DETERMINING THE DEPENDENCE OF THE VIBRATIONS OF THE REFLECTOR MOUNTED ON THE COTTON FINE DETERGENT ON THE IMPACT FORCE OF THE COTTON AND THE MASS OF THE REFLECTOR

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Abstract:

The article obtained mathematical models representing the vibration of the reflector mounted on a cotton ginning device. Based on the numerical solution of the problem, graphs of the dependence of the defined parameters were constructed, as a result of their analysis, the optimal values of the parameters were obtained and recommended for the design of the purifier.

Key words.

Small contaminant cleaner, reflector, spring, mass, dissipation, law of motion, vibration, amplitude, velocity coverage, cleaning effect.

Introduction

The ginnery UHK has been widely introduced in ginneries. The UHK unit is a serially installed system, which includes sections for cleaning cotton raw materials from small and large contaminants. The ginnery UHK has been widely introduced in ginneries. The UHK unit is a serially installed system, which includes sections for cleaning cotton raw materials from small and large contaminants. It was found that the cleaning efficiency is high when the raw cotton is well ground.

Materials and Methods

A refiner was recommended to improve the ginning process when cleaning raw cotton on a 1XK device. In the fine debris removal zone of the recommended cotton gin, the cotton pieces from the supply rollers fall into the third pile drum. The drum pegs carry cotton pieces from above [1, 2]. In this case, some pieces of cotton are hit on the reflector at high speed. As a result, the reflector vibrates due to deformation of the spring. The pieces of cotton that come in hit the reflector with varying strength. As a result, mainly fine wastes from cotton are separated. Then the cotton pieces fall onto the pile drums. They are then transported through a mesh surface and cleaned of debris again. Therefore, to determine the laws of vibration of the reflector when cotton pieces are exposed to the reflector, It is important to select their optimal values based on the analysis of the connection graphs of the parameters. The reflector design and calculation scheme Figure 1a shows the reflector scheme, and Figure 1b shows the calculation scheme representing the oscillation of the reflector.

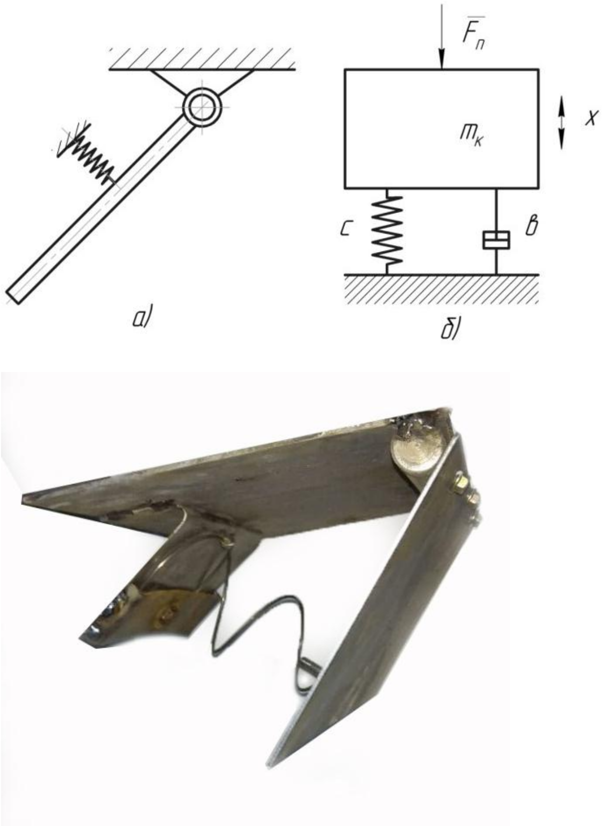


Figure 1. The constructor (a) and calculation scheme (b) of the reflector, the appearance of the reflector s.

s)

Results

The circuit for calculating the oscillation of the reflector is basically a one-mass system. We determine its motion using Lagrange's second-order equation [3,4].

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{q}}\right) = \frac{\partial T}{\partial q} - \frac{\partial \Pi}{\partial q} - \frac{\partial \emptyset}{\partial \dot{q}} + Q(q) \qquad (1)$$

Here, T, P are the kinetic and potential energies of the system, Ф- The dissipative function of the relay, -time, -generalized force.tQ(q)

Based on the calculation scheme of the reflector shown in Figure 1.1.b, based on its kinetic and potential energies, as well as the dissipative function of the relay, we form a differential equation representing the vibration of the reflector of the cotton gin:

$$m_{ц}\frac{d^2x}{dt^2} + Cx + b\frac{dx}{dt} = F_{no} + F_1\sin(\omega t) \qquad (2)$$

We make the following assignments:

$$K^2 = \frac{C}{m_K};\ 2n =;\ ;\frac{b}{m_K} h_1 = \frac{F_{no}}{m_K}\ \ h_2 = \frac{F_1}{m_K};$$

then (2) takes the following form;

$$\frac{d^2x}{dt} + 2n\frac{dx}{dt} + K^2x = h_1 + h_2\varepsilon_n(\omega t) \qquad (3)$$

In this case, using the method given in [5], we obtain the following solution of (3):

$$x = e^{-nt}(x cos\sqrt{k^2-\omega^2 t} + \frac{nx_0+\dot{x}_0}{\sqrt{k^2-\omega^2}} sin\sqrt{k^2-\omega^2 t} - \frac{h_2 e^{-nt}}{\sqrt{(k^2-\omega^2)^2+\varphi n^2\omega^2}} \cdot [\sin(\omega t - -arctg\frac{2n\omega}{k^2-\omega^2}) \cdot cos\sqrt{(k^2-\omega^2)t + \frac{\omega\cos\left(\omega t - arctg\frac{2n\omega}{k^2\omega^2}\right)+n sin\left(\omega t - arctg\frac{2n\omega}{k^2-\omega^2}\right)}{\sqrt{k^2-\omega^2}}} \cdot sin\sqrt{k^2-\omega^2}t + h_1 + \frac{h_2}{(k^2-10^2)+\varphi n^2\omega^2}[(k^2-\omega^2)\sin(\omega t) + 2n\omega\cos(\omega t)] \qquad (4)$$

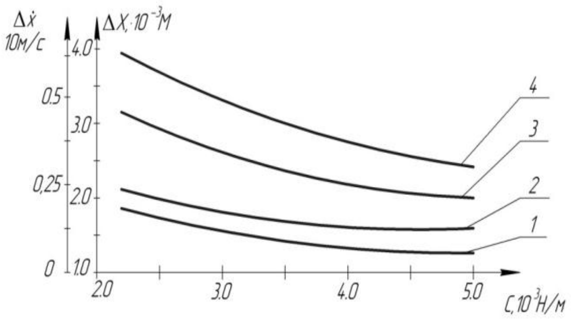
Discussion

The analysis of the resulting solution (4) showed that the values of the first two additions tend to zero with increasing time, so that the third and fourth additions of the solution in constant motion of the reflector remain, i.e., the impact force from the cotton determines the law of motion. However, it can be noted that the solution of (4) corresponds to the oscillation of the reflector in real conditions. Therefore, the following initial values of the reflector parameters were taken into account in the numerical solution of (4):

$$\omega = 50.24C^{-1};\ m_{ц} = 0.85 \cdot кг;\ F_{no} = (1.2 \div 2.1)H;\ \delta(F_{no}) = (0.08 \div 0.13)H;$$
$$C = (3.5 \div 4.5) \cdot 10^3 H/м;\ b = (3.7 \div 4.1)Hc/м$$

Based on the numerical solution of the problem, the oscillation laws of the reflector were determined.

It is known that due to the choice of the reflector spring, it will be possible to change the law of its vibration. As the spring stiffness increases, the vibration amplitude decreases. Figure 2 shows graphs of the dependence of the change of cotton swing displacement, velocity vibration coverage on the spring virginity coefficient. The analysis of the springs showed that when the coefficient of virginity of the reflector spring increases from 2.3·10^3 N/m to 5.0·10^3 N/m, the shear oscillation coverage of the cotton reflector decreases in a nonlinear pattern from 1.44·10^{-3} m to 0.78 ·10^3 m, when Fn = 1.5 N (0.09) N. However, it can be seen that the values decrease from 1.81·10^3 m to 103 m as the impact force increases further. Hence, it is expedient to do this by changing the coefficient of virginity of the reflector spring to determine the required vibration limits of the cotton reflector (Figure 2 and 4 graphs). Therefore, it is recommended to take the ginner's cotton return device in the range of virginity coefficient (2.4).$\div$ 2.9 $\cdot 10^3$N/м



$1 - \Delta x = f(\mathrm{C}) - F_n = 1.5\ N \pm (0.09 \div 0.12)N;$

$2 - \Delta x = f(\mathrm{C}) - F_n = 2.0\ N \pm (0.11 \div 0.14)N;$

$3 - \Delta\dot{x} = f(\mathrm{C}) - F_n = 1.5\ N \pm (0.09 \div 0.12)N;$

$4 - \Delta\dot{x} = f(\mathrm{C}) - F_n = 2.0\ N \pm (0.11 \div 0.14)N;$

Figure 2. Graphs of the dependence of the vibration coverage and vibration velocity coverage of the cotton reflector on the spring virginity coefficient

Conclusion

In order to clean the cotton from fine impurities, a mathematical model was obtained, which represents the vibration of the reflector with a spring shock absorber in the working zone.

Excessive vibration speed can cause seed breakage and cotton fiber damage. Therefore, in order to ensure that ni is in the range of (2.0) and m / s) in the range of m / s, it is expedient that the impact force of the cotton does not exceed (2.1÷2.4) N, i.e. the yield does not exceed (5.06.0) t/s. Δx of $(2.0 \div 3.0) \cdot 10^{-3}$ m and $\vartriangle \dot{x} \leq (4.8 \div 5.2)$ m/s it is recommended to take the ginner's cotton return device in the range of virginity coefficient (2.4).÷ $2.9 \cdot 10^3$ N/m

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