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THE STUDY OF TENSIONS IN THE INNERS BEARINGS

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Abstract *: The moderns methods of mathematical theory of mathematical theory of elasticity permit to solve a large series of the problematic of bearings. In this study is presented the results of the use of plane theory of elasticity for study of the state of tensions in intern inner. The system is compound by the intern inner and the motor shaft acting by concentrated force applied on rolling way.*
Keywords: bearings, inners, elastic, tensions

1.THE STUDY OF TENSIONS

For the system compound by intern inner and the motor shaft, the radial component σ_r, in an arbitrary point of section is measured by the formula (1)

$$\sigma_r = \frac{P_0}{2\pi}\sum_{k=1}^{n} \sin\alpha_k\,(3-c^2)f_k + \left[c(c^2-1)(f_k^2-g_k^2) - \cos(\alpha_k-\theta) - \frac{1}{c}\right] - \frac{P}{2\pi r}\frac{c^2(\chi+3)}{c^2(1+\chi)}\sin\theta \qquad (1)$$

where: P_0-the pressure on the unit of length of the most loaded role; P – the pressure on the unit of length of the ruler; r, θ – the polar circle of the section points; α_k - the angular coordinates of the loaded roles; c=R/r- the radius of the ruler; k – the elastic contact (to the balls bearings).
The study of contact tensions present interest by determinate the similar formulas 2r=d and c=d_1/d ,where d-the cylinder diameter of the contact pressure in every point of surface .
In the figure 1,2,3,4 there are draught of σ_r tensions, built for different c and θ, for the bearings with a number of roles z=6,8,12,24.

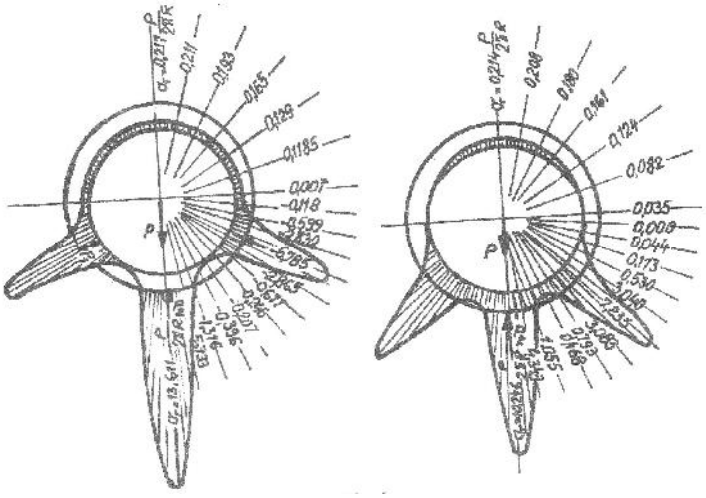

Figure1

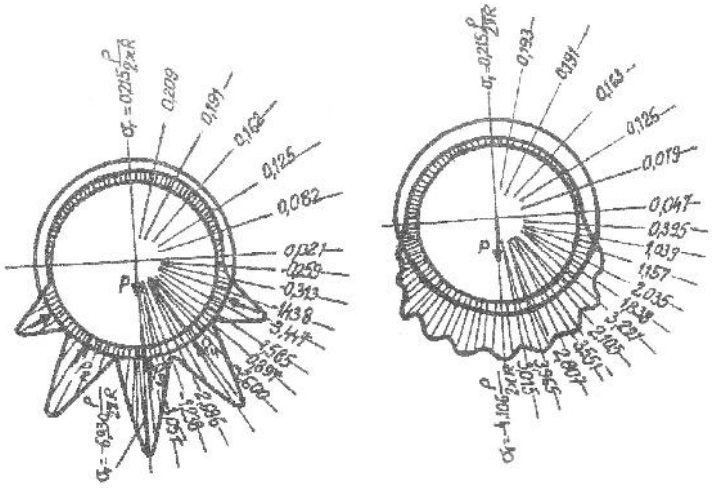

Figure 2

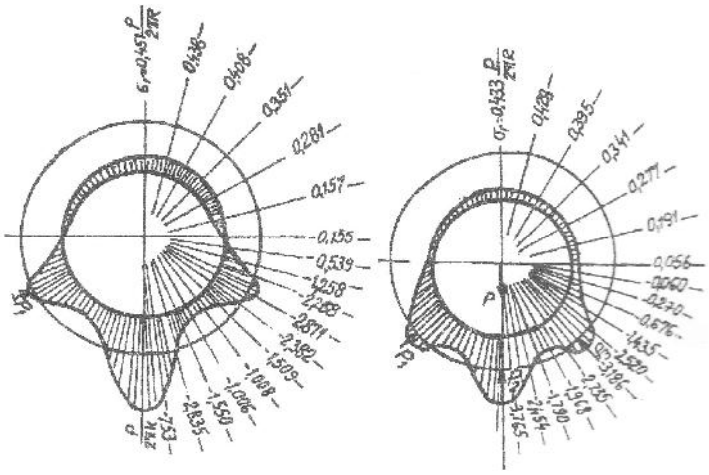

Figure 3

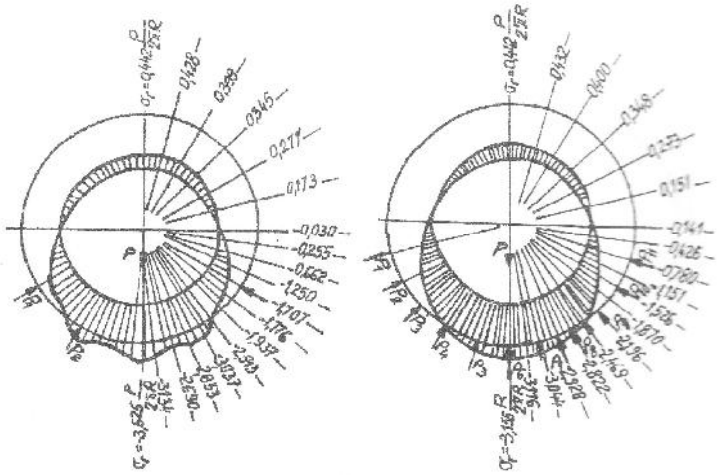

Figure 4

The parameters are considerate to be c=1,2 and respective c=1,5.
The value of c and z represent all types of standardized or non standardized bearings.
The elastic constant k is considered to be equal with 2,15.
On the radius traces by the center of the circumference where are the value positives of the σ_r tensions are take the positive values of tensions σ_r is been taken two times great than his negatives value scale

Recording to the draughts presented here for z and c smalls in the points of contact surface appear the concentrations of tensions, due to the forces transmitted through the roles, concentrations that are bigger when z and c are the smaller.

$$\sigma_r = \lambda \frac{P}{\pi d} \; ; \; \sigma_r^1 = \frac{2\mu}{1+\chi} \frac{1-c^2}{c^2} \Delta \qquad (2)$$

where : λ- coefficient which depends on the bearing construction; on the geometrical relations of the pieces, as well as the angular coordinate θ; d=2R the diameter of the ruler; μ – the modulus of Poisson; Δ – the contact tension ; σ_r^1 - the tension calculated by Lame expression.

In the table 1 there are given the maximum and minimum values calculated for the points with correspond to the points of unload and loaded points of the bearings.

Table 1

Z / C	6		8		12	
	λ_{max}	λ_{min}	λ_{max}	λ_{min}	λ_{max}	λ_{min}
1.2	0.217	-13.611	0.214	-10.246	0.215	-6.930
1.5	0.451	-5.852	0.433	-4.554	0.442	-3.525

Z / C	24		∞		1	
	λ_{max}	λ_{min}	λ_{max}	λ_{min}	λ_{max}	λ_{min}
1.2	0.215	-4.106	0.216	-3.564	0.209	-20.361
1.5	0.442	-3.155	0.446	-3.151	0.419	-8.686

First of them establishes the necessary of the contact tension and the second establishes the maximum value of the tension in the case of the shaft.

In the same chart6 there are given the value of λ for the case when number z is unlimited ($\lambda_z=\infty$) and on bearings is very large, so in the moment pass the roll by points of loaded zone, the whole load is taken only by these roles.

The analysis of the dates the values of contact tension for a chosen value practical is does not depend on the number of rolling bodies. The numerical calculations show that the report for all types of bearing is modified by 10-15%. This allows permitted to obtain another simplified formula of the contact tension. In the last formula there are considered the technological details of the cylinder bore inner-shaft.

The minimal tension calculated according to the formula excludes the possibility of obtaining from same undesirable gang between inner and shaft in the process of function. In this way the minimal contact tension must be determinate by calculation.

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