SOME PECULIARITIES OF THE CHOICE OF BEARING UNIT OF CENTRIFUGE-ROLL MILLS

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ABSTRACT

In the introduction of controlled increased sliding in vertical-roll mills, the grinding effect, and respectively the fine-class yield, are increased but the wearing out of the working organs and the specific energy consumption are also increased.

In the paper, a solution is discussed where the increased sliding is achieved by inclining at a definite angle β of the grinding-rolls' axis as to the housing's vertical axis. In doing so, besides certain changes of the major parameters of the process, the requirements to the main bearing fixing are also changed. Axis-aligned forces are generated which must be accounted for in the design of the bearing knot. These forces are analyzed and the means are outlined for the choice and compliance with the requirements of the rolling bearing.

KEY WORDS: mills, vertical rotor, increased loading, sliding bearings, bearing knot.

Increased sliding with mineral raw material mills results in an increase of the yield of the final product's fine classes. It can be applied whenever the need of finer classes is greater. Whereas, it should be minded that, in this case, energy consumption is increased as well as the wearing out of the machine's working organs. Prior to such sliding's introduction, all these factors should be assessed and the optimal regime should be chosen. With centrifuge-roll mills, it can be established by inclination of the grinding rolls' axes with respect to the mill's vertical axis at a definite angle β (Fig. 1). Thereby, apart from the increased sliding, which increases proportionally with increasing of the inclination angle β , an additional load is created along the mill's axis. This load depends on the inclination angle β and the overall resistance with mill working. It can be determined by the equation:

 $P_{\beta} = P_{c} \sin\beta$, N

where:

Pc is the resistance with mill working.

This resistance can be determined by the use of the relevant equations provided in technical literature (Hoeffle, 1985). The force P_β puts some additional load on the mill's rotor and bearings. It can be applied in both directions, depending on whether the roll is inclined to the left or to the right, and also on the direction of the rotor's rotation.



Figure 1.

In Fig. 2, a solution for such a bearing knot is shown. The design was performed by the program Solid Works 98+. In the design process, the loads P_{β} were taken into account, resulting from the rolls' inclination.

As can be seen in the Figure, two self-adjusting radial bearings and one single-operating ball-bearing have been used. With this configuration of the bearing knot, the self-

adjusting bearings lose their self-adjusting ability. In this case, they were chosen because of their great loadability. Other structural designs are also possible. Since the bearing knot is intended for a mill, operating in strongly dusted environment, double protection is provided on both its sides.





With a view to the rotor bearing group's normal work, the inclination angle β is delimited in both directions for the following reasons:

1. With inclination to the left, as in Fig. 1, the additional load P_{β} will be directed downwards, increasing the axial load, resulting from the rotor's weight P_{G} . Whereas the overall load $P_{a} = P_{G} + P_{\beta}$ will also load the rotor bearings and angle β shall have to be restricted within an acceptable size for the bearing group.

2. With inclination to the right, the force P_{β} will be directed in the opposite, upward, direction, decreasing the bearings overall load $P_a = P_G - P_{\beta}$. This can be allowed only as much as a lifting force P_{β} , lesser than the rotor's weight P_G by the force P_{amin} is achieved. This force is needed to provide for the normal operation of the axial bearing. With further reduction of the force P_{amin} , the normal conditions for the balls' rolling are disturbed by the forces generated by their mass. The force P_{amin} can be determined by the equation:

$$P_{amin} = M (n_{max} / 1000)^2$$

where:

M is a constant, provided in technical literature for rolling bearings (FAG Catalogue 1973).

As a conclusion, it can be said:

1. With centrifuge roll mills with inclined rolls, an additional loading of the rotor's bearing knot is created.

2. The additional loading of the mill rotor's bearing knot can be directed downwards or upwards with the reverse motion. It depends on the inclination angle and can be determined using the machine's geometry and parameters.

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