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Creation of Scientific-Based Construction of the Separator with Insulation Camera

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Abstract: ***The article provides an analysis of existing separators for raw cotton. Their disadvantages are described. The design scheme and the principle of operation of the separator with side grids of the air duct with curved conical holes are presented. The article also analyzes the process of separating cotton from all the separators, mainly the surface and the separation of cotton from this surface. In this system, by pressing the pressure of the cotton flow under the pressure of the air, it will inevitably lead to fiber breakage and mechanical damage to the seeds. In order to avoid this, it is necessary to avoid the adverse effect of air pressure on cotton.***

Keywords: ***Fibrous material, separator, air, chamber, Stripping, brush, friction force, hole, curvature, mesh, vacuum valve, quality.***

I. INTRODUCTION

Currently, the CC-15A separator is also widely used in the pneumatic machine of the seed cotton (Figure 1). It consists of the following components: chamber 1, vacuum valve 6, electric drive 5 fastened to frame 10. The rear wall in the separation chamber 1 is made of a steel sheet and the side walls which have a 6 mm diameter hole net for ventilation.

The net surface 2 is processed with the use of 2 scrapers 7 which are installed in cotton seeds cleaning screw 9. The outer surface of the mesh surface is cleaned from fibrous waste using a scraper 8. During the operation, a mixture of cotton and air is fed into the separation chamber through the inlet pipe. Due to the large size of the camera, the flow rate in the camera drops sharply. The bulk of the cotton is kept under the force of inertia, hitting the back wall, sliding out of it and leaving the vacuum-valve blades, while the rest of the cotton hits the surface. Cotton is separated from the surface by means of elastic scrapers, then it is put into a vacuum valve. The laws of cotton movement in a vacuum valve and the process of distributing cotton seeds by the length of the vacuum valve have not been fully studied yet.

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Unfortunately, most of the cotton that enters the cell in the CC-15A separator is absorbed by the suction force on the two sides of the air suction rods and then rubbed with the scraper.

Certainly, in this case it is not correct to say that cotton is distributed evenly by vacuum-valve working length. This results in an uneven distribution of vacuum-valve rubber blades. Cotton wipes are cleaned using a scraper and elastic grid on a net surface, which are then put into a vacuum valve.

During the cleaning, compression of the cotton piece between the scraper and net surfaces causes fracture of the seeds and separation of the cotton fiber from the seeds, that is "false" fibers, which result in the formation and loss of free fiber. Thus, the separation of cotton seeds from the air flow in the CC-15A separator results in a worsening of its natural properties and loss of fiber.

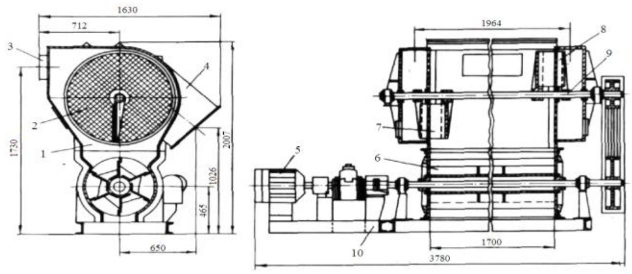

Figure 1. General view of the separator CC-15A
1. camera; 2. A net surface; 3. pipeline with cotton seeds; 4. inlet and outlet pipe; 5. Electro-structure; 6. vacuum-valve; 7. scraper; 8. scraper cleaner; 9. a vacuum valve; 10. frame

II. LITERATURE REVIEW

The most common method for analyzing foreign technology is the US Module System, which is delivered directly to a cotton processing plant and then transmitted to an indirect technology [1-4]. The transmission of this module is based on the technological process shown in Figure 2.

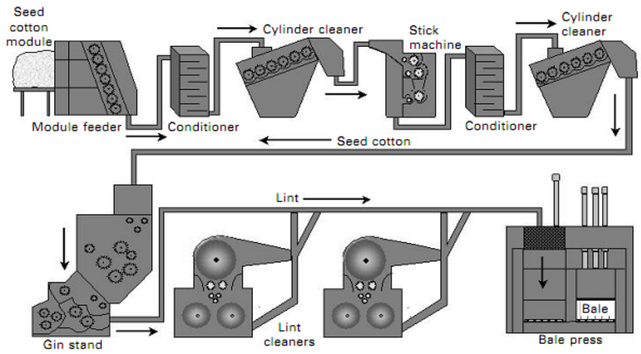

Figure 2. Modern foreign technological process in cotton processing

Figure 2 shows the technological process of drying, cleaning, and drying cotton seeds in a gin cotton mill.

The process starts with the supply module (1) (Figure 3). The main working bodies of this supply module consist of a broken section and roller platform made up of seven-piece drums.

With the drum module, one piece of cotton wraps the cotton in one direction and pneumatically drops it in the same direction. The rotation speed of the cotton module is regulated by the operator from the console. The amount of light fluctuates depending on the amount of cotton, which is converted into an electrical signal and the speed of the conveyor is changed. The cotton seeds, then transferred to the pneumatic pipe, are transmitted to the auto-fuse feeder using the separator (5). The auto-feeder (6) is a large box with vacuum valves (7) on the bottom with two-piece drum separator with a three-piece drum separator and operates automatically for normal sensors.

Cotton seed is first dried in a vertical flow dryer (8), followed by a drum gravity cleaner (9) with a pile for separation of minor impurities from cotton. The hot air is supplied by the cotton dryer. These cleaners act as normal air separators. After the cotton is cleaned from minor impurities, it falls from the major impurities to the cleaner (10). Two-section cleaners with sawed drums are used for cleaning cotton wool from major contaminants. Two-section cleaners with sawed drums are used for cleaning cotton wool from major contaminants. A regenerative drum is also placed on this cleaner to return cotton that has gone through major dirty work. After that, the cotton is dried in a 23- or 24-pane towel type dryer (11). Big "J" separator (Figure 4). This separator, with automatic cotton feed control, consists of 3 pins (2), which are partially cleaned and transferred to the pickup bunker (6). Cotton falls freely in the bunker.

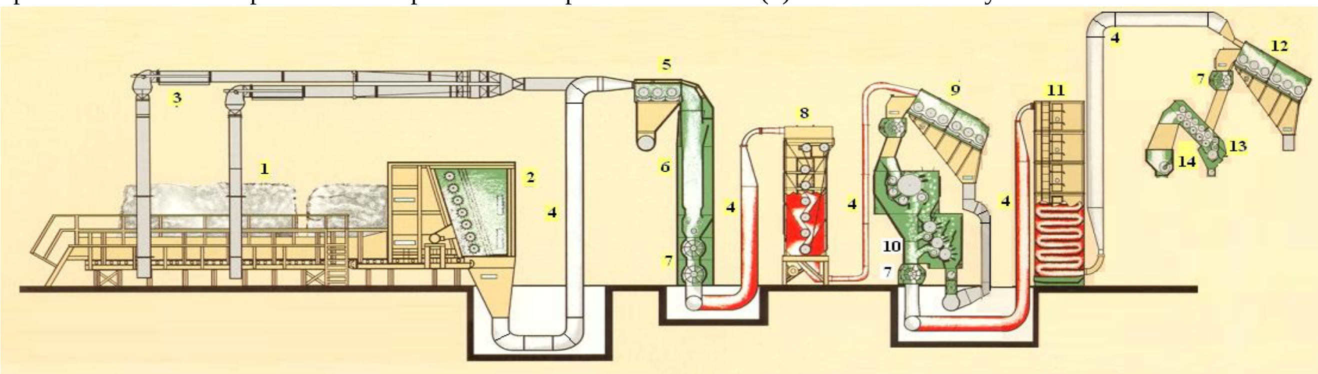

Figure 3. System of technological process for drying and cleaning of cotton seeds

1. Cotton module; 2. Module breaker section with pile drums; 4. Pneumatic tubes; 5. Separator; 6. Vacuum valves for cotton extraction; 8. Vertical flow dryer; 9. Cleaner with pile drum; 10. A drum cleaner with saws; 11. Dry tower type; 12. Drum slide cleaner; 13. Cleaner of minor and major impurities; 14. Distribution screw conveyor;

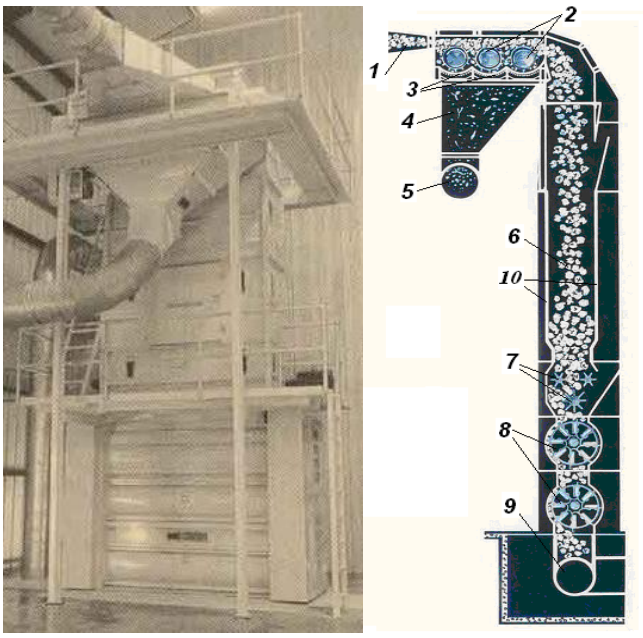

Figure 4. The technological scheme and appearance of the Separator Big "J"

1. Entrance hole; 2. Punch drums; 3. Grid surface; 4. Dirty bunker; 5. Pollution Pipe; 6. Packer-bunker; 7. Gear rollers; 8. Vacuum-valve; 9. Pneumatic cotton picker; 10. Air Pipeline.

The clogged air is removed from the bunker by means of a vertical lifting pipe (10).

Technical characteristics of the Big "J" separator

№	Name	value
1	Productivity, b / h (by fiber)	45
2	Power required, kW	7,4
3	Number of drums with pins, pcs	3
4	Diameter of the drum, m	393.7
Leading roller system:		
5	Power required, kW	2.2
6	lead roller (drum) diameter, mm	260,3
7	Gear drum diameter, mm	393.7
Vacuum Maintenance:		
8	Width, mm	2438
9	Rotor diameter with 2.9 rubber screws, mm	609.6
10	Requirements for gear drum and vacuum valve transmission power, kW	14,8
11	Vacuum valve diameter, m.	914.8
12	Pneumatic pipe diameter, mm	55.5
13	Size: B, mm E, mm U, mm	 6996 2388 3505

Cotton flows continuously into the bunker. The width of the bunker extends above the gear rollers, allowing the cotton to pass freely through the rollers. Gear rollers (7) operate at variable speeds and have a remote control system. The cotton seed inside the bunker is removed from the supply bunker with the help of vacuum valves (8) and transferred to the drying system using hot air. Cracked and controlled cotton streams ensure the efficient operation of drying and cleaning equipment and reduce the amount of clogging in the system.

MZF-15 Cotton Separator (Fig. 5). The separator structure consists of the following parts and details: incoming tube (1), barrier (2), grid drum (3), separator brush (4), vacuum valve (5), split camera (6) and base (7).

Operation: air mixed cotton enters the machine through the fast pipe (1) in 20 diam / min comes to the chamber (6). In the separation chamber, the cotton loses its initial velocity due to the sudden expansion of its inner surface, and the surface of the drum (3) drops and sticks to the surface. The cotton then rotates along the drum net, and, due to its centrifugal force and weight, separates the drum from the center and falls into the vacuum valve (5) below the interior walls of the equipment (7). The vacuum-valve delivers its load of cotton to the process at a rate of 40 cycles per minute. Minor impurities are passed through various surfaces along the air, transferred to the vacuum cleaner.

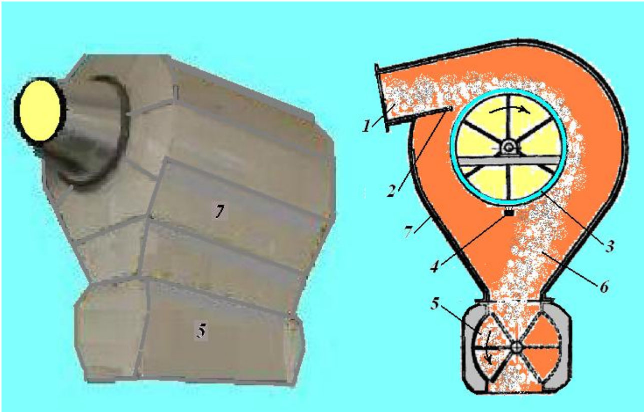

Figure 5. View of the MZF-15 cotton separator

1. Inlet pipe; 2. Stack; 3. Drum with different surfaces; 4. Separate brush; 5. Vacuum-valve; 6. Dividing camera; 7. The foundation;

The separating brush (4) retains the remaining pieces of cotton on the surface of the drum net and cleans the surface of the net, as it ensures that the air enters the drum surface.

Technical characteristics of the MZF-15 cotton separator

1	Productivity, kg/h	15000
Rotation number, rpm / min:		
5	a) drum net	20
6	b) Vacuum-valve	40
7	Gear drum diameter, mm	393.7
Circular (diameter), mm:		
8	a) drum with net	770
9	b) Vacuum - valve	680
10	c) Net holes	4.2
Exterior Dimensions, mm:		914.8
	Length	2825
	Width	1680
	Height	2500

All the separators analyzed above are widely used in the process of separating cotton from the air, with a net and a cotton separator. In this system, of course, the pressure of the cotton flow under the pressure of the air leads to fiber breakage and mechanical damage to the seeds. In order to avoid this, it is necessary to avoid the adverse effect of air pressure on cotton.

III. RESULTS AND DISCUSSION

For this reason, we have proposed the above-mentioned net surface design on the CC-15A separator and in addition the insulator type scraper [5-10].

Isolation type scraper design forms a cavity zone before the entry zone. In the cavity zone, the suction and pressure of air is 0, and the amount of pressure that presses cotton on the surface is 0.

This force is zero with F2 between the fiber and the net surface decreases friction force. This is because the cotton is made from a grid resulting in a lowering of the separation force. As a result, the cotton falling from the lattice surface falls without any effect. It is obvious that the introduction of these new devices will preserve the natural properties of cotton and increase its output by preventing fiber breakage.

Increasing the output of the fiber can be achieved by preventing the formation of short fiber and its loss.

Figure 6 shows the new device mounted on the CC-15A separator general view scheme.

Figure 7 shows the transverse section of the new isolation cell.

Figure 8 shows the axonometric longitudinal section of the new isolation chamber.

As shown in Figure 6, the main new unit consists of a separator chamber 1, incoming 2 and 3 pipes, insulator type 8 and net 6, isolation chamber 9 and vacuum valve 4.

Separator operates as follows: Separator chamber 1 with airflow through cotton seed incubator 2.

As soon as the bulk cotton enters the separation chamber, it redirects the vacuum-valve 4 at its own speed to reduce its speed and is removed from the separator by means of a vacuum-valve.

The rest of the cotton, along with the airflow, moves towards the surface of the net and clings to it with the help of air force.

The adhesive cotton is isolated from the lattice using an insulating type scraper and transferred to a vacuum valve. During the separation of cotton from the grid, the effect of air force on the previously striated cotton is lost.

This is accomplished by reducing air pressure at the expense of the isolation chamber 9 mounted on the outside of the net surface. That is, with respect to the main scraper 8 installed by the separator chamber 5, the isolation chamber 9 is set at a certain degree, depending on the direction, the angle of inclination 25° to our position.

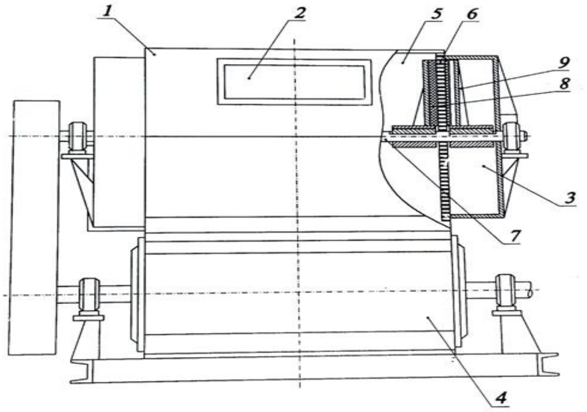

Figure 6. An overview of the new fixture mounted on the improved CC-15A separator

As a result, when the scraper (8) separates the cotton from the net surface, the insulating chamber, which is mounted on the back of the grid, covers 9 air pressure and expands the pressure of the pressurizing air to the net, which means that it absorbs the air. At the same time, the scraper (8) will separate the cotton from the net surface with fire.

Because of this, the cotton clinging to the surface of the net only breaks with the help of its own weight and falls into a vacuum valve.

As a result, the strength of friction between the cotton and net surfaces is sharply reduced, which does not result in an increase in the mechanical friction of the seeds, preventing the break of fiber and reducing the amount of fibers.

Figure 10 shows the isolation chamber positioned against the main scraper. Figures 11-12 show the separator positioning of the separator on the net surface and the isolation chamber tightly attached.

This situation was established at the Chelak cotton cleaning factory in Samarkand region, and on this basis an improved CC-15A separator was created. Of course, the study of this process also takes into account the movement and analysis of dust air from the processing of cotton. [11–15].

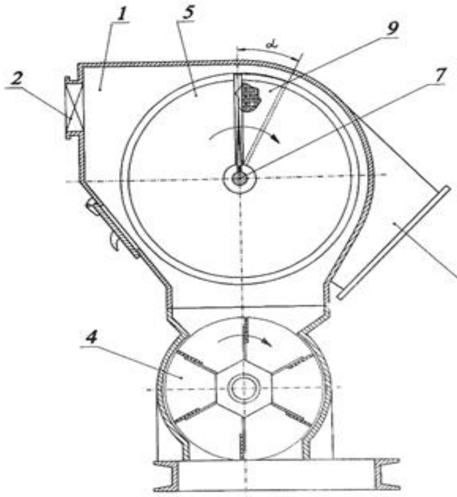

Figure 7. Cross-sectional view of the isolation chamber

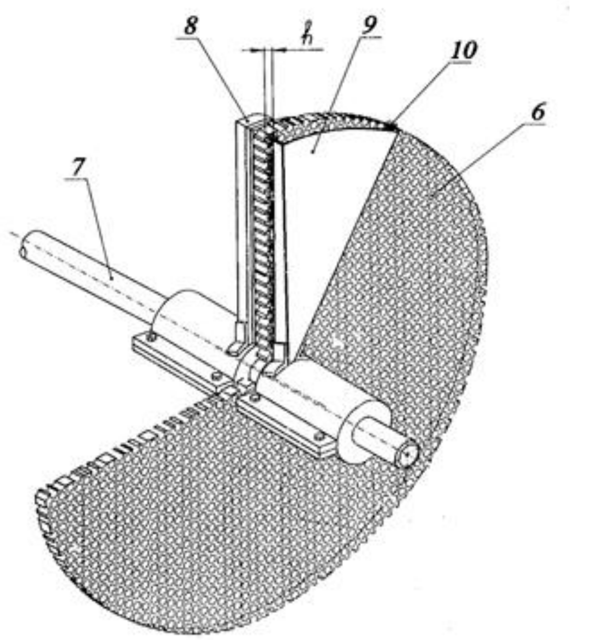

Figure 8. Axonometric view of the insulating chamber

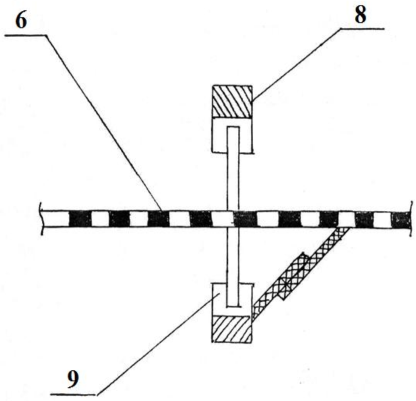

Figure 9. Longitudinal section of the insulating chamber

Figure 10. Appearance of the inner separator of the improved separator

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Figure 11. The view of a new 25 degree isolation camera

Figure 12. View of an improved CC-15A separator at the suction pipe at Chelak Cotton Plant in Samarkand Region

IV. CONCLUSION

As a result of theoretical and practical researches it can be concluded:

The laws of the *abcd* sector sectors moving at a ω speed speed to apply cotton flow Q_0 with pressure Δp on the surface of the CC-15A separator and to remove the cotton seeds stuck to the surface.

An analysis of the effect of the thickness of the cotton seeds with a slope of k and a value of $k_m = 1/(2\pi - \alpha)$.

Different performance values of the separator surface have different angularity of φ angles of cotton seeds and different values of parameter k.

Calculations have been made to determine the degree of pressure of the cotton seeds with the height of h and φ depending on the pressure changes, and the correlation of these parameters with the parameter k.

The separator with insulation chamber was created as a result of theoretical and practical research.

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