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ANALYSIS OF DEPENDENCE ON THE PARAMETERS OF THE ANGLES AND LOADINGS OF THE CONVEYOR SHAFT AND THE DRUM SET WITH A CURVED PILE AFTER CLEANING COTTON FROM SMALL IMPURITIES

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Abstract: The article provides a justification of the recommended values based on the analysis of the graphs of dependence of the vibration coverage and loads of the curved pile drum and the angular velocities of the drive shaft on the rotation stiffness and moment of inertia of the belt drive.

Keywords: Cotton, lint contamination, drum, inclined grid, electric motor, rotor, machine unit, operational law, loading, technological resistance, torque, angular velocity, humidity, purity, dissipation, cleaning efficiency.

Introduction. A drum-type construction with inclined grids for cleaning lint from cotton is recommended to prevent lint contamination. [1.2] The validation of the cleaning efficiency and the determination of the angular velocity of the inclined grids and the rotor of the cleaning machine unit are also important because they ensure cleaning efficiency. Therefore, the machine unit of the cleaning process is dynamically simulated.

In this regard, the mathematical model of the cleaning machine unit was developed using Lagrange's second-order equations. This includes the calculation based on the mechanical static characteristics of the asynchronous electric motor."

Methodology & empirical analysis. A system of differential equations representing the movement of the cleaning machine unit [3,4,5,]

$$J_{ю}\ddot{\varphi}_{ю} = M_{ю} - b(\dot{\varphi}_{ю} - U_{юб} * \dot{\varphi}_{б}) - c(\varphi_{ю} - U_{юб} * \varphi_{б});$$
$$J_{б}\ddot{\varphi}_{б} = U_{юб}[b(\dot{\varphi}_{ю} - U_{юб} * \dot{\varphi}_{б}) + c(\varphi_{ю} - U_{юб} * \varphi_{б}) - (M_0 + M_1 sin\omega t \pm \delta M_0) \dots\dots\dots\dots] \quad (1)$$

Here: $M_{ю}$, M_H, M_k- driving torque on the shaft of an asynchronous electric drive, its nominal and critical values; S, S_k- slip coefficient of the electric drive and its critical value; $\dot{\varphi}_H$ $\dot{\varphi}_0$- angular velocities of the nominal and ideal mode of the drive rotor; active and inductive resistances in r, r_u-short circuit.

Values of the initial parameters of the main parameters [8,9], asynchiron electric drive N=2.2kVt, n=45 rot/min f_c=50 Gs φ_c=0.86; ω_0=157c^{-1} η=0.835

ω_n=98.91c^{-1}; S_N=0.054; S^1_k=0.193; p=2;

n_q=440 rot/min $U_{юк}$=1.0; $J_{ю}$=0.028 mm^2;

Þ$_q$=0.192mm^2; C=(300÷400)Nm/rad;

b=(2.4÷2.8) Nmc/rad; M_{tq}=24.5+1.5 $sin\omega t$ ±δ$M_{тқ}$

Based on the solution of the problem, connection graphs were built.

$1 - \Delta\dot{\varphi}_{ю} = f(c);$ $2 - \Delta\dot{\varphi}_{H} = f(c);$
$3 - \Delta M_{Ю} = f(c);$ $3 - \Delta M_{К} = f(c);$

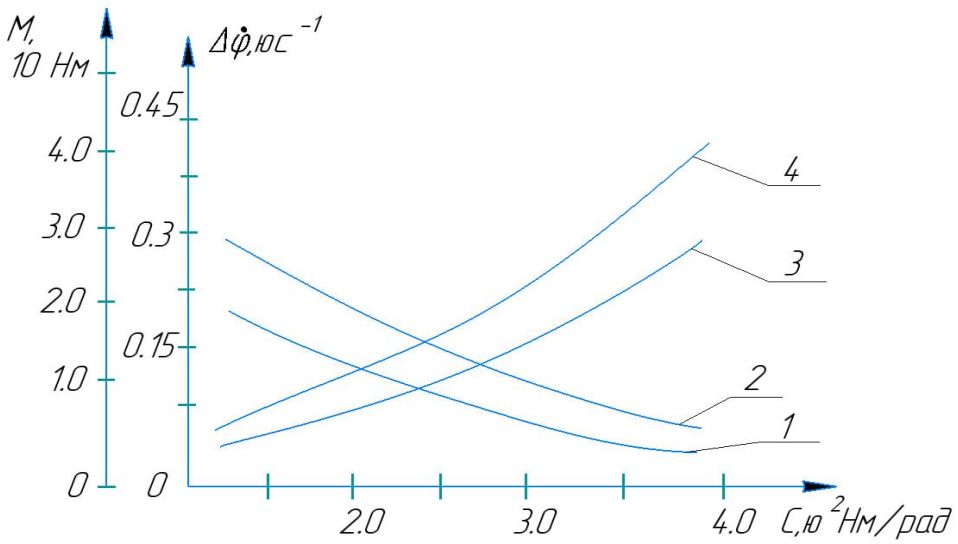
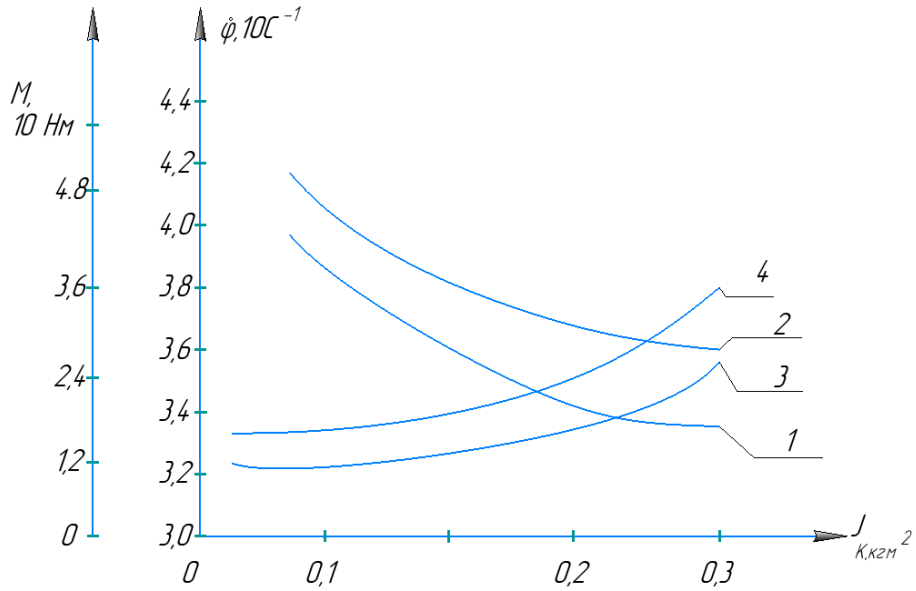


Figure 1. Shows the graphs of dependence of the recommended cleaner pile drum drive shaft and pile headset angular velocities, vibration coverage and screw moments, drum rubber bushing rotation coefficient.

Values of the rotation coefficient of the drum rubber bushing with curved piles based on the equations 150Nm/rad until 400 Nm/rad after increased $\Delta\dot{\varphi}_{К}$ values 3.74 C^{-1} until 0.86 C^{-1} decreased to if it is reduced to, respectively $\Delta\ \dot{\varphi}_{ю}$ values 0.09 C^{-1} until 0.58 C^{-1} it will only decrease. Therefore, the load increases as the rotation stiffness of the rubber bushing increases. Because the resistance to the system, that is, the rotary deformation of the rubber bushing, requires more force. In this case, if $M_{К}$values increase in non-linear bond from 3.8Nm to 42 Nm, $M_{ю}$ values increase from 2.1N/m to 29.8N/m. Therefore, in order to ensure the specified values of the angular speed vibration coverage of the pile headset that cleans the cotton from small impurities, it is advisable to have the values of the rotational angle coefficient of the curved pile drum rubber bushing (320÷350) in the range of Nm/rad.

In this case, it is recommended to make a rubber bushing from 7IRP-13-46 brand rubber.

Result. It is known that the values of their moments of inertia are increased in order to ensure that the speed of movement of rotating working bodies is uniform. [8.9]. But the consumption power increases. Figure 2 shows the graphs of the dependence of the angular velocities and loads of the pile drum drive shaft and the pile headset on the moment of inertia of the pile headset.



$1 - \dot{\varphi}_к = f(J_K);$ $2 - \dot{\varphi}_ю = f(J_K);$

$3 - M_Ю = f(J_K);$ $4 - M_К = f(J_K);$

$M_{ЮК} = 36\ Hm;$

Figure 2. Graphs the dependence of the angular velocities and loads of the pile drum drive shaft and pile headset on the moment of inertia of the pile headset.

When the moment of inertia of the pile headset is increased from 0.07 kg m² to 0.31 kg m², the values of $\dot{\varphi}_к$ decrease from 38.2 C^{-1} to 34.5 C^{-1}, respectively, and the values of $\dot{\varphi}_ю$ decrease from 40.8 C^{-1} to 35.7 C^{-1} in nonlinear bonding. But the increase in consumption power due to the increase in $J_к$ increases the torque. In particular, if $M_К$ values increase from 18.6 Nm to 36.5 Nm, $M_К$ values increase from 17.2 Nm to 24 Nm. It is recommended to choose the moment of inertia (2.9÷3.2) kg m² in the range of to ensure that the angular speed of the pile drum is higher than 40 C^{-1}.

Conclusion. A construction with rubber bushing drums with curved piles of cotton gin was recommended. Based on the dynamic analysis of the machine unit, which includes the mechanism of keeping the pile drum, the laws of movement and loads of the pile drum and the drive shaft were determined. Based on the analysis of results, the recommended values of the parameters of the pile set and the rubber bushing were determined.

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