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NamMTI ILMIY-TEXNIKA JURNALI TAHRIR HAY'ATI A'ZOLARI

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ANALYSIS OF PROBLEM IN THE AERODYNAMIC SYSTEM OF COTTONSEED LINTERING EQUIPMENT IN COTTON PROCESSING PLANTS

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Abstract: The article describes the results of an analytical and experimental study of the existing disadvantages and problems of the aerodynamic systems of removing and transporting fluff from the Sawtooth in 5LP linters, which are practically diluted in cotton cleaning enterprises in the system of cotton textile clusters.

Keywords: linter, fluff, sprayer, fan, pressure, speed, coefficient, pipe, aerodynamic, performance.

Introduction. It can be observed that the batteries of linters of the 5LP, which are currently being used in the main cotton cleaning enterprises of our Republic, do not use blower VTS-8 fans, which are applied to remove the fluff from the Saw tooth. The consequence of this is that during the linterization process, complete removal of the torque from the saw cylinder teeth is not provided. A piece of torque can be observed re-entering the working chamber with saw teeth. During the linterization process, there is no complete transportation of torque in pneumatic tubes due to the uneven distribution of the pressure and amount of airflow supplied by the absorbent fan to the air chambers, and there are cases of fluff deposition at the base of each linter.

In addition to this, in the established working mode to ensure the residual fluidity that meets the requirements of the regulation, the linter's presence in the working Chamber of the linter-containing seeds in excess of the required time and the damage of the linter-produced seeds caused by meeting with the saws averaged 4.9% in high-grade seeds, the mass fraction of dirty impurities, it has been found that the mass fraction of dirty impurities and whole grains in the fluff is on average 0.8% (ABS) higher. The quality factor of the produced torque is low, corresponding to the Type B "dirty" class based on the state standard O'zdst 645-2016. In this case, the working productivity of the equipment in terms of seeds is on average 495 kg/hour, and the work in its technical characteristic is relatively low in productivity [1].

To find a solution to the issue, we will theoretically tax the aerodynamic state of the linter battery. By placing the air pipe Chamber of the coordinate head linter battery in the section of the starting part, we point the axis along the center line of the camera. We assume that the air pipe chamber changes according to the law of cross-section, the parameters of movement in its desired cross-section are: air velocity - (0 Index), let be the air flow affected by the speed with which the chamber is moving in cross-section figure 1.

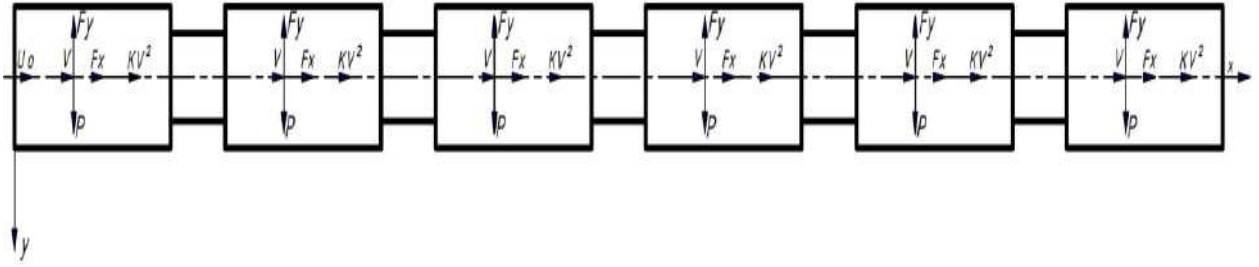


Figure 1. Battery of 6 existing 5LP linters analysis of the movement of the airway on aerodynamic air chambers

The one-dimensional equation of motion of the components of the air flow passing through the planes of incompressible fluids in cylindrical pipes [1], through the Chamber of the air pipe, can be written in the following View, based on the law of conservation of mass:

$$\rho_0 u_0 \frac{du_0}{dx} = -\frac{\rho_0}{\rho_0^{(0)}} \frac{dp}{dx} + k(u_1 - u_0) \quad (1)$$

$$\rho_0 u_0 s = u_{00} \rho_{00} s_0 = const, \quad \rho_0 = m \rho_0^{(0)}, \quad \rho_0 = \frac{m}{m_0} \rho_{00}, \quad (2)$$

here: ρ_0 , - density of air in the air duct;

$\rho_0^{(0)}$ - $x=L$ -air density along the length of the air duct in the section;

k -aerodynamic drag coefficient;

u_1 - $x=L$ -the final velocity of the air in the section;

ρ_{00} , u_{00} , - air pipe $x = 0$ air density and initial velocity at section.

Air u_{00} speed by air pipeline Q_0 (kg/s) the salary can be calculated based on the productivity of the work:

$$u_{00} = Q_0 / m_0 \rho_{00} s_0, \quad (3)$$

(2) and (3) from the equations come the following equations that determine the speed and density of air flowing through a stream of linter in the air pipe:

$$u_0 = \frac{m_0}{m} \frac{s_0}{s} u_{00}, \quad \frac{\rho_0}{\rho_0^{(0)}} + \frac{\rho_1}{\rho_0^{(0)}} = 1 \quad (4)$$

Using the expression (2), we give Equation (1) as:

$$\rho_0^{(0)} u_0 \frac{du_0}{dx} = -\frac{dp}{dx} + \frac{\rho_0^{(0)}}{\rho_0} k(u_1 - u_0) \quad (5)$$

$$\rho_1^{(0)} u_1 \frac{du_1}{dx} = -\frac{dp}{dx} - \frac{\rho_1^{(0)}}{\rho_1} k(u_1 - u_0) \quad (6)$$

From the system of equations (5) and (6) in the linter of each air pipe $\frac{dp}{dx}$ we release the air pressure and form the following:

$$\rho_0^{(0)} u_0 \frac{du_0}{dx} - \rho_1^{(0)} u_1 \frac{du_1}{dx} = \left(\frac{\rho_0^{(0)}}{\rho_0} + \frac{\rho_1^{(0)}}{\rho_1} \right) k (u_1 - u_0) = \frac{k}{m(1-m)} (u_1 - u_0), \quad (7)$$

(4) according to the equations, the density and velocities of the components in the desired cross section of each linter from the air pipe is the porosity of the medium $m(x)$ can be expressed through [1].

Cross-sectional surface of the air pipe...0.0294 m², saw cylinder length a let's assume that it will be equal to. Using Equation (7) to Equation (4), the air velocity is $u_0(x)$ after ejection satisfies the following equation:

$$\frac{dm}{dx} = \frac{P_1(m)}{P_0(m)} \frac{s'(x)}{s(x)} \quad 0 \leq x \leq L \quad (8)$$

here: $P_0 = \rho_0^{(0)} u_{00}^2 m_0^2 (1-m)^3 + \rho_1^{(0)} u_{10}^2 m^3 (1-m_0)^2, P_1 = m(1-m)$

The density of components is expressed by air using equations $\rho_0(x)$, speed $u_0(x)$, (7) and (8).

When the cross-section surface of the air pipe is equal to the length of the saw cylinder, we determine using the formula below.

$$s = \pi \cdot R^2, \quad 0 \leq x \leq L \quad (9)$$

Using equations (5) and (6) to analyze the air flow rate and pressure movement in an air pipeline designed to transport separated torque, the 5LP type linters applied to linter cotton pollen are graphed in their rational values through the Maple-6 program (Figure 2).

The graph in Figure 2 shows that when the spray fan in the linter battery of 6 linters in the system is compressed from the installed side, it was known that the air in the first linter pipe has a speed of 20.06 m/s, dynamic pressure of 24.6 kg/m² and static pressure of 180 kg/m², the speed in the air chamber.

The calculation is performed in the following parameters $m_0 = 0.82p, u_{00} = 20 \text{ M/c}, u_{10} = 2,93 \text{ M/c}, \rho_{00} = 1,2 \text{ kg/M}^3, a = 1.4 \text{ M}, h = 1,4 \text{ M}, L = 15 \text{ M}, p = 24,6 \text{ kg/M}^2, S_0 = 0.0294 \text{ M}^2, Q_0 = 1.1 \text{ M}^3 / \text{c}$

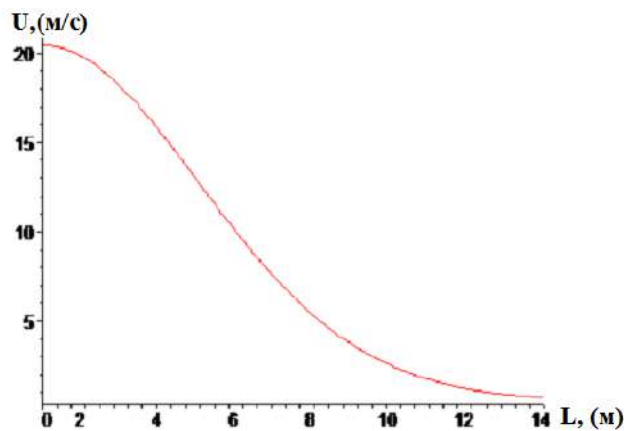


Figure 2. The battery of the 6 existing 5LP linters is the speed of the air in aerodynamic air chambers $u_0 = 20 \text{ m/s}$ value and dynamic pressure $P = 24,6 \div 0,52 \text{ kg/m}^2$ the first and sixth linters in their quantities in the range are the change graph in the xavo cameras

From this it can be concluded that in aerodynamic mode on a battery of 6 existing linters, har does not give the opportunity to completely remove the bubbles separated from the saw cylinder of one linter and deliver them to the absorption pipe, that is, at the expense of a sharp decrease in the air flow rate, static and dynamic pressure are also reduced and we can see from Figure 2. This results in a state of re-entrainment of pollen-separated vesicles into a re-entrainment vesicle chamber, resulting in a decrease in linter-to-wax work productivity.

We received the following results when we studied the air pressure, speed and consumption in the aerodynamic system of the linter battery at the cotton ginning enterprise "Qadir textile cluster" LLC in the Oltinkol District of the Andijan region (Table 1).

Table 1. Aerodynamic dimensions of the battery of linters at the cotton ginning enterprise "Qadir textile cluster" LLC in the Oltinkol District of the Andijan region

Equipment installation procedure	Pipe diameter, mm	Static pressure, kg/m ²	Mean dynamic pressure, kg/m ²	Airspeed, m/s	The amount of storage costs, m ³ /s	Air Spray Equipment name
After 1 linter	355	-2,0	7,56	11,11	1,1	
After 3 linter	500	-9,0	17,39	16,84	3,3	Y1 BLI
After 6 linter	800	-15,0	9,92	12,72	6,4	

According to the data in the table, when the static pressure in the air chambers averages around 170–180 kg/m², the 5LP-type linters completely remove the lint from the saw teeth of the saw cylinder. In this case, the amount of air extracted from each linter averages about 1.1 m³/s.

From these results, it can be concluded that to ensure the required static pressure and air volume for a 5LP battery consisting of six machines, the Y1 BLI fan must be used.

Based on the above analysis, it can also be concluded that, at present, not enough attention is being paid to improving the systems that remove lint from the saw teeth during the linting process and transport it through pneumatic pipelines. In reality, research in this area should continue, because improving this system will increase the productivity of lint removal, reduce air consumption in the aerodynamic regime - thereby saving electrical energy-and improve the sanitary conditions of the linting workshop.

Methods: One of the main drawbacks of the aerodynamic regime developed and tested at the "Qadir Textile Cluster" LLC cotton-processing plant, which belongs to the "Pakhtasanoat" association in the Oltinko'l district of Andijan region, is the inability to achieve perfectly uniform adjustment of air volume and pressure in the air chambers of each linter within the linter battery.

This occurs because when one or several linters in the battery are not operating (due to stoppages, maintenance, replacement of the saw cylinder, etc.), the amount and pressure of air distributed to the remaining linters change. In such situations, the system

has to be re-adjusted. In addition, the design of the pneumatic pipeline system has become highly complex.

Results: According to the research findings, in the linter battery consisting of six linters, the airflow parameters measured from the side where the blower fan is installed show that in the air duct of the first linter, the air velocity is 20.06 m/s, the dynamic pressure is 24.6 kg/m², and the static pressure is 180 kg/m². However, by the time the airflow reaches the air chamber of the sixth linter, the velocity decreases to 2.93 m/s, the dynamic pressure to 0.52 kg/m², and the static pressure to 140 kg/m².

Discussion of Results: The conducted research shows that in the aerodynamic regime of the six-linter battery, the stability and uniform distribution of the airflow are not ensured. Although the air supplied by the blower fan has sufficient velocity and pressure in the first linters, as it moves through the linter sequence, both its velocity and its static and dynamic pressures sharply decrease.

The air velocity of 20.06 m/s in the first linter creates favorable conditions for the linting process; however, the decrease to 2.93 m/s in the sixth linter indicates that the airflow is no longer sufficient to effectively remove and transport the lint from the saw teeth. The corresponding reduction in static and dynamic pressure confirms that the kinetic energy of the airflow is inadequate, leading to inefficient pneumatic transportation of lint in the later stages of the linter battery.

This instability of airflow negatively affects the productivity of the linters. Since a portion of the separated lint is not sufficiently extracted, it may fall back into the seed-roller chamber, reducing both lint quality and the overall operational efficiency of the linters. Furthermore, the practical impossibility of adjusting air volume and pressure individually for each linter increases the technological unreliability of the system and complicates operation and maintenance.

One of the key reasons for these issues is the complexity of the pneumatic pipeline system and the uneven distribution of air across the linters. Therefore, it is necessary to optimize the current design, stabilize air distribution, and ensure individual aerodynamic parameters for each linter through scientific and practical improvements.

Conclusion: From these results, it can be concluded that the existing aerodynamic regime in the six-linter battery does not allow complete removal and delivery of lint separated from the saw cylinders to the suction duct. The sharp decrease in air velocity leads to a reduction in both static and dynamic pressure, and as shown in Figure 2, the airflow becomes insufficient to blow the separated lint through the consecutively arranged linter chambers. As a result, part of the lint separated from the cottonseed may fall back into the seed-feeding roller chamber, leading to a reduction in the lint-processing productivity of the linters.

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