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DETERMINATION OF THE FORCES OF INTERACTION OF THE RAW MATERIAL WITH THE SAW CYLINDER

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A R T I C L E I N F O.

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Abstract

It‟s necessary to study a roller‟s movement and its mechanical properties for alternative provision in cotton ginning process. As a‟ roller of raw material has not the same sort of cylindrical capacity has taken as an environment in the article. Equation of this environment is compound its position can be known of its structure. Two layer concen-elastic trated cylinder and roller‟s position was determined the average by mechanical parameters

It is of particular importance to study the state of raw materials as a changing and moving environment in the alternative provision of the ginning process. Some properties of the raw material, laws of speed distribution on its surface profile Miroshnichenko G.I., Tillaev M.T. and analyzed by others. The composition of the roller is composed of a complex environment, and its physical and mechanical properties have not been sufficiently studied. According to experts, most of its composition consists of hairless or short hairy seeds, which occupy the inner zone of the roller.

The seed cotton raw materials mainly occupy the outer shell of the roller.

When determining the condition of raw materials, we pay attention to the following aspects

1. The raw material shaft rotates under the influence F of the saw cylinder. External horizontal reaction and vertical Q forces acting on the saw cylinder create a torque that L rotates the shaft.

2. The strength of the raw material shaft to the saw cylinder F'. This force resists the sliding of the roller and partially causes the fiber to separate from the surface of the raw material.

3. Normally distributed forces generated by the raw material reaction on the contact surface of the saw cylinder and the raw material. The specific pressure created by these forces p is constant along the direction of the roller and the saw cylinder, and this pressure depends on the distance from the axis of the raw material to the plane perpendicular to it. The front layer of the area formed by the raw material roller of the saw cylinder is from the plane passing through the axes of the saw cylinder and the raw material roller ξ distance will be the extracted part. $\xi = \xi_1 > 0$ the beginning of mutual contact of both cylindrical surfaces, $\xi = \xi_2 < 0$ marks its end.

The balance of forces acting on the saw cylinder is as follows:

$F' - F = 0$, $Q - \int_{\xi_1}^{\xi_2} bp(\xi)d\xi = 0$, $FR_a - L + \int_{\xi_1}^{\xi_2} b\xi p(\xi)d\xi = 0$ (2.1)

Here FR_a – useful resistance torque, and this integral

$$M = \int_{\xi_1}^{\xi_2} b\xi \cdot p(\xi)d\xi \qquad (2.2)$$

swaying (kacheniya) friction moment. For the generation of such a moment, the following condition must be fulfilled

$$F' = F \angle f \cdot Q \qquad (2.3)$$

Here: f is the coefficient of friction between the sliding saw cylinder and the surface of the raw material roller, otherwise the saw cylinder slides along the surface of the roller. The inequality (2.3) is always valid in case of gear saw cylinder. Its highest point in the rotation of the saw cylinder A from the surface of the roller y_0 will be at a distance. This distance, in turn, gives the distance of approach of the raw material shaft to the axis of the saw cylinder.

Now centers ($(O_1, R_1 + y_0)$), (O_1, R_2) we see the equations of the circle at the points.

$y_1 = -R_1 + \sqrt{(R_1 + y_0)^2 - \xi^2}$; $y_2 = R_2 - \sqrt{R_2^2 - \xi^2}$; $R_1 = R_c$, $R_2 = R_a$

The distance of approach to the axis of the sawed cylinder at an arbitrary point of the raw material shaft is as follows.

$$y = y_1 - y_2 = -R_1 + \sqrt{(R_1 + y_0)^2 - \xi^2} - R_2 + \sqrt{R_2^2 - \xi^2}$$

Based on the following conditions:

$$\left(\frac{\xi^2}{2R_2}, \frac{\xi^2}{2R_1}\right) << 1 \left(\frac{\xi^4}{4R_2^4} = 0; \frac{\xi^4}{4R_1^4} = 0\right), \left(\frac{\xi^2}{2R_2}, \frac{\xi^2}{2R_1},\right) << 1,$$

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$$y = y_0 - \frac{R_2 + R_1}{2R_2R_1}\xi^2 \qquad (2.4)$$

The convergence of the saw cylinder at the point of initial contact with the raw material is zero, therefore $u = 0$ агар $\xi = \xi_1$ if, then $0 = y_0 - \frac{\xi_1^2 \alpha}{2R_1}$ ($\alpha = (R_1 + R_2)/R_2$) is and we get the following relation. $y_0 = \frac{\alpha \xi_1^2}{2R_1}$

At the point where the roller comes out of contact with the saw cylinder, the value of their convergence may not be zero in general, but the pressure is zero because the roller is separated from the saw at this point. So we can write. $p(\xi_2) = 0$

The starting point of the approach $\xi = \xi_1$ when it comes to, the pressure at this point is equal to zero or can vary depending on the state of deformation of the raw material. If its deformation obeys Winkler Voigt's law [4] (medium prone to relaxation), then we can get the following expression for pressure.

$$p = Ky + \mu \frac{dy}{dt} \qquad (2.5)$$

Here is K the virginity module, μ- damping coefficient of the raw material $y, \frac{dy}{dt}$, y0 taking into account the expressions of , according to (4) and (5), we find the following connections.

$$p = K\frac{\alpha}{2R_1}\left(\xi_1^2 - \xi^2\right) + \mu\frac{\alpha\omega_1 R_1}{R_1}\xi = \frac{K\alpha}{2R_1}\left(\xi_1^2 - \xi^2\right) + \mu\alpha\xi\frac{c}{R_1}$$

The expression of the vertical force acting on the saw cylinder is as follows.

$$Q = \int_{\xi_2}^{\xi_1} bp(\xi)d\xi = b\alpha\left[K\left(\frac{\xi_1^3}{2R_1} - \frac{1}{6R_1}\xi_1^3\right) - K\left(\xi_2\frac{\xi_1^2}{2R_1} - \frac{1}{6R_1}\xi_2^3\right) + \mu\frac{c}{2R_1}\left(\xi_1^2 - \xi_2^2\right)\right]$$

and buckling resistance moment.

$$M = \int_{\xi_2}^{\xi_1} bp(\xi)d\xi = b\alpha\left[K\left(\frac{1}{4R_1}\xi_1^4 - \frac{1}{8R_1}\xi_1^4\right) - K\left(\frac{1}{2}\frac{\xi_1^2}{2R_1}\xi_2^2 - \frac{\xi_2^4}{8R_2}\right) + \mu\frac{c}{3R_1}\left(\xi_1^3 - \xi_2^3\right)\right]$$

This equation

$$p(\xi_2) = \frac{\alpha K}{2R_1}\left(\xi_1^2 - \xi_2^2\right) + \alpha\mu\frac{c}{R_1}\xi_2 = 0 \qquad (2.6)$$

taking into account, we can write:

$$Q = \alpha b\left[\frac{K}{R_1}\frac{1}{3}\left(\xi_1^3 - \xi_2^3\right) + \mu\frac{c}{2R_1}\left(\xi_1^2 + \xi_2^2\right)\right] \qquad (2.7)$$

$$M = \alpha b\left[\frac{K}{R_1}\frac{1}{8}\left(\xi_1^4 - \xi_2^4\right) + \mu\frac{c}{6R_1}\left(2\xi_1^2 + \xi_2^3\right)\right] \qquad (2.8)$$

The shaking power is determined using this formula:

$$F = \left(L - M\right)/R_1, F < fQ \qquad (2.9)$$

This condition must be met to ensure that the saw cylinder moves without slipping $L > M$ must Thus, in order to ensure the contact in the indicated mode and to move the saw cylinder in the required condition of interaction with the raw material shaft, the externally applied moment must satisfy this inequality: $M < L < M + fQR_1$

If no vertical external force acts on the raw material shaft, then Q force is equal to its weight, i.e $Q = mg$ (m -roller mass) (2.6) ва (2.7) from formulas ξ1 и ξ2, identify

(2.8) we find the moment M of sway $\xi_2 = -\xi_0 R_1$ ($\xi_0 > 0$) and (2.6) equation ξ_1 we will solve relatively

: $\xi_1 = \sqrt{\xi_0(\xi_0 + 2\beta)}$

and putting its expression in equation (2.7). ξ_0 we get the following equation for:

$$\xi_0(\xi_0+2\beta)\sqrt{\xi_0(\xi_0+2\beta)}+\xi_0^3+3\beta\xi_0(\xi_0+\beta)-3\lambda/\alpha=0$$

Here: $\beta=c\mu/KR_1$, $\lambda=Q/KR_1^2b$

dimensionless parameters relative external force $\lambda=Q/KR_1^2b$ and the quoted drag coefficient

$\beta=c\mu/KR_1$ coordinates for ξ_1, ξ_2, to move

y_0 and resistance torque values of are given. From the analysis of the calculation results presented in the table λ at small values of β coordinate of the parameter

ξ_1 It can be seen that the values of Parameter

λ as it increases (for example, external force

Q with increasing) coordinates ξ_1 ва ξ_2 the difference between them decreases.

Summary

1. Raw materials in the process of aging are divided into two based on the theory of close environments
2. It is considered as a layered cylinder and its deformation state is studied
3. To determine the mechanical parameters of the cylinder, it is proposed to use effective Young's and displacement modules
4. Based on the calculation results, it was determined that the thickness of the layer and its mechanical properties can greatly influence the stress value in the layer.

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