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SIMULATION OF THE MOVEMENT OF THE FIBROUS MASS IN THE ZONE BETWEEN THE ROTATING ROLLERS OF THE GIN FEEDER

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Мақолада аррали жинлаш жараёнига пахта хом-ашёсини узатиш жараёни тахлил қилинган. Қозиқчали барабанга жиннинг маълум параметрлари орқали узатиладиган пахта хом-ашёси миқдорини аниқлаш модели ишлаб чиқилди.

В статье проанализирована подача хлопка-сырца на пильное джинирование. Разработана модель для определения объема хлопка -сырца, которая передается через определенный параметр на колковый барабан джина.

The article analyzes the supply of raw cotton for sawing ginning. A model has been developed to determine the volume of raw cotton, which is transmitted through a certain parameter to the gin's bell drum.

The movement of the fibrous mass between the rotating rollers will be studied in accordance with the model proposed in the work [1]. In contrast to these works, the fibrous mass is taken as a compressible medium, the state of the criterion is determined by the pressure, which is determined through the mass density of the cotton. those. $P = \dot{P}_0 = f(\rho - \rho_0)$ $\dot{P}_0$ – pressure and densities in the initial state. This dependence was obtained on the basis of experimental data obtained for raw cotton in the work [2]. In addition, we consider that lateral pressure acts on the contact surface of the fibrous mass with the rollers k.r. (k – side pressure coefficient).

Fig.1., set the origin at the point O, and direct the axis OX vertically up. The area of motion of the mass is divided into two parts. In the first 0 < x < a, we write the motion and the equation in the form:

$$\rho S V \frac{dV}{dx} = -\frac{d}{dx}(Sp) + \frac{kp(\sin\alpha + f\cos\alpha)}{L} + \gamma S \qquad (1)$$

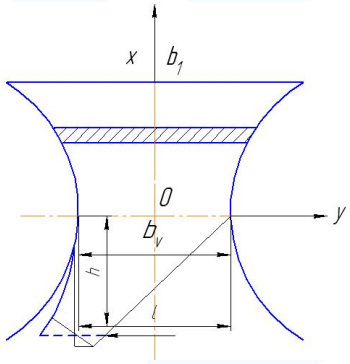


Fig.1.

In the second part, the mass is stretched under the influence of impact, at which a piece is separated from the main mass. Depending on the shape of the feeder blades, the mass may partially compress and compact when stretched. The mass and volume of the torn off piece depends on the length of the canvas fed in the impact zone (ribbons), density, blade shape and speed [3].

In the general case, the description of the equation for the separation of a piece from the main mass and the formulation of the equation for its movement is difficult, therefore, here we use an

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approximate representation of the model for the formation of a portion of cotton and its division into parts.

We will assume that the mass of cotton is an extensible mass, one end of which, under the action of the feeder blade, acquires speed V_1, other end, entering from the compression zone has a speed $V_2 = V_0 \sin \omega t$ (Fig,2), where V_0, — mass exit velocity from this zone (Fig.2).

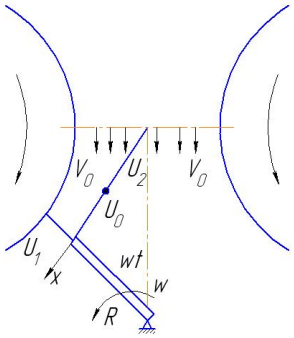


Fig.2.

$R = 0.2m, l = 0{,}01\text{m}, n = 8tur/\text{min}, \omega_1 = 450 - 550\ \text{tur/min}, \omega_2 = 500 - 700\ \text{tur/min}$

Let us direct the OX axis along the thread, setting the origin of coordinates at the point where the mass exits the compression zone. Consider two cases of modeling the process of stretching the canvas and the formation of a shred after hitting it with a knife. Denote u_1 and u_2 movement of the pulp at the point of capture then and at the point of exit from the compression zone.

According to the adopted scheme, the canvas has a constant speed before tearing off V_0 and its displacement, taking into account the force of weight, will be equal to:

$$U = \frac{\gamma}{2E} x(x - 2V_0 t) + V_0 t \qquad (2)$$

where: $\gamma = \text{рд}$ — canvas specific gravity, E — Young's modulus cotton mass material. The amount of deformation is calculated by the formula:

$$\frac{du}{dx} = \frac{\gamma}{E}(V_0 t - x) \qquad (3)$$

We see that the greatest tension takes place at the exit point from the compression zone and is equal to

$$\varepsilon_{\max} = \frac{\gamma}{E} V_0 t \qquad (4)$$

At the point in time t=ts, maximum stretch reaches limit value $\varepsilon_{\max} = \varepsilon_s$, at which the canvas is torn off, and thus a piece is formed. This time will be:

$$t_s = \frac{E}{V_0 \gamma} \varepsilon_s = \frac{E}{\gamma V_0} \varepsilon_s \qquad (5)$$

In this case, the mass of the formed piece will be equal to:

$$m_s = \varepsilon_s \frac{ES}{g} \qquad (6)$$

We assume that the blow to the cotton is made at the moment $t = t_0 < t_s$

In the future, gravity affects the elongation of the canvas. Then, before the impact, the mass will not be in a stretched state and its length will be equal to:

$$l = V_0 t_0 \qquad (7)$$

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After the impact, the movement of the canvas points is determined by the formula:

$$U = V_0 t_0 + (t - t_0)\ R\omega k \frac{l - x}{l} + V_0 \sin \omega t \frac{l - x}{l} \quad (8)$$

where: R— shred radius, ω — its angular velocity; к— parameter that takes into account the shape of the tuft and the friction between the tuft of cotton.

The elongation of the mass of cotton can be determined by the formula:

$$\frac{du}{dx} = (t - t_0)\ \frac{R\omega k}{l} - V_0 \sin \omega t \frac{1}{l} \quad (9)$$

Assuming $\frac{du}{dx} = \varepsilon_s$, determine the time of separation of the mass of cotton and the formation of a shred $t = t_s$

$$(t_s - t_o) \sin \omega t_s + \frac{R\omega k}{l} = \varepsilon_s t_0 \quad (10)$$

The total length of the barb after impact will be determined by the formula:

$$h = V_0 t_0 (1 - \varepsilon_s) \quad (11)$$

In this case, the mass of the separated piece will be equal to:

$$ms = \rho h S = V_0 t_0 (1 + \varepsilon_s) S\rho \quad (12)$$

The resulting equation will allow you to calculate the mass of cotton fed to the peg drum with known values of the parameters of the gin feeder, optimize the feeder operating modes depending on the performance of the machine.

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