CALCULATION OF THE POINT CONTACT FORCE OF A PIECE OF COTTON AND THE TENSION GENERATED IN THE FIBER BUNDLE UNDER THE EFFECT OF SCRAPING

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Abstract. *Graphs of the dependence of the tension force created by an external pressure air flow on the speed of rotation of the scraper were obtained for the condition of a constant speed of movement of a cotton piece along the scraper under the influence of external pressure, point traction force and gravity.*

Keywords: *waste, seeds, cotton, fiber, separator, speed, trajectory, particle, graph, line, guide, resistance, density, point, tension, arc, force, contact, equation.*

Introduction. Cotton is constantly in contact with the mesh surface during movement. Under the influence of external pressure, the process of friction of some cotton fibers in the holes on the surface of the mesh creates a stretching force, and under its influence, the fibers are in a state of stretching, and high values of the force can be observed in cases of damage or breakage. 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.1).

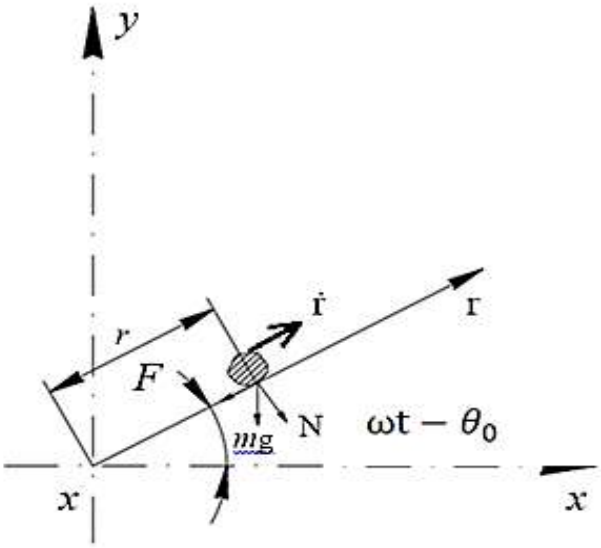

Figure 1. Scheme of movement of the particle along the scraping surface.

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, *or* 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.

1. Particle gravity. It is a p projection of force or in a direction.

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

2. $\dot{r}$ > 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

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

Here: f0 - 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 in paragraph.

$$T = T_D = T_A \frac{\cos\gamma_1 + f\sin\gamma_1}{\cos\gamma_2 - f\sin\gamma_2} \qquad (1)$$

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

$$m\ddot{r} - m\omega^2 r = -mg[\ \sin n(\omega t - \theta_0) + f_0\cos(\omega t - \theta_0)]$$
$$-2f_0\dot{r}\omega m - f_0 p_0 S + T_D \qquad (2)$$

(2) 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 acceleration at the values of r=r 1, (r 1 - the radius of the cutting edge), r˙ =0 at a t=0 . Using the equation ˙r˙(2), we 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)

$$T_D < T_D^* = m\omega^2 r_0 - f_0 p_0 S - mg(f_0\cos\theta_0 + \sin\theta_0) \qquad (3)$$

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

$$T_A < T_A^* = (\cos\gamma_2 - \mu\sin\gamma_2)(m\omega^2 r_1 - f_1 p_0 S - mg(f_1\cos\theta_0 + \sin\theta_0)/(\cos\gamma_1 + \mu\sin\gamma_1) \qquad (4)$$

Figure 2. 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 , θ0 = 0 , r 0.005м 0 = , p_0 =1200 Pa accepted in accounts .α = 0

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

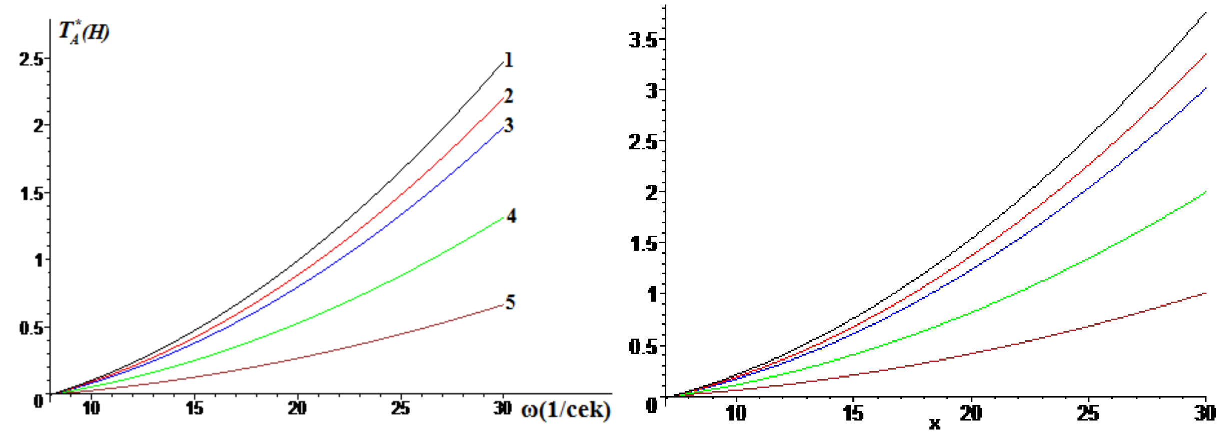

Figure 2. Graphs of the relationship between the tension force generated on the outer surface of the mesh surface under the influence of suction T_A* pressure and p_0 the scraper rotation speed at different values of ω (1/ sek) the particle mass m(kg) and the friction coefficient between the mesh surface holes and the fiber.

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

From the analysis of the graphs in Figure 1, 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_A* 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 ω < 7(1/ sek) is equal to zero if the scraper has a rotational angle in the obtained parameters.

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

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.

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. 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.

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.

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.

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.

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.

Conclusion. 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.

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