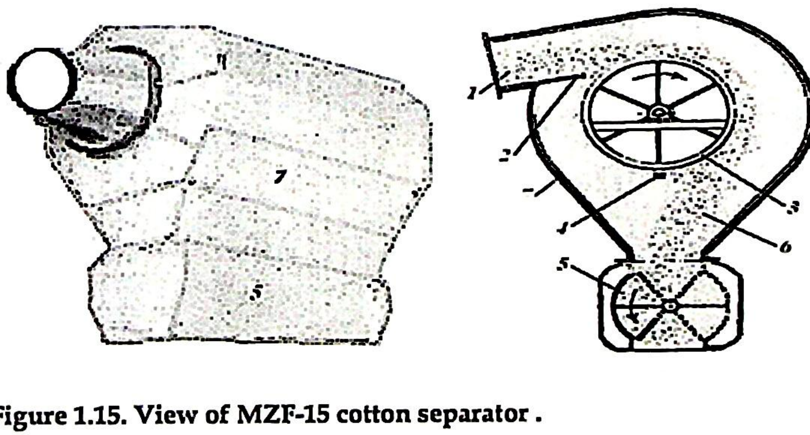


Figure 1.15. View of MZF-15 cotton separator .

1. Incoming pipe; 2. Barrier; 3. Drum with mesh surface; 4. Separating brush; 5. Vacuum valve; 6. Dividing chamber; 7. Basis;

Cotton mixed with air to the machine 20 rev/min. At high speed, the incoming pipe orca (1) falls into the incoming chamber (6). Due to the sudden expansion of its inner surface in the dividing chamber, the cotton loses its initial speed and falls and sticks to the surface of the rotating net drum (3). Then, the cotton rotates together with the drum with a rotating mesh, due to the centrifugal force and weight, it is removed from the surface of the drum and falls into the vacuum valve (5) installed on the inner walls (7) of the equipment. The vacuum valve rotates at 40 revolutions per minute and delivers the loaded cotton to the next process. Small impurities pass through various surfaces and are sucked together with air from the edge of the separator with the help of a fan and transferred to the dust collector device.

The separating brush (4) catches the cotton particles on the various drum surfaces and cleans the mesh surface, as it must ensure that air enters the mesh drum surface.

Technical parameters of MZF-15 cotton separator

1. Productivity, kg/hour 15000
2. Number of revolutions , rpm : a) mesh drum.............................. .20
   b) vacuum valve..... 40
3. Circumference (diameter), mm: a) mesh drum..........................770
   b) vacuum - valve.......................680
   c) net holes......... ....4 , 2
4. External dimensions , mm: Length.......................... 2825
   Width 1680
   Height.. 2500

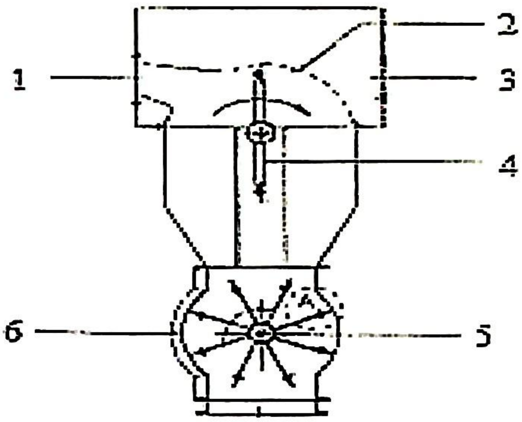


Figure 1.16. The cross-cutting scheme of the "Bajaj" separator used in the cotton ginning enterprise of the Indian state.

1st cotton inlet; 2-mesh surface; 3-separated air outlet;

4th blade; 5th shaft; 6-vacuum-valve.

Figure 1.17 shows a general view of the BAJAJ type separator [46; 42-45 p.] .

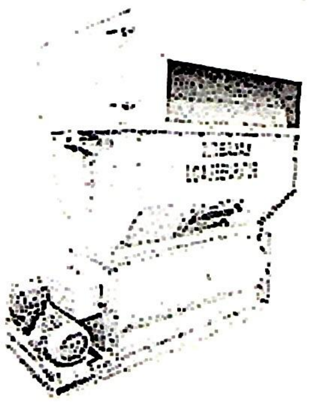


Figure 1.17. "Bajaj" in the cotton ginning enterprise of the state of India

an overview of the separator.

The separator of the Hardwick-Etter company is used in the pneumatic transport equipment of the US cotton factories (Fig. 1.18).

The separator consists of a hermetically sealed housing and a diverter connected to the inlet pipe. In the central part of the body, there is a drum with a mesh surface, and under it is a brush whose bristles touch the mesh surface, and a vacuum valve is fixed in the lower part of the body.

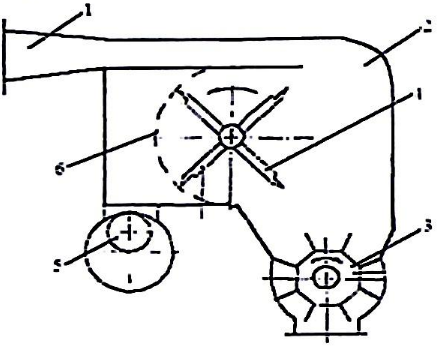


Figure 1.18. General of the Hardwick-Etter company separator view scheme.

1- channel; 2- wall; 3 - vacuum valve; 4-rotating separator;

5 - pipe; 6th surface.

The cotton stream moving in the pipe 1 falls on the wall 2, hits it, goes to the vacuum valve 3 and is taken out, the air sucked by the fan in the pipe 5 passes through the surface 6, which is constantly cleaned by the rotary separator 4.

The separator works as follows: air is drawn from a mesh drum with a fan connected to a 75 kW motor, which dilutes the air in the hermetically sealed casing pipe to which the inlet pipe is connected, and as a result, the cotton raw material is conveyed to the inlet slit at a speed of 20 m/sec.

The company points out the following advantages of the new separator: the cotton does not fall directly on the mesh surface, which prevents it from drying out, the mesh surface is always clean, as a result, the air flow is maintained. But in the separator, there is a sudden change in the direction of movement, which leads to an increase in air pressure loss [47; 231-236 p.].

Conclusions and recommendations.

The analysis of scientific research conducted in order to improve the technological process of separators used in the process of separating cotton from air showed that it is necessary to carry out a number of scientific and practical works in this regard:

1. He showed that it is necessary to study the dynamics of wool movement in each section of the cotton air pipeline and to determine the process of influencing the natural properties of cotton by the number of twists in the main sections of the main network, and on this basis to determine the rational values of the number of turns.

2. The conducted analyzes show that one of the main factors that negatively affect the natural properties of cotton is the separators installed in the network.

In this case, the movement of cotton in all joints of the separator should be studied separately.

3. At the stage of improvement of separators, the connection between the mesh surface and the cotton is maximally maintained, which leads to a negative increase in its natural properties.

4. In the process of removing cotton from the air stream, fiber breaks and mechanical damage to the seed occurs based on the tearing of its layers. There is a need to study this process from a theoretical point of view.

II - CHAPTER. THEORETICAL RESEARCH CONDUCTED ON THE IMPROVEMENT OF THE PROCESS OF COTTON SEPARATION FROM AIR

§2.1. The influence of the shape of the separator guide on the air flow parameters

To study the movement of the air flow in the separator and determine its aerodynamic parameters, we consider the horizontal movement of the cross-sectional area of the flow (shown in Fig. 2.1) in the pipe [48; 399-403 p .].

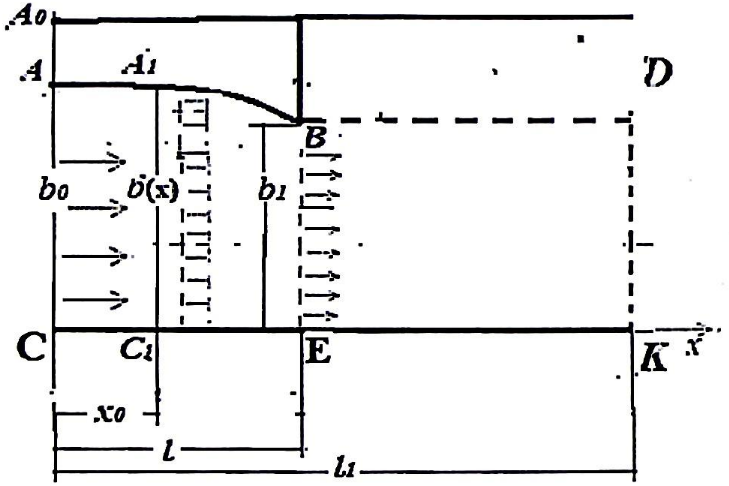


Figure 2.1. Diagram of the movement of the pipe Q of variable cross-section of the air flow

We assume that the density of the air flow is constant. In addition, we assume that the air flow movement in each ASA $_1$S $_1$, A $_1$S $_1$VE and BDEK zones is one-dimensional. For accuracy, we determine the change of the cross-sectional area along the coordinate x-axis with the following two laws: $0 < x < x_0$ in the interval, the cross-sectional area decreases according to the law of a straight line.

$$S_1 = (b_0 - kx)L \qquad 0 < x < x_0 \quad (2.1)$$

Here b_0 is the height of the surface at the section x=0, k the straight line is the angle

coefficient, k >0, L – the length of the separator shaft.

$x_0 < x < l$ we determine the change of the surface of this section in the interval with this function.

$$S_2 = (b + a\sqrt{l^2 - x^2})L \qquad x_0 < x < l \quad (2.2)$$

Here a and b are constant coefficients and are determined from these terms $S_1(x_0) = S_2(x_0)$, $S_1'(x_0) = S_2'(x_0)$. According to (2.1) and (2.2),

$$b = b_0 - kx_0 - a\sqrt{l^2 - x_0^2}, \quad a = k \cdot \sqrt{l^2 - x_0^2}/x_0 \quad (2.3)$$

In the BDEK region, the cross-sectional area is unchanged $S_3 = const = S_0 = S_2(l)$.

Figure 2.2 $S(x)/L$ shows the distribution graphs of the separator length at different values of x(м) the span length when the cross-sectional area is x_0(м)(m). $k = 0.1$

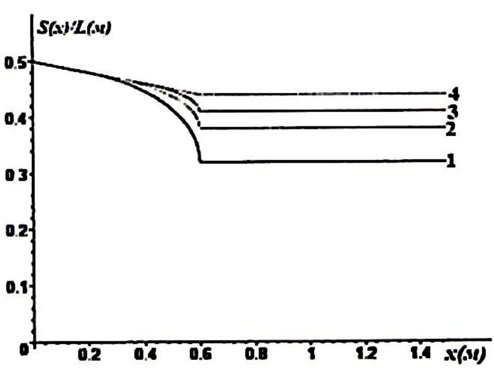


Figure 2.2. Graphs of the change of the separator cross-sectional surface $S(x)/L$ (m) along the axis x_0 at different (m): $1 - x_0 = 0.2$м, $2 - x_0 = 0.3$м, $3 - x_0 = 0.4$м, $4 - x_0 = 0.6$м

From the analysis of the graphs, it was observed that the values of the intermediate length x_0 can have a sufficient influence on the change of the cross-sectional surface along the axis of the separator. At its small values, it was observed that the surface of the cross-section changes sharply and x_0 becomes relatively constant as the length approaches. l

We write the air flow movement in each area using Euler's equation: ACA $_1$C in $_1$ area: (area 1).

$$\rho_1 v_1 S_1 \frac{dv_1}{dx} = -\frac{d(S_1 p_1)}{dx} \qquad 0 < x < x_0 \quad (2.4)$$

A_1C_1BE in the area (2 - area)

$$\rho_2 v_2 S_2 \frac{dv_2}{dx} = -\frac{d(S_2 p_2)}{dx} \qquad x_0 < x < l \qquad (2.5)$$

VDEK in the region: (region 3)

$$\rho_3 v_3 \frac{dv_3}{dx} = -\frac{dp_3}{dx} \qquad l < x < l_1 \qquad (2.6)$$

Here ρ_1, ρ_2, ρ_3-air density in the first, second and third regions; v_1, v_2, v_3- speed of air flow in areas; p_1, p_2, p_3– their pressure; l_1- separator length, L- separator axis length

The following conditions are assumed when integrating equations (2.4) and (2.5).

1. The density of the atmosphere does not change in regions

$$\rho_1 = \rho_2 = \rho_3 = \rho_0$$

2. The movement of air flow is stationary. In this case, the amount of mass per unit of time does not change, i.e

$$\rho_1 v_1 S_1 = \rho_2 v_2 S_2 = \rho_3 v_3 S_3 = \rho_0 v_0 S_0 = Q \quad (2.7)$$

Here $Q = Q_0 \rho_0$; Q_0- air consumption, $м^3/сек$, ρ_0, v_0- air flow density and velocity in the initial section of the separator, $S_0 = S_1(0)L$

According to these assumptions, we determine the air flow speed and pressure in each area.

(2.7) is equal $\rho_1 = \rho_2 = \rho_3 = \rho_0$.

$$v = v_1 = \frac{Q_0}{\rho_0 S_1} = \frac{Q_0}{\rho_0 L(b_0 - kx)} \qquad 0 < x < x_0 \ (2.8)$$

$$v = v_2 = \frac{Q_0}{\rho_0 S_2} = \frac{Q_0}{\rho_0 L(a + b\sqrt{l^2 - x^2})} \qquad x_0 < x < l \ (2.9)$$

$$v = v_3 = v_2(l) = \frac{Q_0}{\rho_0 La} \qquad l < x < l_1 \ (2.10)$$

Integrating equation (2.4)-(2.6) under the conditions, we determine the pressure distribution along the axis: $p_1(0) = p_0, p_2(x_0) = p_1(x_0), p_3(l) = p_2(l)$

$$p_1 = \frac{S_0}{S_1(x)}[p_0 - \rho_0 v_0(v_1 - v_0)] \qquad 0 < x < x_0 \ (2.11)$$

$$p_2 = \frac{S_1(x_0)}{S_2(x)}[p_1(x_0) - \rho_0 v_1(x_0)(v_2 - v_1(x_0))] \qquad x_0 < x < l \ (2.12)$$

$$p_3 = p_2(l) - \rho_0 v_2(l)(v_3 - v_2(l))] \qquad l < x < l_1 \ (2.13)$$

Formulas (2.8)- (2.13) represent the distribution laws of velocity and pressure in a pipe with a variable cross-sectional area. In particular, if the cross-sectional surface is invariant (k =0), $p = p_0$ $v = v_0 = \frac{Q_0}{\rho_0 L b_0}$ we get the values.

of the cross-section surface in a constant $l < x < l_1$ range is expressed by this formula [49; 26-30 p .] .

$$v_3 = v_2(l) = \frac{Q_0}{\rho_0 La} \qquad (2.14)$$

This speed $l < x < l_1$ is maintained at intervals. The formula (2.14) indicates that the speed of the air flow is in zone 3 $v_3 = v_2$, and its value

$n=\frac{v_3}{v_0}=\frac{b_0}{a}$ changes in proportion to the speed of the flow in the separator zone. In particular $b_0=0.5м$, $l=0.6м$ if , $x_0=0.2м$ then $n=1.56$, $a=0.32$ if $x_0=0.4м$, $a=$ 0.41м then $n=1.22$and $x_0=0.6м$ if a=0.43, $n=1.13$equal to .

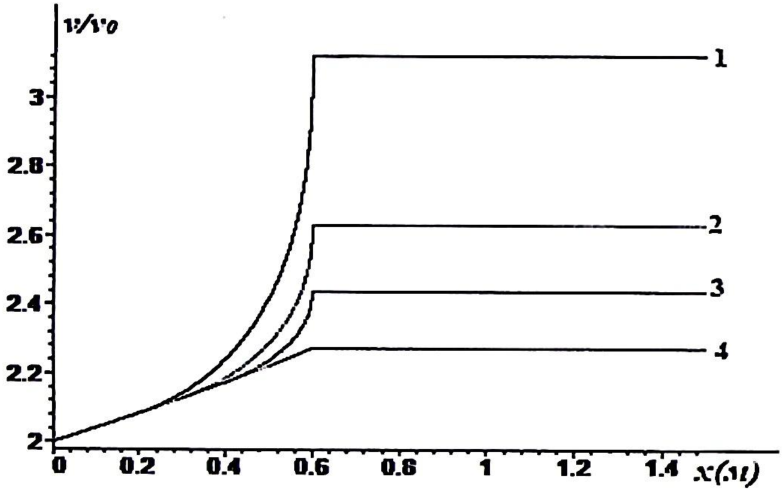


Figure 2.3. Graphs of change in different values of (m) $1-x_0=0.2м$ when the speed $x_0$ratio $k=0.1$along the axis of the separator is: v/v_0, $2-x_0=0.3м$, $3-x_0=0.4м$, $1-x_0=0.6м$

Figure 2.3 shows the graphs of the change in the length of the separator at different values of $x(м)$ the interval length when $x_0(м)$ the speed ratio $v/v_0$is $k=0.1$ [50; 46-49 p .] .

From the graphs, $x_0(м)$ it was observed that the speed of the air flow (line 1) increases sharply with the decrease in the percentage of the straight line area on the cross-sectional surface determined by the intermediate length.

·· The law of variation of air speed on the surface of the separator axis cross-section is straight and non-linear variable. A sharp increase in air flow speed was observed with a decrease in the percentage of the straight line area on the cross-sectional surface.

§2.2. Theoretical determination of the tension of a fiber moving at a constant speed along the arc of a curve

A fiber AB moves with constant velocity v_0 from point to point B covering the arc of a A curve whose equation is $y = y(x)$ The region of movement of the fiber is an arc of three sections 1-AB , the straight line shape of the 2-VD fiber, the point connection of the 3-D fiber (Fig. 2.4). The directions of the steady-state stresses during the movement of the fiber at a constant speed are shown in Figure 2.4.

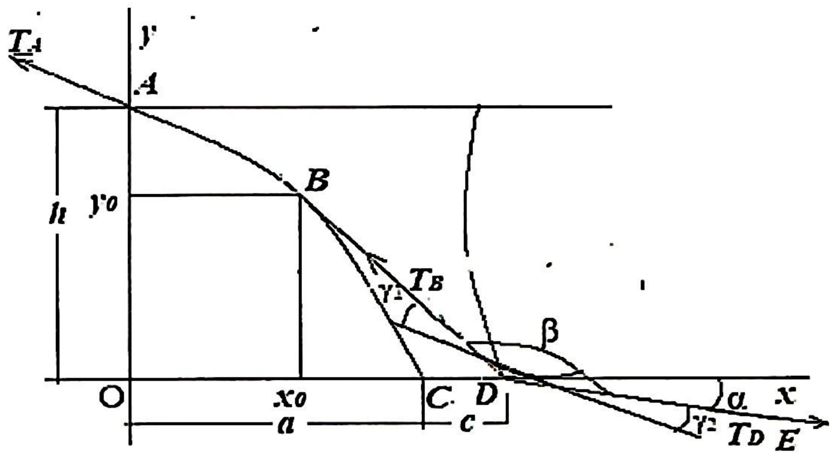


Figure 2.4. A steady-state diagram of the fiber in each region during constant velocity motion.

To determine the tension in each region, we use the equations presented in works [1,2] in the case of its movement in regions at a constant speed.

In arc AV

$$\frac{dT_1}{ds} - \tau = 0 \quad (2.15)$$

$$\frac{T_1}{\rho(s)} - q = m\frac{v_0^2}{\rho(s)} \quad (2.16)$$

s - arc length calculated from point A of the curve, , м fiber T_1 - tension at an arbitrary point of the arc, Н, $\rho = \rho(s)$ radius of curvature of the curve, .м, τ and q intensity of effort and normal forces, $H/м$, m - mass of linear density of fiber (tex), кг/м.

The tension on the straight line VD is constant, and from its continuity condition, this equality is valid.

$T_2 = T_B$, (2. 17)

the tension in the region DE D is in contact at the point, Euler's formula cannot be used to determine the tension at this point, and the formula given in [1] is used to determine it.

$$T_3 = T_D = T_2 \frac{\cos\gamma_1 + \mu \sin\gamma_1}{\cos\gamma_2 - \mu \sin\gamma_2} = T_B \frac{\cos\gamma_1 + \mu \sin\gamma_1}{\cos\gamma_2 - \mu \sin\gamma_2} \quad (2.18)$$

D the angle β and the connection between the angles γ_1 from Figure 2.4 γ_2.

$$\gamma_2 = \pi - \beta - \gamma_1$$

The angle γ_1 [1] is calculated by this formula according to the work.

$$\gamma_1 = \arccos\{\{s + \sqrt{s^2 - 4(1+b)(1+\mu^2)[\mu(1+b)(a-\mu b) - a^2/2]}\}/2(1+b)(1+\mu^2)\} \quad (2.19)$$

where $s = \mu a(1+b+\mu a)$, $a = \cos\beta$, $b = \sin\beta$, μ is C the coefficient of friction in the point contact of the fiber.

Since there is a Coulomb friction force between the fiber and the surface in the AV region, this equation is valid $\tau = fq$ (f-coefficient of friction). Using this equality, we make the equation (2.15) and (2.16) look like this.

$$\rho(s)\frac{dT_1}{ds} - fT_1 = -fmv_0^2 \quad (2.20)$$

The equation of the curve $y = y(x)$ then the following formulas are appropriate.

$$\rho = \frac{(1+y'^2)^{3/2}}{y''}, ds = \sqrt{1+y'^2}dx$$

Taking into account the last equalities, $\bar{T}_1 = T_1 - mv_0^2$ we reduce equation (2.20) to the following form with respect to this function.

$$\frac{d\bar{T}_1}{\bar{T}_1} - f \cdot \frac{y''}{1+y'^2}dx = 0$$

of this equation $\bar{T}_1 = \bar{T}_A = T_A - mv_0^2;\ x = 0$ we will find the solution by integrating under the condition that

$$\bar{T}_1 = \bar{T}_A \cdot exp[f \int_0^x \frac{y''}{1+y'^2}dx] \quad 0 < x < x_0 \, (2.21)$$

was used to calculate the voltage at an arbitrary point given the equation of the curve AV and the voltage at point A. T_1 In particular, the tension at point V is calculated using the following formula.

$$\bar{T}_B = mv_0^2 + (T_A - mv_0^2) \cdot exp[f \int_0^{x_0} \frac{y''}{1+y'^2}dx] (2.2\,2)$$

(2.18) CDcan be calculated using the formula. we get $y = y(x)$the function as a parabola passing through the abscissa and ordinate axes $x = a$and $y = 0$point (Fig. 2.8).

$$y = C_1(x-a) + C_2(x-a)^2 \, (2.2\,3)$$

We determine the constant coefficients $C_1$and from the conditions of equality C_2 of the parabola $A(0,h)$ passing through the point and A the angle of the test at the point with the Ox axis [52; β46-53 p .].

Using these conditions, we get the following equations:

$$-C_1 a + C_2 a^2 = h$$

$$C_1 - 2C_2 a = k = tg\beta$$

From these equations C_1we determine and C_2

$$C_1 = 2C_2 a + k \qquad C_2 = -(h/a + k)/a \, (2.2\,4)$$

B as the coordinates of a point , we write the equation of a straight line passing through this point. $y = y_0$, $x = x_0$

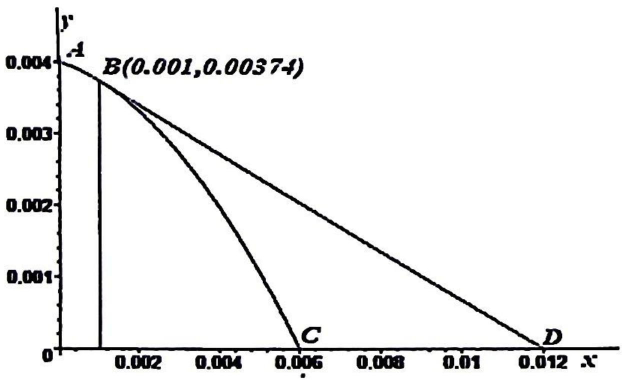
$$y = k_0(x - x_0) + y_0 \quad (2.25)$$

· Here, $k_0 = tg\alpha = y'(x_0) = C_1 + 2C_2(x_0 - a)$ the straight line is the slope coefficient.

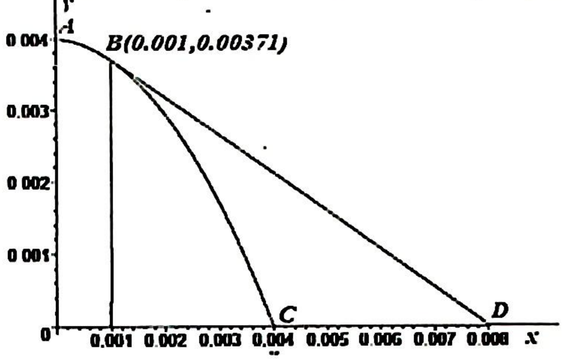
Calculations were performed on the following values of the constants:

$a = 0.006м$, $h = 0.004м$, $c = 0.006м$,

Figure 2.5 $y = C_1(x-a) + C_2(x-a)^2$ shows the graph of the curve $\beta = 170^0$, $OC = a$ and given the distances SD=c B, $y_0 = 0.00374м$ the coordinates of the point are determined $x_0 = 0.001м$ (Figure 2.5).



2. Figure 5 . $y = y(x)$ the graph of $a = 0.006м$.



2. Figure 6 . $y = y(x)$ the graph of $a = 0.004м$

Curved $y = y(x)$ using the formula of the line (2.2 5), we determine the expression of the function under the integral (2.2 1).

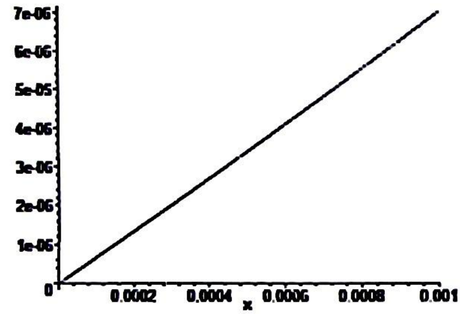
$$F_0 = F_0(x) = \frac{y''}{1 + y'^2} = \frac{2C_2}{1 + [C_1 + 2C_2(x - a)]^2}$$

this expression $F(x)$ as an integral.

$$F = \int_0^x F_0(x)dx$$

of this function a at two values of the parameter 2. It is presented in Fig . 7

$a = 0.006м$ $a = 0.004м$



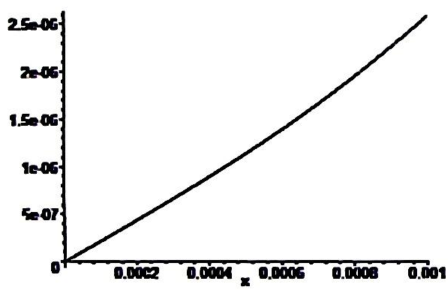


Figure 2.7. $-F(x)$ graphs of the function at two values of the parameter a

$F(x)$ we calculate the fiber tension along the arc $\bar{T}_1 = \bar{T}_A \exp[fF(x)]$ by putting the expression of the function in the formula (2.22) , AB $0 < x < x_0$

in the above graphs $F(x)$ is close to zero, $\exp[fF(x)] \approx 1$ it can be assumed that the equality is appropriate. Then $T_1 = T_A = T_B$ the equality holds, that is, AB the tension of the fiber along the arc is the same and its value T_A is equal, including $T_2 = T_A$ the equality is fulfilled. (2. 18) DE we determine the tension in the direction from the formula.

$$T_D = T_A \frac{\cos\gamma_1 + f\sin\gamma_1}{\cos\gamma_2 - f\sin\gamma_2} \quad (2.26)$$

$\gamma_2 = \pi - \beta - \gamma_1$ in the formula, the value of the angle β is determined as follows:

$$\beta = \pi + artg[y'(x_0)] + \alpha$$

where α the angle is given. γ_1 angle (2.19) is determined with the help of the formula . Accepted in accounts . $a = c = 0.004м$

forms an angle with the speed of the scraper . α This angle is usually close to zero on the surface of the mesh surface, as a result of which the array of fibers is in point contact with the holes in the mesh surface. In this case, the tension in the fibers moving on the mesh surface T_D can take high values. Graphs of the angular dependence of the ratio of such tension $T_Д$ to the friction coefficient at different values α are presented in Fig. 2.8.

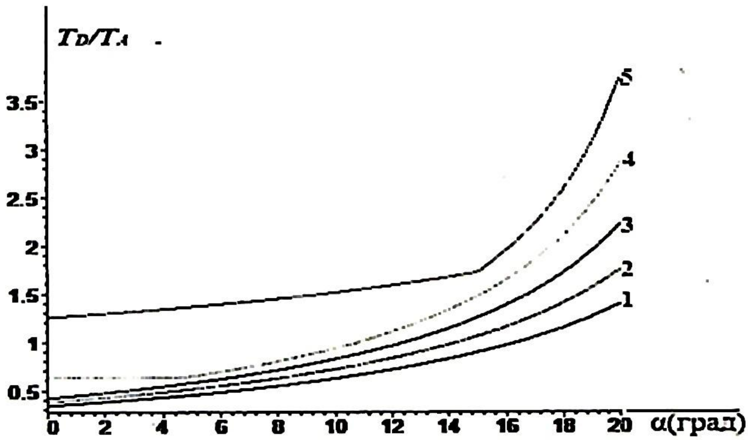


Figure 2.8. Graphs of dependence of the tension ratio on the angle $T_D / T_Д$ formed by the mesh surface hole of the fiber assembly at different values of the friction coefficient $\alpha(град)$.

$1 - f = 0,\ 2 - f = 0.1,\ 3 - f = 0.2,\ 4 - f = 0.3, 5 - f = 0.4$

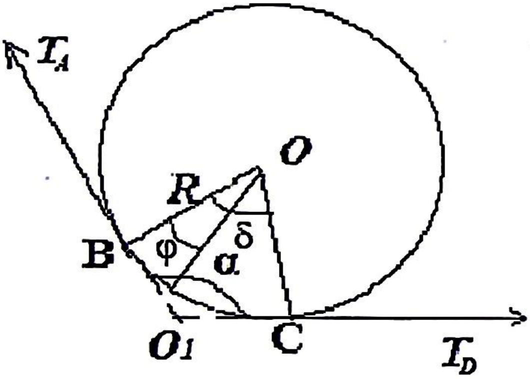


Figure 2.9. The scheme of replacing the point connection O_1 with the VS arc with the coverage angle δ

In order to reduce the tension in the point connection, we replace the arc α between two cross-sections forming a mutual angle δ with an arc VS, which is an angle of coverage, then the tension can be determined by Euler's formula (Fig. 2.9).

Table 2.1 shows the tension at the exit of the point-connected fiber T_D and δ the ratio of T_D / T_A the tension determined by Euler's formula to the tension at $T_Э = T_A \exp(f\delta)$ the entrance to the scraper region of the fiber at different coverage angles on the rounded surface arc T_A and $T_Э / T_A$ values of different friction coefficient dependences of are presented.

, it is observed that the friction coefficient can be sufficiently affected by tension . T_D In this case, the effect is explained by the relatively high values of the friction coefficient $f > 0.4$.

Therefore, the main reason for the breakage of fibers on the surface of the mesh surface is that the friction coefficient of the fibers in the holes of the mesh surface is large.

Table 2.1. The dependence of the ratio of the T_D / T_A tension $T_Э / T_A$ on the entrance to the scraping region of the fiber T_A on different values of the friction coefficient is presented [53; 1-8 pp.].

Table 2.1

Account results

f	0.38	0.4	0.42	0.44	0.46	0.48	0.5
T_D/T_1	1.206	1.355	1.517	1.694	1.887	2.098	2.333
T_D/T_1 ($\delta = 10^0$)	1.068	1.072	1.076	1.079	1.083	1.087	1.091
T_D/T_1 ($\delta = 20^0$)	1.141	1.149	1.157	1.169	1.174	1.182	1.190
T_D/T_1 ($\delta = 30^0$)	1.220	1.233	1.245	2.539	1.272	1.285	1.300

From the analysis of the results of the table, it was observed that the values of the tension in the array of fibers in point contact with the holes of the mesh surface can increase significantly when the coefficient of friction increases. To reduce tension, α it is recommended to replace the point connection with an arc with a limited coverage angle.

From the analysis of the calculation results, it was observed that the friction coefficient can sufficiently influence the external tension force. This effect $f > 0.4$ is explained by the relatively high values of the friction coefficient. Thus, it was determined that the main reason for the breakage of fibers on the mesh surface is the friction coefficient of the fibers in the holes of the mesh surface.

§ 2.3. Calculation of the point contact force of a piece of cotton and the tension generated in the fiber bundle under the effect of scraping.

is located on the scraper at a distance $r=r_0$ from the center at the moment t=0 .

Let the blade rotate around the point O with a constant speed ω (Fig. 2.1 0).

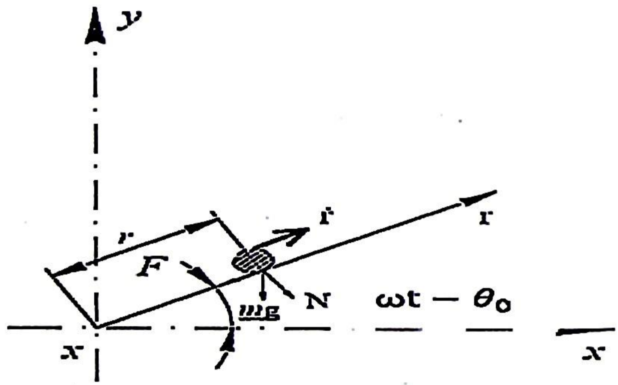


Figure 2.10. Scheme of movement of the particle along the scraping surface.

We formulate the equation of motion of the particle on the surface of the scraper at an arbitrary moment t>0. If the particle is located on the scraper surface at a distance r at an arbitrary moment, we determine the forces acting on the particle, taking into account the friction between the surface and the particle. For the sake of clarity, $O\bar{r}$ we assume that the motion of the particle along the vector axis is positive. We determine the forces acting on the particle in this direction. These forces are as follows [54; 31-34 p .] .

1. Particle gravity. It is a p rojection of force $O\bar{r}$ in a direction .

$$P = mg\ \sin(\omega t - \theta_0)$$

2. $\dot{r}$ If > 0, according to Zhukovsky's method, the force of resistance to it is in the normal direction, and this force is in the opposite direction to the speed of the particle, its value is:

$$P_K = 2\dot{r}\omega m f_0$$

3. The force of the particle's weight on the scraper is its frictional force

$$P_r = -f_0 mg\cos(\omega t - \theta_0)$$

Here: f_0 - the coefficient of friction between the particle scraper

4. On the grid surface, the particle is affected by pressure p 0 from the external environment. If the particle $S = \pi r_0^2$ is considered to be the surface in contact with the surface, then this pressure creates a frictional force.

$$P_0 = -fp_0 S$$

f - the coefficient of friction between the mesh surface and the particle

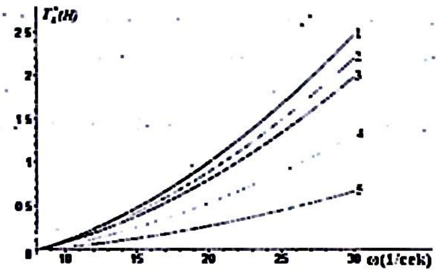
5. In addition to the pressure, the tension force T of the fiber bundle from the open parts of the mesh surface acts on the particle, and we determine it using the formula (2.22) in paragraph 2.3 .

$$T = T_D = T_A \frac{\cos\gamma_1 + f\sin\gamma_1}{\cos\gamma_2 - f\sin\gamma_2} \quad (2.27)$$

The equation of movement of the particle along the surface under the influence of the above-mentioned forces is as follows.

$$m\ddot{r} - m\omega^2 r = -mg[\ \sin n(\omega t - \theta_0) + f_0\cos(\omega t - \theta_0)]$$

$$-2f_0\dot{r}\omega m - f_0 p_0 S + T_D \quad (2.28)$$

(2.28) is the equation of motion of the particle on the surface of the scraped and netted surface. In order for the particle to move in the direction $t = 0$ from time, Or the condition >0 must be fulfilled for the we 

acceleration at the values of r=r 1, (r 1 - the radius of the cutting edge), $\dot{r}$ =0 at a t=0. Using the equation $\ddot{r}$ (2. 28), get the following inequality from this condition:

$$m\omega^2 r_0 - mg(f_0 \cos\theta_0 - Sin\theta_0) - f_0 p_0 S - T_D > 0$$

From this inequality follows the following condition for the tension (ω-lattice surface rotation rate).

$$T_D < T_D^* = m\omega^2 r_0 - f_0 p_0 S - mg(f_0 \cos\theta_0 + \sin\theta_0) \quad (2.29)$$

(2.27) T_D and T_A taking into account the interrelations of stresses, T_1 we get this inequality related to the speed of rotation of the scraper for the stress generated under suction pressure

$$T_A < T_A^* = (\cos\gamma_2 - \mu\sin\gamma_2)(m\omega^2 r_1 - f_1 p_0 S - mg(f_1 \cos\theta_0 + \sin\theta_0)/(\cos\gamma_1 + \mu\sin\gamma_1)$$
(2.3 0)

Figure 2.11 shows the graphs of the change of the tension T_A^* (N) ω versus the scraper rotation angle (1/c) at different values of the two friction coefficients of the particle mass. , $r_1 = 0.1м$, $f_0 = 0.3$, $\theta_0 = 0$, $r_0 = 0.005м$, $p_0 = 1200Па$ accepted in accounts . $\alpha = 0$

$m = 10 * 10^{-3} кг$ $m = 15 * 10^{-3} кг$

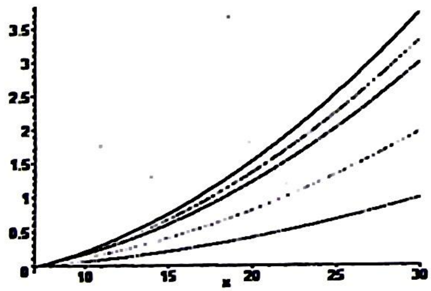


Figure 2.11. Graphs of the relationship between the tension force generated on the outer surface of the mesh surface under the influence of suction T_1^* pressure and p_0 the scraper rotation speed at different values of $\omega(1/cek)$ the particle mass $m(\kappa z)$ and the friction coefficient between the mesh surface holes and the fiber .μ

$1-\mu=0,\ 2-\mu=0.1,\ 3-\mu=0.2,\ 3-\mu=0.3,\ 4-\mu=0.4,\ 5-\mu=0.5.$

From the analysis of the graphs in Figure 2.11, it shows that the tensile strength increases with the increase of the scraper rotation speed and the friction coefficient between the hole surface and the fiber, T_1^* and its values are significantly dependent on the particle mass. It was observed that the increase in tensile strength increases proportionally to the mass of the particle, and in addition, the value of tensile strength $\omega<7(1/cek)$ is equal to zero if the scraper has a rotational angle in the obtained parameters.

Graphs of the connection between the tension force generated by the external suction air flow and the rotational speed of the scraper were obtained for the state of constant speed of the cotton piece along the scraper under the influence of external pressure, point traction force and gravity force.

Conclusions and recommendations

The conducted theoretical research made it possible to obtain the following results:

1. The law of change of air velocity on the cross-sectional surface of the separator axis is straight and on the non-linear variable surface. A sharp increase in air flow speed was observed as the percentage of the straight line region on the surface of the sample decreased.

2. A sharp change in speed at the border of variable and constant cross-section surfaces indicates that an additional aerodynamic force can be generated in the separator, and this can lead to a change in the speed and density of cotton raw material moving along the axis of the separator.

3. It is shown that the movement of a piece of cotton along its axis under the influence of air flow in the area of the guides installed in the separator is close to the parabolic law in terms of time. It has been observed that a reduction in the length of the guide region results in a reduction in the cotton ball speed.

4. From the analysis of the calculation results, it was observed that the friction coefficient can have a sufficient influence on the external tension force. This effect $f > 0.4$ was explained by the relatively high values of the friction coefficient. Thus, it was found that the main reason for fiber breakage on the mesh surface is the friction coefficient of the fibers in the pores of the mesh surface.

5. From the analysis of the obtained results, it was observed that the values of the tension in the array of fibers in point contact with the holes of the mesh surface can increase significantly when the friction coefficient increases. To reduce tension, α it is recommended to replace the point contact with an arc with a limited coverage angle.

6. Graphs of the connection between the tension force generated by the external suction air flow and the rotational speed of the scraper were obtained for the condition of constant speed of the cotton piece along the scraper under the influence of external pressure, point traction force and gravity.

7. From the analysis of the graph, it was found that the tension force increases as the speed of rotation of the scraper and the friction coefficient between the surface of the hole and the fiber increases, and the increase of this force is proportional to the mass of the cotton piece. $\omega < 7(1/cek)$.

CHAPTER III. CREATION AND DEVELOPMENT OF IMPROVED SS-15A SEPARATOR .

§ 3.1. Development of an improved mesh surface separator.

It is known that the SS-15A separator has a mesh surface construction and, in addition, an insulating scraper construction [55; pp. 129-131].

An isolation-type scraper construction creates a cavity region before the inlet region. In the void area, the air suction and compression force is equal to 0, and the amount of force pressing the cotton against the mesh surface is equal to 0.

Zeroing this force reduces the frictional force $F_{2 \text{ between the fiber and the mesh surface}}$. This, in turn, leads to a decrease in the force F_{1}, which is the force to separate the cotton from the mesh surface [56; pp. 131-135].

It can be seen that the implementation of these devices leads to the preservation of the natural properties of cotton and the increase of fiber output.

Increasing fiber output is at the expense of preventing short fiber formation and loss.

Figure 3.1 shows a schematic diagram of the new device installed on the SS-15A separator.

As can be seen from Figure 3.1, the main new device consists of a separation chamber 1, inlet 2 and outlet 3 pipes, an insulating scraper 8 and mesh surface 6, an isolation chamber 9 and a vacuum valve 4.

The separator works as follows: seeded cotton enters the separation chamber 1 through the inlet manifold 2 along with the air flow. As soon as the main amount of cotton enters the separation chamber, it is directed to the vacuum valve 4 by reducing its speed and is removed from the separator using the vacuum valve .

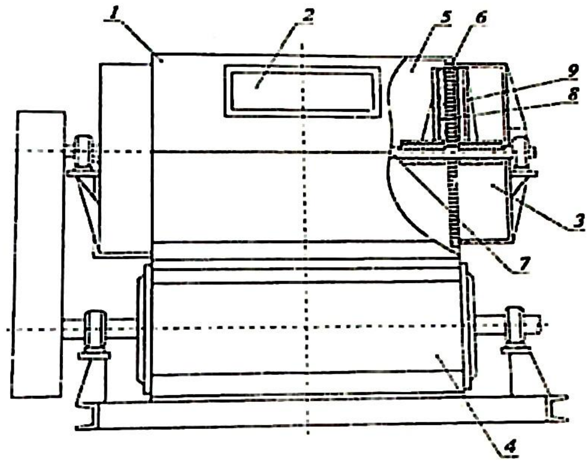
The remaining amount of cotton moves towards the mesh surface together with the air flow and sticks to it with the help of air force. Adhered cottons are separated from the mesh surface using an insulating scraper and transferred to a vacuum valve. During the separation of the cotton from the mesh surface, the effect of the air force acting on the previously attached cotton disappears [57; pp. 51-52].

This situation is realized by reducing the air pressure at the expense of the insulating chamber 9 installed on the outside of the mesh surface. That is, relative to the main scraper 8 installed by the inner chamber of the separator 5, the insulating chamber 9 is set forward by a certain degree depending on the direction of its movement, that is, in our case, the angle of deviation is 25-30°.

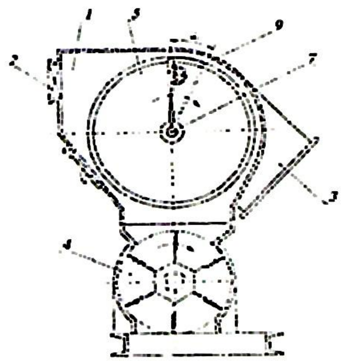
As a result, when the scraper 8 separates the cotton from the mesh surface, the insulating chamber 9 installed on the back side of the mesh surface closes the air pressure and reduces the force of the air pressing the cotton on the mesh surface to 0, that is, it closes the process of air absorption. At the same time, the scraper separates the cotton from the 8-mesh surface without fire.

Due to this situation, the cotton stuck to the mesh surface is separated only by its own gravity and falls into the vacuum valve. As a result, it has been shown that the force of friction formed between the cotton and mesh surface is sharply reduced, it does not cause an increase in the level of mechanical friction of the seed, and fiber breakage is prevented, and the amount of short fibers is sharply reduced [71; pp. 316-319].

This device was installed and tested at Chelak cotton ginning enterprise of Samarkand region.



3.1 . Overview of the new device installed on the improved SS-15A separator.



3.2 . A cross-sectional view of an isolation chamber.

As a result of testing in production conditions, the rapid failure of the rubber sheet in the area of contact with the mesh surface of the isolation chamber device, as well as the installation of an additional device, complicates the construction of the separator. Due to this, by further improving this process, a new improved construction was created by us [70; 71-90 pp.].

This innovation is an improvement in the mesh surface construction of the seed cotton separator, and the newly proposed invention patent IAP 06632-2019 has been obtained. The field of use of this separator : in the textile industry, specifically in devices for separating cotton raw materials from the carrier air flow in pneumatic transport equipment. Its purpose is to improve the design of the separator, to reduce the friction force between the cotton fibers and the surfaces of the holes of the perforated discs. The essence of the invention: a separation chamber with branched inlet and outlet pipes, perforated disks (net) on the side walls of the chamber, in which the holes in the disks are made at an angle of 45-60° relative to the horizontal plane, and include scrapers with belt shovels, mounted on the transmission shaft, falling on the disks cotton raw material separator is proposed. The holes of the perforated disks are made in a conical shape with a curved surface, where the ratio of the diameters of the hole bases is chosen as $d2=(1.15 \div 1.25)d1$, where d1 is the diameter of the small base, d2 is the diameter of the large base [58 ; 1-6 p.] .

The main purpose of this proposed separator is that the cotton fiber passes through the surface holes as a result of the air suction in the mesh surface holes in it. As a result, when separating seeded cotton from the mesh surface using a scraper, the fibers passing through the hole are cut off and come out together with the air. The main reason for this is that the edges of the holes cut the fiber due to the fact that the holes in the mesh surface are orthogonal. In order to prevent the cotton fiber from breaking, holes in the mesh surface are made by the air outlet of the separator in the form of a cone at an angle of 45-60°. That is, if the mesh surface hole diameter is d_1, the outer hole diameter is at least as follows: $d_2 = (1.15 \div 1.25)\ d_1$. A mesh surface construction made in the same approach prevents fiber breakage. Figure 3.3 shows the improved separator longitudinal shear scheme. Figure 3.4 shows the cross-cutting scheme of the improved separator. Figure 3.5 shows the view of the mesh surface opening in the new construction.

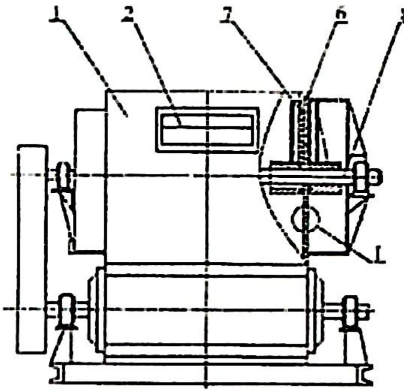


Figure 3.3. Improved separator longitudinal shear scheme.

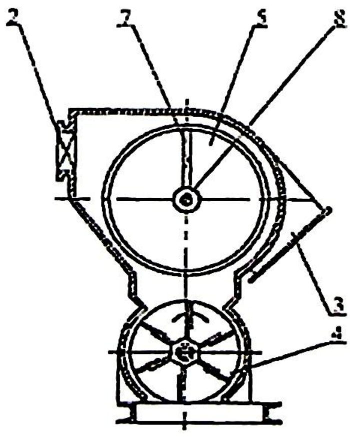


Figure 3.4. Improved separator cross-cutting scheme.

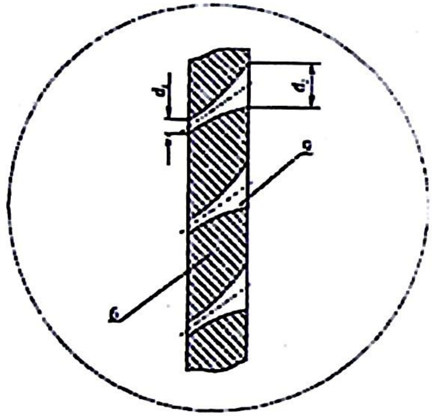


Figure 3.5. Clipping scheme of the mesh surface.

The seed cotton separator consists of body 1, inlet 2 and outlet 3 pipes, vacuum valve 4. The body 1 has a cylindrical chamber 5 and a mesh surface 6 on both sides. There is a scraper 7 for removing seeded cotton from the mesh surface, which is mounted on a shaft 8 [59; pp. 5806-5811].

Making mesh surface holes $d_2=(1.15\div1.25)\ d_1$ and having mesh surface holes at a slope of 45-60° prevents fiber breakage, as a result, allows cotton to preserve its natural properties.

§ 3.2. Conducting preliminary tests on the improved new separator and obtained results.

The improvement of the SS-15A separator was carried out in the following directions:

At the entrance of the separators, the cotton layer does not hit its right back wall at a high speed, and it is equally distributed along the working lengths of the vacuum valve, and the main goal is to preserve the natural properties of the cotton falling into the vacuum valve. In this case, it causes the cotton mass to hit the rear wall of the separator with force, and as a result, mechanical damage to the seed increases. This is one of the shortcomings that causes mechanical damage to the seeds, quick corrosion of the back wall of the separator, and a decrease in the life of the separator.

Long-term operation of the pneumatic transport due to the prevention of premature failure of the surface of the inner wall of the separator and the vacuum valve by eliminating the cotton from the air hitting the wall of the SS-15A separator and directing it to the vacuum valve, reducing its speed to 7-8 m/s The main goal is to create a separator that provides [72; pp. 72-74; 73; pp. 176-178].

The purpose of the proposed improved separator is to use a new guide device in the separator structure to preserve the natural properties of the cotton and significantly extend its life. In the separator, a sheet metal guide is installed to ensure the stability of the equipment by filling with the device installed in the inlet of the air separation chamber.

In order to increase the performance of the equipment along the circuit connecting the air pipe with the separator, the diverter is installed with the help of existing bolt fasteners, in addition, the installation of the diverter, especially the possibility of its easy replacement, allows to increase the service life of the separator. If the diverter fails, it can be easily replaced with a new one, while reducing the impact of the raw cotton on the partition wall.

The cotton separator has a separation chamber, in the working part of which there is a mesh surface with scrapers, in the lower part of the chamber there is a rubber vacuum valve. A diverter is installed at the entrance of the separator chamber. In this case, the guide is made of a metal sheet with a thickness of d = 2 mm and is installed so that it oscillates around its axis. In addition, the angle of rotation of the guide relative to the center of the incoming cotton movement is a = 25° ÷ 35°.

Improvement of separator design, reduction of friction force between cotton fibers and hole surfaces of perforated discs, as well as selection of the necessary ratio of values of the diameters of the bases of conical holes in the net consists of a proposed new hole design [63 ; 1-8 p.] .

In it A cotton raw material separator consisting of a separation chamber with branched pipes for inlet and outlet, perforated disks (net) on the side walls of the chamber, in which the holes in the disks are made at an angle of 45-60° relative to the horizontal, and scrapers with belt shovels, installed on the extension shaft, falling on the disks offered. The holes of the perforated disks are made in a conical shape with a curved surface, in which the ratio of the diameters of the hole bases is chosen as $d2=(1.15\div1.25)d1$, where d1 is the diameter of the small base, d2 is the diameter of the large base.

The main purpose of this proposed separator is that the cotton fiber passes through the surface holes as a result of the air suction in the mesh surface holes in it. As a result, when separating seeded cotton from the mesh surface using a scraper, the fibers passing through the hole are cut off and come out together with the air. The main reason for this is that the edges of the holes cut the fiber due to the fact that the holes in the mesh surface are orthogonal. In order to prevent the cotton fiber from breaking, holes in the mesh surface are made by the air outlet of the separator in the form of a cone at an angle of 45-60°. That is, if the mesh surface hole diameter is d1=6mm, the outer hole diameter is at least as follows: d2=10mm.

mesh surface holes $d_1 = 6$ mm, $d_2 = 10$ mm, and the mesh surface hole at a slope of 45-60° prevents fiber breakage, as a result, it allows cotton to preserve its natural properties.

In order to test this, an improved separator with a new construction of a guide and a mesh surface was prepared, and initial test works were carried out at the "Kumkurgan cotton ginning" enterprise of the Surkhondarya region, which belongs to the "Dream cotton textil" LLC .

The tests used a simple SS-15A separator located at the top of the drying drum and an improved SS-15A separator installed in the UXK cleaning stream.

The amount of fiber added to the waste was selected as the main object of analysis, and the following method was used to determine its amount. During the 40-minute operation time, the waste collected in the dust collector was collected in a mesh bag, and its weight was determined with an accuracy of 0.01 g [64; 70 b]. Then this waste was passed through a 3x3 mm mesh screen to remove all impurities. The remainder was fiber, which was then weighed on a weight scale.

And the degree of mechanical lat eating of the seed was determined based on the existing method [74; 221-224 b] .

In the experiment , I , III, IV and V industrial grade cottons were used. In the experimental testing of the separators, cotton from one gram was used.

Bukhara-102 selected cotton variety is used in the experiment. The dirtiness of industrial grade I cotton is 2.15%, moisture level is 8.2%. The dirtiness of industrial grade III cotton is 3.98%, the moisture level is 10.90%, the dirtiness of industrial grade IV cotton is 6.8%, the moisture level is 14.0%, and the dirtiness of industrial grade V cotton is 12.4%, and the moisture level is is 16.5%.

Air consumption was the same in both separators, and the efficiency was 10-15 t/s [75; 248-251 b] .

As can be seen from Table 3.1, the mass of fiber added to the waste composition of the improved separator was 0.56 kg/h, and 1.65 kg/h for cotton of the III grade. Compared to a simple separator, it was 0.33 kg/h for I grade cotton and 0.92 kg/h for III grade cotton.

The results obtained in the experiments are presented in Table 3.1.

Table 3.1

Actual test results of improved separator with SS-15A separator.

Cotton variety	Separator brand	The amount of mechanical damage to the seed, %	The amount of fiber separated from the waste composition	The level of dirt and moisture of cotton,%
I	CC-15A	1, 12	0.70	Z = 2.15 W=8, 2
	Improved separator	1, 0	0.40	Z = 2, 1 5 W=8, 2
II	CC-15A	1.31	1.18	Z = 3.0 W= 9.3
	Improved separator	1.21	0.76	Z = 3.0 W= 9.3
III	CC-15A	1.5	1.70	Z = 3.98 W= 10,90
	Improved separator	1.28	0.95	Z = 3.98

				W=10. 92
IV	CC-15A	2.17	4.0	Z = 6.8 W=1 4 ,0
	Improved separator	1.67	2.5	Z = 6.8 W=1 4 ,0
V	CC-15A	3.5	4.4 _	Z = 1 2 ,4 W=16. 5
	Improved separator	2.17	3.0	Z = 1 2 ,4 W=16. 5

It is known that the degree of mechanical damage to the seed is one of the main indicators when separating cotton from air. In the experiments, this indicator was determined both in the simple SS-15A separator and in the improved version. The obtained results are presented in the form of a histogram in Figures 3.6 and 3.7.

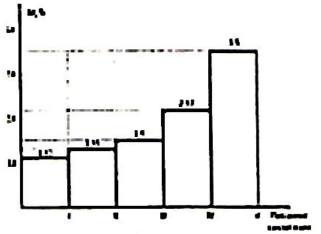
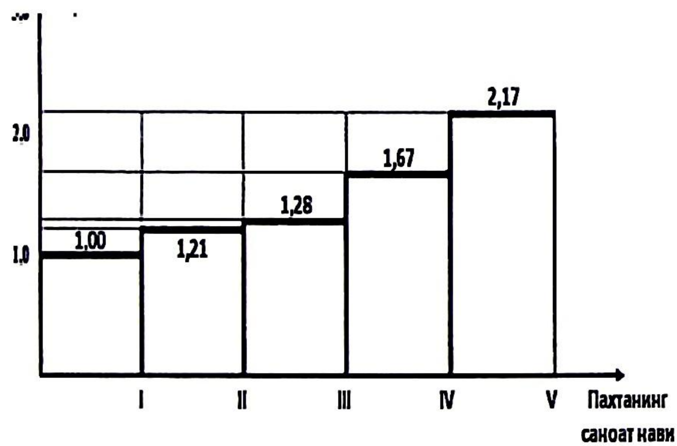


Figure 3.6. The degree of mechanical damage to the seed by the varieties of cotton using the SS-15A separator.

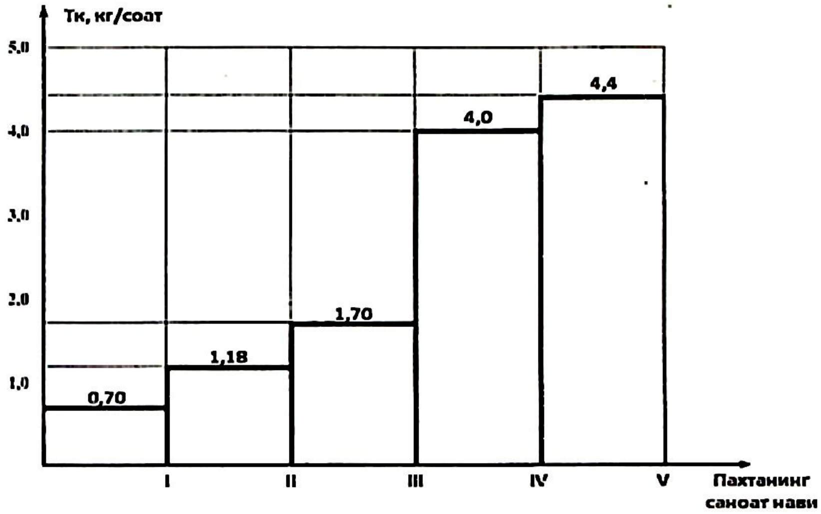
3. Figure 6 shows the results obtained in the simple version of the SS-15A separator. As can be seen from this obtained histogram, there is a certain relationship between the degree of mechanical damage to the seed according to the types of cotton, when the mechanical damage of the seed increased by 1.32% in industrial grade I cotton passing through the separator, in grade II - by 1.41%, in grade III - by 1.41% - by 1.52%, in type IV - by 2.07% and in type V by 3.38%. When cotton from the same batch was passed through the improved SS-15A separator, the degree of mechanical damage to the seed decreased by about 15-18%.



3. 7 – picture. The degree of mechanical damage of the seed by cotton varieties in the improved separator.

The obtained results are available in the histograms presented in Figure 5. The degree of mechanical damage of the cotton passed through the improved SS-15A separator was equal to the following amounts according to the varieties:

It was equal to 1.08% in I grade cotton, 1.21% in II grade cotton, 1.38% in III grade cotton, 1.87% in IV grade cotton and 2.57% in V grade cotton. Now, the next main indicator is the amount of short fiber in industrial cotton varieties, this indicator is also important, and this indicator is directly related to the length of the fiber and the degree of fiber output.



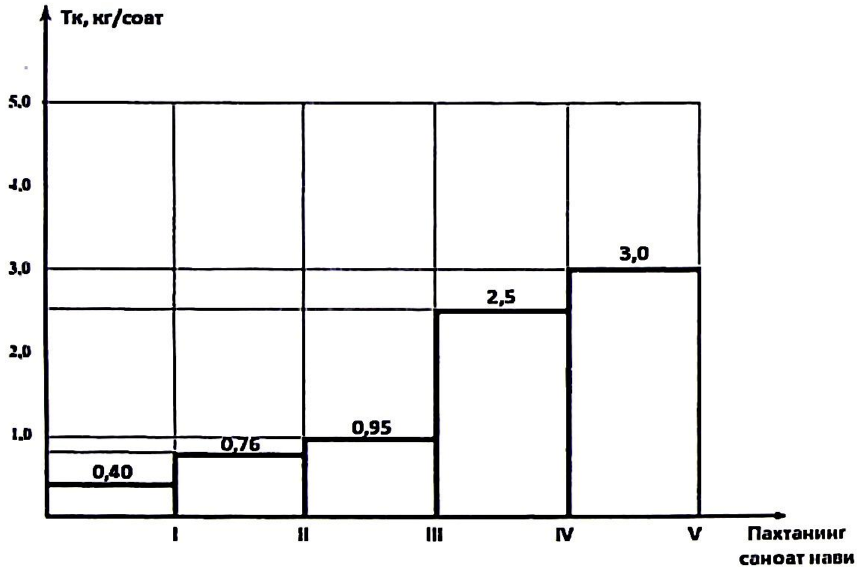
3. 8 – picture. Changes in the amount of short fibers in the SS-15A separator according to the industrial grades of cotton.

Figure 3.8 shows the change in the amount of short fiber as a result of cotton separation from a simple separator.

As can be seen from this histogram, the amount of short fiber when passing cotton of grade I is 0.7 kg/hour, in cotton of grade II it is 1.18 kg/hour, in cotton of grade III it is 1.78 kg/hour, and cotton of grade IV is 2.07 kg/hour. hour and 2.28 kg/hour in grade V cotton.

The variation of these indicators is also shown for the cotton varieties passed through the improved separator given in Figure 3.22. In this histogram, the amount of short fiber by species is equal to:

0.46 kg/h in grade I cotton; 0.76 kg/h in grade II cotton; 1.05 kg/hour in grade III cotton; It was 1.16 kg/h in IV grade cotton and 1.32 kg/h in V grade cotton. Comparing the histogram in Fig. 3.21 with the histogram in Fig. 3.9 , the amount of short fibers in the improved SS-15A separator is small It was found to be 23-30% less.



3. 9 - picture. Changes in the amount of short fiber by industrial varieties of cotton in an improved separator.

So In conclusion, it should be said that the improved new design of the separator proposed by us has been improved in 2 directions, firstly, by the discovery of a diverter of a new design that moves the cotton stream entering the separator directly to the vacuum valve without reaching its back wall, and secondly, by expanding the holes of the mesh surface and 45 ° slope prevents fiber breakage and reduces mechanical damage to the seed.

In general, it allows cotton to maintain its natural properties.

Conclusions and recommendations.

The following conclusions can be made as a result of the conducted scientific and practical research:

1. An improved separator with mesh surface was developed, the hole diameter of its entrance part was $d_1 = 6$ mm, and the rear part was expanded to $d_2 = 10$ mm;

2. The opening of the expanded mesh surface was made at 45° to the horizontal plane, and the main purpose of it was to prevent the fibers passing through the mesh surface holes from breaking;

was implemented at the "Kumkurgan cotton ginning" enterprise belonging to "Dream cotton textil" LLC, Surkhandarya region ;

4. The construction of a new separator with a guide was also created, it was achieved that the cotton flow completely hit the rear wall of the separator, as a result, the mechanical damage of the seed was reduced to 1.5% on average;

5. With the help of the recommended new guide, the bending of the rear wall of the separator was completely eliminated;

6. The preliminary test results of the manufactured improved separator showed the possibility of preserving the natural properties of cotton.

CHAPTER IV. DEVELOPMENT TESTING OF AN IMPROVED NEW SS-15A SEPARATOR

§4.1. Practical experiments on the improved S C -15A separator transfer justify the main factors and their level for inclusion in the experiment plan .

In the process of applying the new separator to production, the separator, which includes the fact that the cotton moving from the inlet pipe falls through the new diverter and the mesh surface of the new construction installed in the separator, was installed at the "Kumkurgan cotton cleaning" enterprise of Surkhondarya region , which belongs to "Dream cotton textil" LLC . The proposed separator is shown in Figures 4.1 and 4.2.

In the new separator SC-15AA presented in Figure 4.2, test work was carried out during the production process.

The results of the tests conducted in the production made it possible to determine the degree of contamination, moisture and mechanical damage of the seed.

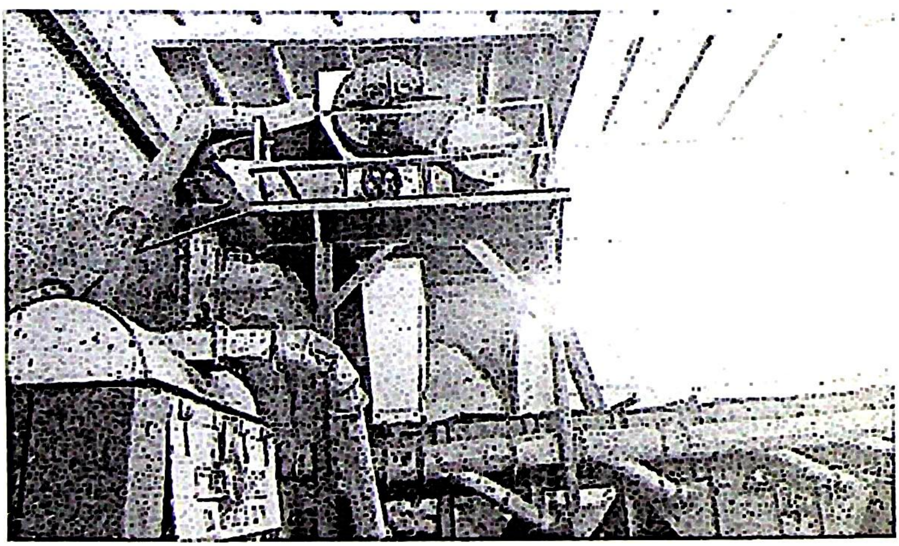


Figure 4.1. Side view of the new SS-15A separator.

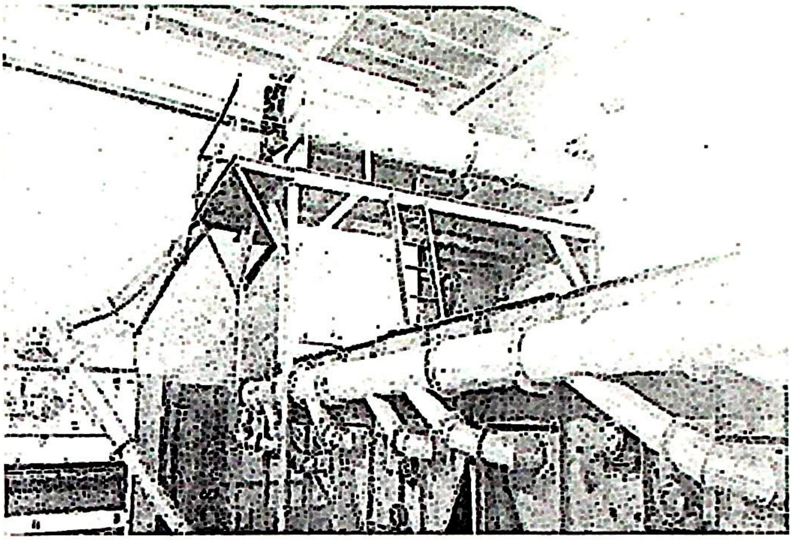


Figure 4.2. Front view of the new separator SS-15A.

The following four main factors were selected for testing: separator performance, angle of inclination of mesh surface holes, moisture level of cotton and height of diverter.

The following main factors were selected for the full factorial experiment:

a) separator productivity factor, t/hour; b) degree of slope of mesh surface holes, degrees; c) moisture level of cotton, %; g) height of the guide, cm.

Actual and coded amounts of each factor are presented in Table 4.1. The experimental plan is presented in Table 4.2.

Experiments were conducted mainly on Bukhara- 102 selection cotton. Industrial grade - II.

Table 4.1

Quantities of prime factors in real and coded form.

F actors	Naming of factors	Measurement level of factors			
		High		Lower	
		real	coded	real	Encoded
X_1	Separator efficiency, t/s	15.0	+	8	-
X_2	Degree of slope of mesh surface holes, degrees	60	+	15	-
X_3	Cotton moisture, %	14.0	+	10.0	-
X_4	The height of the guide, cm .	30.0	+	15.0	-

When conducting these experiments, the following parameters were selected:

Y_1 is the degree of mechanical damage to the seed, %.

Y_2 – amount of fiber loss, kg/s.

Y_3 - the amount of impurities and defects in the fiber, %.

Let's examine the factors affecting the process separately:

a) k factor of separator efficiency - X_1.

In the process of separating cotton from air, the amount of cotton transferred from the separation chamber per unit of time plays a major role. Research shows that the change in the amount of cotton entering the separator within a unit of time affects its quality indicators. Therefore, it is important to study the effect of separator performance on the technological process. Based on this analysis, it should be noted that the performance indicator of the separator is one of the main factors affecting the process.

b) Slope angle of mesh surface openings – X_2.

Table 4.2

Research plan:

o	X_1, t/s		X_2, degrees		X_3, %		X_4, cm	
	Code	Real	Code	Real	Code	Real	Code	Real
		15.0 --		60		14.0		30.0
		8.0		60		14.0		30.0
		15.0 --		15		14.0		30.0
		8.0		60		14.0		30.0
		15.0 --		60		10.0		30.0
		8.0		60		10.0		30.0

cotton in the SS-15A separator, its interaction on mesh surfaces, and the effect on the natural properties of cotton were studied.

In the newly improved SS-15A separator, the built-in diverter structure is made in two different sizes, mainly the height of the diverter is changed. In Figure 4.3, the height of the router is set to h=15cm. In Figure 4.4, the height of the router is set to h=30cm. As it can be seen from the design of the diverters in the figures 4.3 and 4.4, the change in its height increases the probability that the cotton will go directly to the vacuum valve due to the movement of the cotton flow from the inlet of the separator through the diverter.

The deflector surface installed at the inlet of the newly improved separator is given a highly polished appearance. Because, in the case of cotton flow movement, the coefficient of friction between the cotton and the surface of the guide should be minimal, because if the coefficient of friction is high, then the cotton fiber may be damaged. Therefore, it will be possible to make the material of the proposed guide in the future from a polymer material.

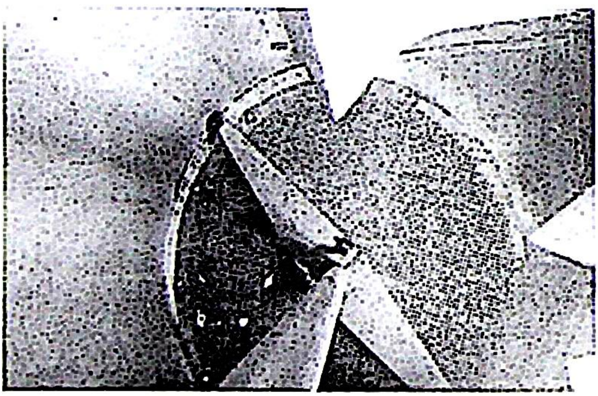


Figure 4.3. The position of the router with a height of h=15cm.

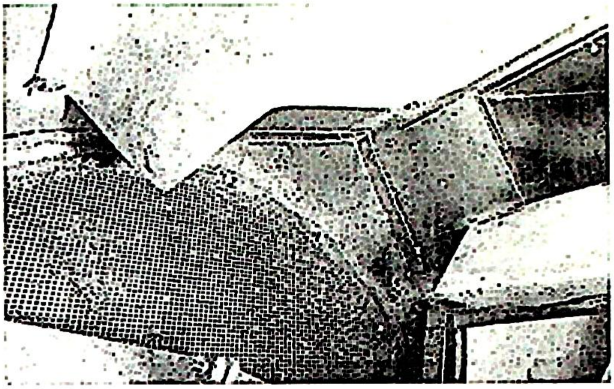
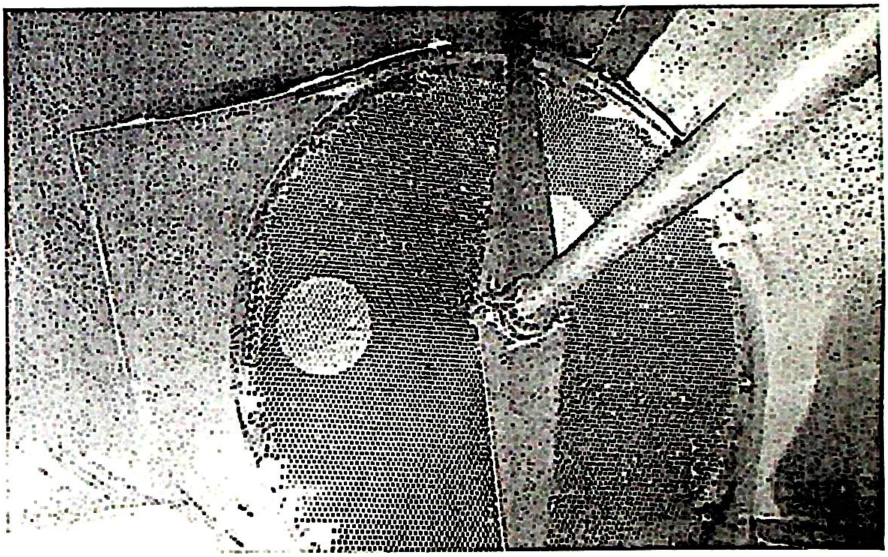


Figure 4.4. The position of the router with a height of h=30cm.



4.5 . Improved appearance of mesh surface.

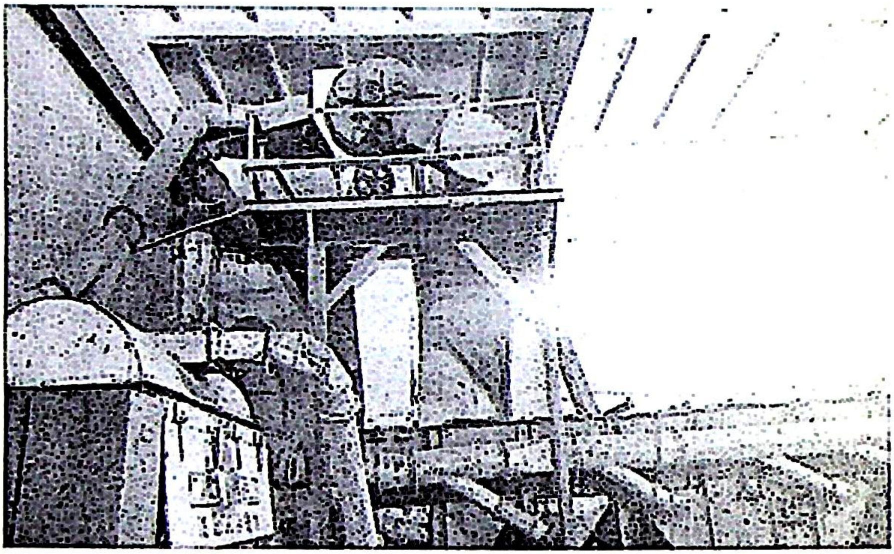


Figure 4.6. A view of the newly improved SS-15A separator.

Figure 4.5 shows the appearance of the mesh surface of the new separator with openings based on the slope angle.

An improved SS-15A separator with a new guide and mesh surface shown above is shown in Figure 4.6, and this new separator was tested in production.

Production experiments were conducted at the "Kumkurgan cotton ginning" enterprise belonging to "Dream cotton textil" LLC . The obtained results based on the output parameters are presented in Table 4.3.

Table 4.3

Results of output parameters.

No	X_1	X_2	X_3	X_4	Y_1, %	Y_2, kg, s	Y_3, %
1	+	+	+	+	1.	0.2	3.87

					18	1		
2	-	+	+	+	1.20	0.23	4.02	
3	+	-	+	+	1.19	0.24	4.12	
4	-	-	+	+	1.20	0.21	4.11	
5	+	+	-	+	1.36	0.24	4.35	
6	-	+	-	+	1.42	0.28	4.54	
7	+	-	-	+	1.33	0.30	4.52	
8	-	-	-	+	1.37	0.31	4.65	
9	+	+	+	-	1.21	0.21	4.35	
10	-	+	+	-	1.23	0.22	4.42	
11	+	-	+	-	1.20	0.23	4.40	
12	-	-	+	-	1.22	0.24	4.43	
13	+	+	-	-	1.38	0.28	4.61	
14	-	+	-	-	1.37	0.30	4.68	

15	+	-	-	-	1.40	0.28	4.70
16	-	-	-	-	1.53	0.27	4.71

The results obtained on the basis of the experiments were calculated using EXM based on the method of "Full factorial experiment planning" and regression equations were obtained. The results are presented in Tables 4.4, 4.5 and 4.6, and the results of regression equations are presented in Tables 4.1, 4.2 and 4.3.

Analyzing each of the obtained regression equations separately, we consider the degree of influence of each factor on the output parameters.

The regression equations obtained on the basis of the conducted experiments have the following form.

$$Y_1=1.299+0.434X_1-0.301X_2-0.451X_3-0.093X_4-0.523X_2X_3-0.117X_2X_4-0.119X_3X_4$$

$$R=0.95$$

$$Y_2=0.253+0.094X_1-0.071X_2-0.154X_3-0.019X_4-0.533X_2X_3-0.01X_2X_4-0.01X_3X_4-0.006X_1X_2X_3$$

$R=0.95$

$$Y_3=4.41+1.4X_1-0.631X_2-0.53X_3-0.3X_4+0.12X_1X_3-0.795X_2X_3-0.29X_2X_4-0.29X_3X_4-0.072X_1X_2X_3$$

$R=0.95$

§4.3. Determining the rational values of the main technological parameters of the newly improved SS-15A separator.

We used the simplex planning method to solve the problem aimed at determining the optimal values of the main indicators.

Unlike other methods, this method consists in choosing a direction of movement tending to the optimal area [76; pp. 18-19].

This simplex planning method is based on finding the highest point in the factor space of the optimal area.

Through each research conducted, he determines the point located in the highest space, and as a result determines the optimal value of the indicators [77; pp. 41-42].

We determine the coordinates of the upper points of selected simplexes in the factor space using the following matrices:

We determine the coordinates of the upper points of selected simplexes in the factor space using the following matrices:

$$-r_1 - r_2 \cdots -r_{k-1} \quad -r_k$$

$$\begin{matrix} -R_1 & -r_2 & \cdots & -r_{k-1} & -r_k \\ 0 & -R_2 & \cdots & -r_{k-1} & -r_k \\ \cdots & & & & \\ 0 & 0 & \cdots & r_{k-1} & -r_k \\ 0 & 0 & \cdots & 0 & R_k \end{matrix} \qquad (4.1)$$

k The number of -dimensional simplexes is determined using the following formulas through the radii:

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}.$$

Using this formula, r_{x1y1} =-0.17579, r_{x4y1} =-0.0794, r_{x3y1} =-0.7493, r_{x4y3} =-0.4452, r_{x2y3} =-0.2725, r_{x1y3} =-0.0779 , r_{x4y2} =-0.1430, r_{x1y2} =-0.3633, r_{x3y2} =-0.6460, r_{x3y3} =-0.5603, etc. are found.

$$R = \sqrt{1 - \frac{S_r^2}{S_y^2}} = \sqrt{1 - \frac{\sum(y_i - \hat{y})^2}{\sum(y_i - \bar{y})^2}} = \sqrt{\frac{\sum(\hat{y} - \bar{y})^2}{\sum(y_i - \bar{y})^2}}$$

бу ерда $S_y^2 = S_{\hat{y}}^2 + S_r^2$;

R_1 =0.91, R_2 =0.89, R_3 =0.92

In this case, the movement of simplexes is performed, and as a result, the optimal value is determined. During the movement, unnecessary points are discarded, necessary ones are left, and the coordinates of these points are determined. They can be expressed using the following equation:

$$X_{ji}^{(k+2)} = \frac{2}{k}\sum_{i=1}^{k} X_{ji} - X_{ji}^{*} \qquad (4.2)$$

Here $X_{ji}^{(k+2)}$ - the coordinates of the new points;

X_{ji}^{*} -opt i mal coordinates of points in minimization of indicators;

$\frac{1}{k}\sum_{i=1}^{k} X_{ji}$ - average coordinates of points.

According to the results of this calculation, the following are accepted as rational values of the separator:

Factors	X_1, t/s	X_2, degrees	X_3, %	X_4, cm
Rational values	12.0	55.0	12.0	22.0

Then the output parameters will be:

Y_1=1.12%; Y_2=0.212 kg/s ; Y_3=3.47%

The analysis of the obtained results showed that the experiments conducted on the basis of the main input parameters revealed that the values of the output parameters were obtained with positive values. This is because the new separator created by us allows to preserve the natural properties of cotton.

Figure 4.7 shows an overview of the new improved separator.

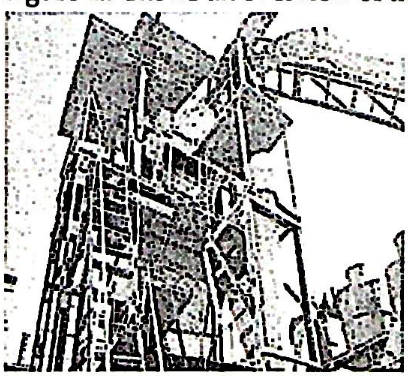


Figure 4.7. Overview of the new improved separator.

§4.4. Calculation of the economic efficiency of using an improved separator in production

In the course of scientific work, the annual economic efficiency obtained from the introduction of the parameters of the calculated separator into the production of the improved SS-15A flow-transport device was calculated.

The economic efficiency of introducing a separator that ensures the production of quality products and reduces cotton seed damage was calculated based on the current "Methodology for determining economic efficiency from the introduction of new techniques, innovations and rationalization proposals to the economy" [78; 34 pp.].

Annual economic efficiency was calculated by comparing the variable costs of the baseline and proposed technological options according to this methodology.

Table 4.7 provides the information needed to perform calculations.

Table 4.7

Information needed to calculate the economic efficiency of introducing SS-15A separator equipment into production in improved parameters

/r	Indicators	Uni t of measure	Options	
			Basi s	Offere d
.	Amount of raw cotton processed	ton s	2800 0	28000
.	Number of installed equipment	piec e	1	1
.	Depreciation Allowances for Equipment	%	15	15
.	Allowance for daily recovery	%	5	5
.	Delivery and assembly allowance	%	10	10

.	Installed power	kW	7.5	7.5
.	Price of consumed 1 kW/h of electricity	sou m	450	450
.	Amount of payment for installed capacity	sou m	3680 0	36800
.	Minimum wage	sou m	3000 00	30000 0
0.	Payment to social insurance	%	25	25
1.	Cotton seed damage rate, average	%	3, 7	1.8
2	The amount of free fibers in the dirt	%	0.83	0.37

The existing SS-15A type separator has been improved based on the development of a device that preserves its natural properties in the process of separating fresh cotton from air. As a result, the degree of mechanical damage of the seed decreases, the process of rapid corrosion of the separator wall is eliminated, and economic efficiency is achieved due to the reduction of free fibers in the dirt content.

Based on the current methodology, the economic efficiency obtained in the production and use of a new labor tool (machine, equipment, etc.) is calculated by the following formula:

$$Э=\left[З_1\cdot\frac{в_2}{в_1}\cdot\frac{P_1+E_н}{P_2+E_н}+\frac{\left(И_1^{\cdot}-И_2^{\cdot}\right)-E_н\left(K_2^{\cdot}-K_1^{\cdot}\right)}{P_2+E_н}-З_2\right]$$

(4.3)

here, Z_1, Z_2- the amount of costs corresponding to one unit of old and new equipment, thousand soums;

$\frac{в_2}{в_1}$- coefficient of comparison of new equipment performance with the old one;

v_1, v_2 - the corresponding performance of the base and new equipment;

$\frac{P_1 + E_н}{P_2 + E_н}$ - the coefficient of consideration of the service life of the equipment compared to the base option;

R_1, R_2 – the percentage of deduction from the balance sheet value for the complete restoration of the base and new equipment, taking into account spiritual wear and tear;

E_n – standard coefficient of efficiency, $E_н$=0.15; $K_1^{'}$, $K_2^{'}$- the amount of consumer-directed capital investment in the base and new equipment;

$И_1^{'}$, $И_2^{'}$- in the implemented option, the annual operating costs of the consumer when using basic and new equipment [79; 468 pp.].

At the same time, as a result of the introduction of new technology into production, the quality indicators of finished products will be improved. In cotton ginning enterprises, as a result of the improvement of the equipment in the main production process and the improvement of its working parts, the output of cotton fiber, the transition from class to class, the improvement of the quality indicators of products such as fluff, seed, and the reduction of the amount of free fiber occur [80; 48 pp.].

Therefore, when calculating the annual economic efficiency from the introduction of new technology into production, it is necessary to take into account the additional economic effect from the improvement of the total quality indicators.

Economic efficiency from improving quality indicators is determined using the following formula:

$$Эс = (Ц_2^1 - Ц_1^1) * A_2 \qquad (4.4)$$

where, $Ц_1^1$ - the price of the product in the base option;

$Ц_2^1$ - the price of the product in the new version;

A_2 - annual product production volume in the new version.

The cost-effectiveness of doing this research is based on the cash flow from all costs associated with purchasing, transporting, installing, and operating the equipment.

1. Calculation of operating costs:

Accounting works are carried out only on changed cost elements.

2. Depreciation allowances

In the basic version:

126735.4x0.15 = 19010 thousand soums;

In the proposed option:

132375.4x0.15 = 19856 thousand soums.

Expenses for daily maintenance

In the basic version:

126735.4x0.05 = 6337 thousand soums;

In the proposed option:

132375.4x0.05 = 6619 thousand soums.

4. Electricity consumption is calculated as follows:

$$W = P_y \cdot K_c \cdot T_c \cdot C_э \quad (4.5)$$

where, P_y- power of installed electric motors;

K_c- demand coefficient;

T_c annual useful working hours of the equipment ;

$C_э$- the cost of electricity consumed per 1 kW/h.

In the basic version:

(14x0.7x3556x250)/1000 = 7980 thousand soums;

In the proposed option:

(14x0.7x3556x250)/1000 = 7980 thousand soums.

5. A total of 5,640,000 soums for research and development works.

6. Material consumption costs :

In the proposed option, the following additional materials were used to improve the equipment:

- St-10 type steel: 2 9 kg * 2036 soums = 59 , 04 thousand soums;

Total: 59 , 04 thousand soums.

The obtained results are summarized in Table 4. 8 .

Table 4.8

Estimated and operational costs based on the basic and proposed options, in thousands of soums

INDICATORS	Options	
	Basis	New
Until improved cost of equipment	2 8000	2 8000
Equipment transportation and installation costs	2248	2248
Proper capital expenditure	19535	19535
Costs of ITIs	-	2630
Production funds capital investments for the creation of equipment	19535	21175
Costs for the preparation of equipment	2 6 6 00	2 8 90 0
Operating expenses , total	3 3400	3 5539
including:		
- depreciation allowances	19010	20 856
- daily maintenance	63 45	66 39
- edible cost of electricity	79 85	79 85
- material costs	-	59

The amount of directed capital funds is taken in the amount of 10% of the balance sheet value of the base and applied equipment:

$K_1 = \frac{24728 * 10}{100} = 2472.8$ thousand soums;

$K_2 = \frac{25464 * 10}{100} = 2546.4$ thousand soums.

Putting the obtained data into the formula, we calculate the annual economic efficiency of the improved equipment:

$Э_{й.} =$

$26600 \cdot 1,0 \cdot 1,0 + \frac{(33400-35539)-0,15\cdot(2546,4-2472,8)}{0,164+0,15} - 28900 = 4473,8$ a thousand c oum.

The economic efficiency obtained from the elimination of cotton seed damage is equal to the following .

As a result of the decrease in the level of damage to the cotton seed, the transition from variety to variety occurs in the following distribution:

from type III to type II :

$P_3 = (Ts_2 - Ts_3) * Q_{ch} = (1545930-1280400)*71$ tons= 18852.6 thousand soums;

from type II to type I :

$P_2 = (Ts_1 - Ts_2) * Q_{ch} = (1876990-1545930)*83$ tons= 27447.9 thousand soums;

$Э_{умум.} = П_1 + П_2 + П_3 = 18852.6 + 27447.9 = 46300,5$ минг сўм

Total: 46300,5 минг сўм.

The total economic efficiency will be equal to:

$Э_{умум.} = Э_{й.} + Э_{чиг.сиф.} + Э_{эр.тола} = 4473,8 + 46300,5 + \frac{28000 \cdot 32.9 \cdot 0,4}{100 \cdot 100} \cdot 11329,05 = 4473,8 + 46300,5 + 417362,2 = 468136.5$ минг сўм.

Conclusions on Chapter IV.

1. In order to experimentally test the newly improved SS-15A separator, the experimental method, main factors and output parameters were selected. Based on the selected method, a plan for conducting a "Full factorial experiment" was drawn up.

2. The rational parameters of the new improved separator were determined using the "full factorial experiment" method. In particular, the efficiency of the separator $X_1 = 12.0$ t/s, the slope angle of the mesh

surface holes X_2 = 55 degrees, the humidity of the cotton X_3 = 12.0% and the height of the cotton guide X_4 = 22.0 cm.

3. Based on the experiments, the values of output parameters are equal to the following: Y_1=1.12%, Y_2=0.212 kg/s, Y_3=3.47%.

4. According to the results of research conducted in production, as a result of elimination of mechanical damage of seeds and loss of fiber products in the proposed improved separator, 468136.5 thousand soums of economic benefit was achieved.

CONCLUSIONS AND RECOMMENDATIONS

The research work carried out in our country and in foreign countries on the improvement of the separator device used in the separation of cotton from air was analyzed and the following conclusions were reached based on the analysis:

1. Studying the movement of cotton in each section of the air pipeline and determining the effect of the number of turns on the natural properties of cotton in the main sections of the main network, and on this basis, the effect of the number of turns on its natural properties was studied.

2. At the stage of improvement of separators, the connection between the mesh surface and the cotton is kept as much as possible, which leads to a negative increase in its natural properties.

3. As a result of theoretical studies, it was shown that a sudden change in speed at the border of variable and constant cross-sectional surfaces can create an additional aerodynamic force in the separator, and such a situation can cause a change in the speed and density of cotton raw material moving along the axis of the separator.

4. From the analysis of the calculation results, it was observed that the friction coefficient can have a sufficient influence on the external tension force. This effect $f > 0.4$ was explained by the relatively high values of the friction coefficient. Thus, it was found that the main reason for fiber breakage on the mesh surface is the friction coefficient of the fibers in the pores of the mesh surface.

5. An improved separator with mesh surface was developed, the hole diameter of its entrance part was $d_1 = 6$ mm, and the rear part was expanded to $d_2 = 10$ mm. The main purpose of this is to prevent the fibers passing through the mesh surface holes by making the expanded mesh surface hole at 45° to the horizontal plane.

6. The construction of a new separator with a guide was also created, it was possible to completely eliminate the impact of the cotton

flow on the rear wall of the separator, as a result, the mechanical damage of the seed was reduced to an average of 1.5%, and the bending of the rear wall of the separator was completely eliminated.

7. The improved grid surface separator was implemented at the "Kumkurgan cotton ginning" enterprise belonging to "Dream cotton textil" LLC, Surkhandarya region ;

8. The rational parameters of the new improved separator were determined using the "full factorial experiment" method. In particular, the efficiency of the separator X_1 = 12.0 t/s, the slope angle of the mesh surface holes X_2 = 55 degrees, the humidity of the cotton X_3 = 12.0% and the height of the cotton guide X_4 = 22.0 cm. Based on the experiments, the values of output parameters are equal to the following: Y_1=1.12%, Y_2=0.212 kg/s, Y_3=3.47%.

9. According to the results of research conducted in production, as a result of elimination of mechanical damage to seeds and loss of fiber products in the proposed improved separator, 468136.5 thousand soums of economic benefit was achieved.

LIST OF USED LITERATURES:

1. Decree of the President of the Republic of Uzbekistan dated January 28, 2022 No. PF-60 "On the new development strategy of Uzbekistan for 2022-2026".
2. Decision PD-4633-con of March 6, 2020 "On measures for the widespread introduction of market principles in cotton production" .
3. Resolution PD16 of November 16, 2021 "On measures to regulate the activities of cotton-textile factories" .
4. Decision No. PD-3408 of November 28, 2017 "On measures to fundamentally improve the management system of the cotton industry."
5. Cotton: World Statistics . htt r:// www . IC A C .o rg ; htt r s :// www . st a tist a. c o m .
6. Zikriev E. Technological regulation pererabotki hlopka-syrtsa . // Association " Uzkhlopkopromsbit " and RNTs " Khlopkoprom " . Tashkent: Labor . 1997 g . — 110 s .
7. R.M. , Ziyaev X.A., Kadirkhadzhaev S.Kh. // Khlopkaya promqshlennost. - Tashkent. 1983. No. 3. -12-13 p.
8. Musaev N.M. Mechanization trudoyomkix rabot po priemki i skladirovaniyu hlopka na hlopkazavodax: // Autoref. Diss. kand. techn. nauk. Tashkent.: TITLP, 1970. -9-10 p .
9. Ziyaev K.A. Issledovanie vliyaniya v geometricheskom transportirovanii . // Khlopkovaya promyshlennost . -Tashkent, 1980 .- #1. -15-16 p.
10. Fayziev R.R., Azimov X.O. Issledovanie povrejdaemosti semyan pri pneumotransportirovki klopka-syrtsa . // Khlopkovaya promyshlennost .-Tashkent. 1978 . - #2 . — 6-7 p .
11. Amirov R., Tikhomirov G.A., Suslin A.K. Question about seed damage during transportation of cotton-surface // Khlopkovaya promyshlennost. -Tashkent, 1975.- #1. — 4-5 s .
12. Ziyaev K.A. Issledovanie vliyaniya v geometricheskom transportirovanii . // Khlopkovaya promyshlennost. -Tashkent, 1980.- #1. — 15-16 p .
13. Kadyrkhadzhaev S.Kh. Razrabotka i issledovaniya maketa inertsionnogo separatora klopka - syrtsa s vydachey zayavki s iskhodnymi trebovaniyami na proektirovanie opytnogo obraztsa: // -T.: 1984, -Otchet. TsNIIXPROM, #19801303. — 38s
14. Kadyrkhadzhaev S.Kh. Razrabotka separatora dlya klopka - syrtsa s tselyu sokhraneniya ego kachestvennyx pokazateley i

sokrashcheniya poter volokna: // Diss.kand.tekn.nauk. -Tashkent: TsNIIXPROM, 1986 . — 153 s.

15. Akhmedkhodjaev Kh. T. Issledovanie transportirovaniya klopka-syrtsa v metallopolimernykh truboprovodax i ix vliyanie na kachestvo fiber i semyan. - Diss. ... candy. tech. nauk. - Tashkent, 1980. - 28-29 p.

16. Samandarov S.A., Libster S.A., Pashkin V.G. Vliyanie pneumotransporta na obrazovanie voloknistyx porokov v tonkovoloknistom hlopke. // "Khlopkovaya promyshlennost", 1979, No. 4 . — 10-11 p.m. _

17. Muradov. R. Construction of separators that separate cotton from the air flow during processing. // UzNIINTI, Tashkent, 1992. -31 p.

18. Muradov R. Fundamentals of improving the efficiency of the transportation process in the technology of primary processing of cotton. // Tex..fan.doct....diss. Tashkent, 2006. -79-81 p.

19. Shodiev Z.O. Creating a cotton flow distribution system in the SX separator. // Tex..fan. candidate. ... diss. Tashkent, 2010. - 42-43 p.

20. Shodiev Z.O. Harmonic movement of cotton mass under the influence of dynamic force. // Problemy introduction of modern technology and technology and production: Sbornik nauchnykh trudov Republican scientific and practical conference. May 18-19, 2007. - Dzizak: DPI, 2007. - 71-73 p .

21. Shodiev Z.O. O dvizhenii massy hlopkovogo syrtsa v rabochem organe pneumotransporta . // Problemy intensifikatsii integratsii nauka i proizvodstva: Sbornik trudov Mejdunarodnoy nauchno-prakticheskoy konfirentsii. - Bukhara, Bux TIP i LP, 2006. — 427 p .

22. Shodiev Z.O. On the mathematical modeling of the process of extracting a piece of cotton from the mesh surface of the cotton separator . //Collection of lectures of the scientific and technical conference of the Republic.-Tashkent: 2004. — 15-17 p .

23. Shodiev Z.O. Mathematical modeling of the process of transferring cotton raw materials using pneumatic transport // Mechanical problems. - Tashkent, 2005. -#1. — p . 64-67 .

24. J. Jabborov G., Otametov T.U., Khamidov A.Kh.. Technology of seed cotton processing. // Tashkent: Teacher, 1987. — 98-100 p.

25. M. T. Khojiev, Sh. Sh. Khakimov, D. D. Eshmurodov. Ways to preserve the natural properties of cotton during air separation. // TTESI. Scientific and practical conference "21st century - the century of the young intellectual generation". Section 1. Tashkent-2016. — p. 91-92.

26. Salokhiddinova M. Improvement of the construction of the elements of cotton air separation equipment and justification of parameters. // Fortune..science. PhD diss. ... Namangan, 2020. — 32 p.

27. Salokhiddinova M., Muradov R., Mardonov B. Study of the movement of cotton on the inclined mesh surface of the separator equipment // Scientific and technical journal of the Fergana Polytechnic Institute. Ferghana. #1. 2019y.33-39b.

28. Salokhiddinova M.N., Makhkamov A., Muradov R. Ways to improve the vacuum-valve operation of the separator // Andijan Institute of Mechanical Engineering, collection of international scientific-practical conference "Modern materials, techniques and technologies in mechanical engineering". April 19-21. 2016 — 131-135 p.

29. Mamatkulov O. Creating a rational construction of a cotton separator. // Philology. PhD diss. ... Namangan, 2019. -93-94 p.

30. Mamatkulov O., Muradov R., Salokhiddinova M.. Separating small impurities and heavy compounds using the cotton separator. // XV International scientific conference "Actual scientific research in the modern world". Pereyaslav-Khmelnitsky. Ukraine. 2016 — 185-187 p.

31. Mamatkulov O., Muradov R., Issledovanie raboty separatora pri ustanovke cylindricheskoy setki. // SurGU, Materialy II Vserossiyskoy konferentsii molodyx uchenyx "Nauka i innovatsii XXI veka". 2014. April 14. — 213-215 p.

32. Mamatkulov O., Karimov A., Isakhanov Kh.. Theoretical and practical study of the movement of cotton particles in the working chamber of the improved separator. // Mechanical problems. Number 2. Tashkent 2014. p. 106-109.

33. Khusanov S.M. Improvement of pneumatic transport device elements. // div..science. PhD diss. ... Namangan, 2020. — 35-36 p.

34. Khadzhiev M.T., Shodiev Z.O. Separator for fiber material // NGK.:Tez. Doc. Mejd. Conf. May 20-22, 2000. - Kostroma, 2000. - 30-32 p.

35. Shodiev Z.O. Creating a cotton flow distribution system in the SX separator. // Tex..fan. candidate. ... diss. Tashkent, 2010. — 25-26 p.

36. T.M. Kuliev, E.T. Maksudov. Handbook of Cotton Preprocessing. // Tashkent 2019. "AUTO-NASHR" JSC. — 153-154 p.

37. US Screw Conveyor Corporation. Screw conveyor catalog and engineering manual,//Screw Conveyor Corporation. Hammond. 987. #787.64 -65 p

38. Anthony WS and William D. Mayfield. Cotton ginners handbook. // Agricultural handbook. Number 503. United States Department of Agriculture. December 1994. — 337 pp

39. Mc. Cascill. OL, Baker RV and Stedronsky VL Fans and Piping. In cotton Ginners Handbook. // US Department of Agriculture, Agricultural Handbook 503. 1977 — 57-67 p . p.

40. Eshmurodov DD, Abbasov IZ, Khaitbayev XX Researches to improve the CC-15A separator. // Materials of the XV international scientific and practical conference. "Conduct of modern science - 2019" November 30 - December 7, 2019. Volume 13. England-2019. - 94-96 pp

41. Eshmurodov D.D., Khodzhiev M.T. Development of technology for separating cotton from air while preserving its natural properties. // Innovative ideas and developments of talented young people in the conditions of modernization of cotton ginning, textile, light industry, printing production techniques and technologies Collection of scientific and practical online theses of the Republic. Part I. November 18. Tashkent-2020. -179-182 p.

42. Eshmurodov D., Khodzhiyev M., Muqimov N, Makhkamov I. //Cotton on the separation of the air convey in impact of netting surface for cotton seeds // European scientific review No. 5–6. Vienna 2018. May–June. -369-373 pp

43. Wright. TE Separators and droppers. In Cotton Growers Handbook, US Department of Agriculture. Agricultural Handbook 503 . 1977 _ — 53-56 p . p.

44. https://bajajngp.com/products-services/bajaj-ginning-pressing-machinery/ginning-pressing-machinery/air-separator/ Cotton Machinery India.

45. http://www.lummus.com - USA cotton ginning machinery and equipment.

46. M. T. Khodzhiev., A. Kh. Rakhimov. "Analysis of the technological process of existing separators abroad" // Republic-wide scientific-practical conference on the topic "Innovative ideas and developments of talented young people in the conditions of modernization of cotton cleaning, textile, light industry, printing production techniques and technologies" (pages 42-45) 23, 2022 - November 24.

47. M. T. Khodzhiev., A. Kh. Rakhimov. International scientific-practical conference on the topic " Study of separators used in the preliminary processing of foreign advanced cotton " // The role of

higher education and production enterprises in the introduction of innovative technologies in the fields of textile and light industry (pages 231-236) April 29-30, 2022.

48. M. T. Khodjiev., B. M. Mardonov., A. Kh. Rakhimov. International scientific-practical conference on the topic "Influence of the shape of the separator guide on the air flow parameters" //The role of higher education and production enterprises in the introduction of innovative technologies in the textile and light industry sectors (pages 399-403) April 29-30, 2022.

49. Miroshnichenko G.I., Makhkamov R.G. Sbornik TTI, vyp. No. 20, 1967, pp. 26-30.

50. M.T. Khodzhiev., B.M. Mardonov., A.K. Rakhimov. "Effect of the shape of the separator guide on the parameters of the air flow" // Journal of Gulistan State University Bulletin, Series of Natural and Agricultural Sciences. 2022. #2. Department of agricultural and production technologies 46-49 p.

51. H.S. Usmanov. "Introduction of devices to preserve the natural properties of cotton in the process of separating it from the air." // Report on the scientific work on the topic No. IOT-2016-2-10. Tashkent 2017, p. 11-14.

52. Mardonov B.M. Volnovye processy v uprugikh nasyshchennyx sredakh . Tashkent, Science, 1991.

53. MT Khodzhiev., BM Mardonov., A. Kh. Rakhimov. // Theoretical study of the movement of raw cotton on a cotton separator // IOP Conference Series: Earth and Environmental Science. 1112 (2022) 012011. https://iopscience.iop.org/article/10.1088/1755-1315/1112/1/012011 .

54. Rakhmatulin H.A. Gazovaya i volnovaya dynamics. M. Izd. MSU, 1983.

55. D.D. Eshmurodov, O.A. Qasimov, E.R. Qurbanov, TTESI //Creation of a new isolation chamber separator //In the conditions of integration of science, education, production, innovative technologies of cotton ginning, textile, light industry, printing production are relevant problems and their solution Republican scientific-practical conference April 28, 2021. -129-131 p.

56. M. T. Khodzhiev., A. Kh. Rakhimov. "Razrabotka separatora s usovershenstvovannoy netchatoy poverkhnostyu pri pervichnoy obrabotke hlopka" // International scientific conference "Innovative trends in science, practice and education" Foreign international

conference Munich, (Germany) Vol. 1 No. 3 (2022) . pp. 131-135. 05.11.2022.

57. Patent UZ No. FAP 01317. Separator for seeded cotton / Khojiev M.T., Gaibnazarov E.E., Khakimov Sh.Sh., Sarimsakov O.Sh., Kuzmetov M.E., Akhmatov N.M., Eshmurodov D. D. // Official newsletter. – 2018. No. 8. p. 51-52.

58. Patent UZ No. IAP 06632. Seed cotton separator /M.T. Khodzhiev., A.J.Djuraev., O.J.Murodov., A.Kh. Rakhimov.//Official bulletin. 2019. No. 12

59. MT Khojiev., A. Juraev., O. Murodov., A. Rakhimov. "Development of Design and Substantiation of the Parameters of the Separator for Fibrous Materials" // International Journal of Recent Technology and Engineering (IJRTE). India Retrieval Number: B2855078219/19 ©BEIESP. No. 961 (pages 5806-5811). 18.07.2019.

60. Patent UZ No. FAP 01522. Separator for cotton raw materials / M.T. Khodzhiev., O.J. Murodov., A.K. Rakhimov. //Official newsletter. 2019. No. 8

61. M. T. Khodzhiev., A. Kh. Rakhimov. "Creation and production application of a new diverter separator" // International scientific and practical conference "Innovate development in the global science" Foreign international USA (Boston) conference 05.11.2022 (Session 1, Part 7) pp. 21-26. 20.11.2022.

62. Patent RU No. 2701220 C1. Separator khlopka-syrtsa / M.T. Khodzhiev., D.S. Tashpulatov., J.A. Djuraev., O.J. Murodov., A.Kh. Rakhimov., A.F. Plekhanov., S.A .Pershukova., S.V. Kuzyakova., E.V. Bitus., K.E. Razumeev. //Official newsletter. – 2019. No. 27.

63. MTKhodzhiev., A.Kh. Rakhimov. // Study of the influence of a new improved separator design on the natural properties of cotton // IOP Conference Series: Earth and Environmental Science. 1112 (2022) 012045. https://iopscience.iop.org/article/10.1088/1755-1315/1112/1/012045 .

64. I.Z.Abbazov "Creation of an effective technology for cleaning the air coming out of the cotton processing process". // Dissertation prepared for the degree of Doctor of Philosophy in Technical Sciences (Doctor of Philosorhy). Tashkent. 2018 year. -70 p.

65. A.H. Rakhimov. " Effect of pneumatic vehicles on the natural properties of cotton and analysis of the operation process of separators " // Journal of educational and innovative research 2021. Special issue. 228-233b.

66. M. T. Khodzhiev., A. Kh. Rakhimov. " Study of the influence of the process of separating cotton from air on its natural properties " // Journal of Gulistan State University Bulletin, Series of Natural and Agricultural Sciences. 2022. #1. Department of agricultural and production technologies 57-61 p.

67. M. T. Khodzhiev., A. Kh. Rakhimov. "Effect of pneumatic vehicles on the natural properties of cotton" // Republic-wide scientific-practical conference on the topic "Innovative ideas and developments of talented young people in the conditions of modernization of cotton ginning, textile, light industry, printing production techniques and technologies" (pages 39-42) 23, 2022 - November 24.

68. Eshmurodov D.D. A. Rakhimov, I. T. Makhkamov. "Development of the technology of separating cotton from air while preserving its natural properties" // Actual problems of innovative technologies of cotton cleaning, textile, light industry, printing production in the conditions of integration of science, education, production and their solutions. Collection of articles of the Republican Scientific and Practical Conference 1 subsidiary Tashkent-2019. -143-146 p.

69. I.T. Makhkamov "Theoretical study and practical implementation of the movement of cotton in the separation chamber during the separation of cotton from air" Mag. Dissertation. -Tashkent: TTESI, 2019. -83-84 p.

70. M.T. Khodzhiev., B.M. Mardonov., D.D. Eshmurodov., A.Kh. Rakhimov. /Improving the technology of separating cotton from air //Monograph -T. GulDU "Universitet" publishing house, 2022. - 108 pages.

71. Z. Sh. Davlatova., D. Eshmurodov., O.Z. Kasimov., A.K. Rakhimov. International scientific and practical conference on the topic "Improvement of the SS-15A separator used in the process of separating cotton from air" // The role of higher education and production enterprises in the introduction of innovative technologies in the textile and light industry sectors (pages 316-319) April 29-30, 2022 .

72. A.K. Rakhimov. "Analysis of the distribution of cotton flow in SS-15A separators according to the working length of the vacuum valve" // Proceedings of the traditional forty-fifth scientific-practical conference of professors-teachers of Termiz State University dedicated to the end of research work in 2019 (pages 72-74) 05.26.2020.

73. M. T. Khodzhiev., A. Kh. Rakhimov. "Impact of the process of air separation during cotton processing on changes in cotton properties" // Improvement of the state management system for the development of scientific and innovative activity is the need of the day International scientific and practical conference (pages 176-178) 18.12.2020.

74. M. T. Khodzhiev., A. Kh. Rakhimov. International scientific-practical conference on the topic " The state of seed damage occurring in pipes to separators " // The role of higher education and production enterprises in the introduction of innovative technologies in the textile and light industry sectors (pages 221-224) April 29-30, 2022.

75. M. T. Khodzhiev., A. Kh. Rakhimov., D. Eshmurodov. International scientific-practical conference on the topic " Analysis of research conducted on separators in cotton processing " //The role of higher education and production enterprises in the introduction of innovative technologies in the textile and light industry sectors (pages 248-251) April 29-30, 2022.

76. B.M. Mardonov. Modeling of cotton industry technology processes. Lecture text. Part 1. TTESI. 2014 -18-19 p.

77. M.T.Khojiev, B.M.Mardonov, F.N.Sirojiddinov "Cotton ginning process modeling" tutorial. Part 1 TTESI. 2018. -41-42 p.

78. Methodology of the definition of economic effectiveness of new technology, isobretenia and rationalization of predlozheny. -M., 1988. -34 p.

79. Isaev R.A. and others. Production organization and business plan. "Tafukkur" publishing house, Tashkent, 2011. -468 p.

80. Rekomendatsii po opredeleniyu ekonomicheskoy effektivnosti vnedreniya new tekhniki hlopkoochistitelnoy promyshlennosti. JSC "Cotton Industry Scientific Center". Tashkent, 2014. -48 p.