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ANALYTICAL RESEARCH OF WEAR OF WORKING ORGAN FOR HAMMER CRUSHERS

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Analytical research of wear of homogeneous monometallic working organs of hammer crushers is executed. The radius of wear border of working surface of serial hammer of working organ is certain.

Keysword : hammer crusher, working organ, wear, working surface, radius of wear

Entry. The processes of crushing and growing shallow widely apply in metallurgy. Growing of material shallow carry out with use of the special crushers, in particular hammer crushers, where it is executed at operating of shots under it steel hammers. Hammers subject the shock loading and subject to the intensive abrasive wear, as intensively contact with the ground down material [1].

Making of hammers fully from wearresistent material is inadvisable. Therefore it is much offered constructions of the compound hammers, where working borders are made from wearresistent materials and basis of hammers - from Steel 3.

It is known that hammers of serial crushers, which are made from homogeneous material without strengthening have an uneven wear [2]. Peripheral part of hammer, that maximally outermost from centre of rotor rotation, in a greater measure tests destruction [3].

Problem definition. A task of work is necessity of establishment of geometrical parameters of wear of beaters of crushers for the further foundation of the local strengthening of areas them working surface.

Main part of researches. In the arctic system of co-ordinates, which are more comfortable for a further analysis, equation of profile of wear looks like:

$$\rho = \frac{P}{1+\cos\xi} \ , \tag{1}$$

where ρ - an arctic radius of parabola; P - a parameter of parabola; ξ - an angle of slope of arctic radius of parabola.

Thus the area of elementary ground of working surface dS is determined by equation:

$$dS = \frac{P}{1+\cos\xi} \cdot d\xi \cdot r \cdot d\psi \ . \tag{2}$$

The stream of parts of material which stipulates to wear material of beater operates action on an elementary ground. The quantity of parts of material, which get on a plane for some time Δt, depends from the density of material of mass q_3 and relative speed V and evened:

$$N_1 = \frac{\rho}{1+\cos\xi} \cdot d\xi \cdot r \cdot d\psi \cdot q_3 \cdot V \cdot \Delta t \ . \tag{3}$$

In general case the corner of attack α (falling) of particle depends on the corner of turn of beater on rotation of axis Θ, conditioned by resistance of grain-growing mass which is ground down, and curvature of the worked profile of beater. In this case the corner of attack is determined by next dependence:

$$\alpha = 90^0 - \Theta - \chi \ . \tag{6}$$

Putting correlation for χ to equation (6), have:

$$\alpha = 90^0 - \Theta - \operatorname{arctg}\frac{P}{\rho \cdot \sin\xi} \ . \tag{7}$$

Using equation of wear (1), process of mass loss, and trespectively, and geometrical parameters of beater at pin co-operation and destruction of particles of material, it is possible to write down in a next kind:

$$dM = q_M \cdot d\rho = m \cdot V^2 \cdot q_3 \cdot k \cdot \cos\left(\Theta - \operatorname{arctg}\frac{P}{\rho \cdot \sin\xi}\right) \cdot \cos\psi \cdot dt \ . \tag{8}$$

If to assume that in the area of action of beaters grinding down to the rotor the brake effect of walls of chamber of growing shallow is insignificant, then it is possible to consider that linear speed of shock surface of beater changes linear from a center to periphery. Putting the value of projection of speed of arctic radius ρ on the axis of *X*, will get:

$$V = \omega \cdot \left(R_F + \frac{P}{1+\cos\xi} \cdot \cos\xi\right) , \tag{9}$$

Then equation of wear (9) after the substitution of value of speed of blow acquires a kind:

$$dM = q_M \cdot d\rho = m \cdot \omega^2 \cdot \left(R_F + \frac{P \cdot \cos\xi}{1+\cos\xi}\right)^2 \cdot q_3 \cdot k \cdot \cos\left(\Theta - \operatorname{arctg}\frac{P}{\rho \cdot \sin\xi}\right) \cdot \cos\psi \cdot dt \ . \tag{10}$$

Equalization of the got differential equation it can be decided by numerical methods and with the use of computer. However for an analysis consideration of case, when a surface of beater is maximally loaded causes interest. Thus surface not had time to develop thus, that corners of attack were as possible less, but respectively, intensity of wear of working surface went down. Such case is possible in the case when $\chi \Rightarrow 0$, id est.:

$$\operatorname{arctg}\frac{P}{\rho \cdot \sin\xi} \to 0 \ . \tag{11}$$

For analytical research of equation of wear for surface after transformations will have next kind:

$$q_M \cdot \frac{d\rho}{R_F + \rho \cdot \cos\xi} = \frac{m \cdot \omega^2}{q_M} \cdot q_3 \cdot k \cdot \cos\Theta \cdot \cos\psi \cdot dt \ . \tag{12}$$

After a decision of the integral in the left part of equation and certain transformations have equation in more comfortable for an analysis kind:

$$\rho = R_F + P - \frac{q_M}{m \cdot \omega^2 \cdot k \cdot \cos\Theta \cdot \cos\psi \cdot t} \ . \tag{13}$$

Therefore, we get equation which determines the size of arctic radius which is included in description of profile of beaters during their wear.

Conclusions.

1. The analysis of wear of monometallic homogeneous beaters shows that at other things condition equal intensity of wear substantially depends on linear speed of moving of elementary plane of working profile of heater in relation to mass which collapses.

2. The prospect of further researches is a foundation of the local strengthening of areas of working surface thus, that in the process of wear it was formed as most capable of working for growing of material, and also foundation of the rational system of exploitation of hammer crushers shallow by preventive-maintenance repair interferences on the basis of scientifically reasonable recommendations.

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