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ANALYSIS EXPERIMENTAL CONSTRAINT AND DEFORMATION IN THE AXIS OF REDUCTOR OF THE ROTOR EXCAVATION

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ABSTRACT
The purpose of this paper is to be experimental measurements and analysis of strain in the axis of the rotor Excavator reductor the type SchRs 1300 (24 / 5), under the action of the rotor excavators loading during exploitation. With the development of the rotor excavators, problem of their dynamics, a phenomenon which must be taken into account in calculating such constructions. There fore, in this paper examined the measurements of dynamic analysis, under the action of the rotor excavator's cargo. The basic source Excavator loads with resistance rotor is mine. The sharp variability of resistance to mining is due, above all, the specific geometry of the cutting, entry and exit periodical in which mine land. Resistance of mine in this paper will be simulated depending on the work regime of the Excavator. Measurements are made in real working conditions with maximum capacity during Excavator arm movement from right to left and the maximum depth in the lower level of the soil and the minimum interval time, the work of the rotor Excavator.
Keywords: constraints, distortions, measuring tapes, the rotor excavator, load, shaft, adapter.

1. INTRODUCTION
Results of theoretical and experimental research of Excavator with rotor, development of numerical methods of construction mechanisms and progress in production technology appropriately, lead to significantly reduce Excavator own measure in relation to their theoretical capacity [2], figure 1. Curves 1, 2 and 3 in the diagram showed, the answer mining heights: 12m, 20m and 28m. Notable addition is the expanded scope of application of the rotor excavators. So, up to 60-years it is considered that the rotor excavators can be applied to high-strength cast. However, the firm in 1963 KRUPP has produced Excavator with rotor which has implemented specific force mining 65daN/cm^2.

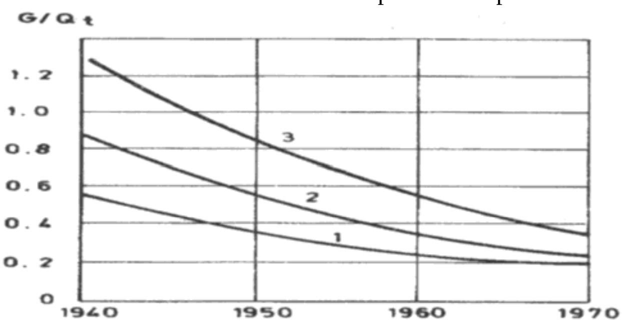

Figure 1. Diagram mining heights

Excavator with rotor with radial mining, excavator system - transporter - packer significantly affects the characteristics of the mentioned system. Aim to achieve positive performance of the rotor

Excavator, first of all capacity, has not followed the proper measure of construction methodology.For this, the best frequent breakdowns argue excavators mentioned in surface mining. Deformations not allowed, breakdown of the various subsystems Excavator omissions are a result of the analysis of real dynamic loads xperience so far, not enough recognition of dynamic processes, repaid by the so-called dynamic weighting. With this increased intensity of the cargo, but it still treated as static, which in most cases, leads to a large scale without the necessary security, namely the huge increase without reasonable size and price of the car. It is important to note that increasing the size of the subsystem, which in most cases, can cause safety and reduce service time Excavator. Mentioned facts raise the demand for a comprehensive analysis and deep dynamic processes that form are the real conditions of exploitation of the rotor Excavator.

2. DEFINING THE ROTOR LOADS EXCAVATOR

During the analysis are given in the whole scheme and pictures of the rotor type Excavator SchRs 1300 (24/5). Given the possibilities of land and state of the rotor Excavator is found that measurements are possible at the entrance to the axis of reductor respecting all possible difficulties. Because, as the entry size is reductor torque, while the axis of circular cross section has reductor, the most reliable method for determining the work load is tenzometrike, the so-called bridge methods Winston’s full [3]. In these cases the axis of reductor gauge strips are glued four active at the same cross section, provided that two and two are diametrically due to self compensation of bending the shaft. Strip gauge on the shaft are welded under the angle 45°, which means that they are located in the direction where the tangential well worth the effort presented largest. For this case measuring tapes are used to type HBM-XY-120, Figure 2. In essence, such straps measuring the overall value set in linear deformations.

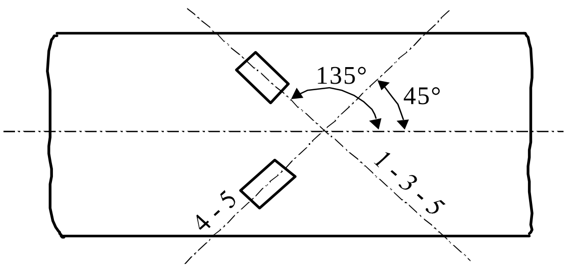

Figure 2. Measuring tapes

Given such a concept of placing the measuring tape and well worth the effort results obtained tangential deformations as follows:

$$\tau_{xy} = \frac{E(\varepsilon_{45} - \varepsilon_{135})}{2(1+\mu)} = \frac{E \cdot \varepsilon}{2(1-\mu)}$$

Where: E - module of elasticity of shaft material,

ε_{45} - Relative deformation in the direction of the axis 4 to 5,

ε_{135} - Relative deformation in the direction of Axis 1 - 3 – 5

μ - Poisson’s coefficient.

Based on the values of tangential strain, respectively, the deformation values measured current value assigned to torzionit, the logaritur the expression:

$$T = \frac{E}{1+\mu} \cdot W_o \cdot \varepsilon$$

Where: Wo - Polar moment of cutting resistant brace in place with straps are glued gauge.

Transfer the measurement signal and supply of bridge measurement is made through a sliding rings and brushes at the entrance to the axis of reductor [1]. In Figures 3 are shown measuring devices that are used during the experiment. During the experiment, these devices are used:

- Strip-type gauge HBM-XY-120,
- Sliding rings with brushes,

- Measuring bridge with six channels of type 6/5-A KWS and
- Oppressor RIKADENKI type graph of 0.05 - 500 V.

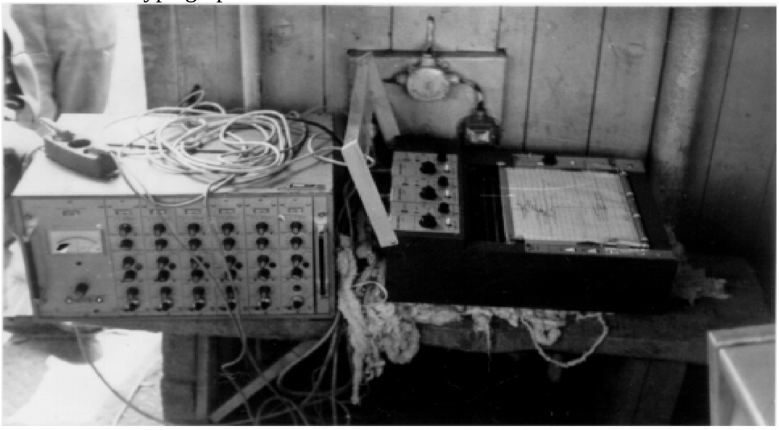

Figure 3. Rikadenki type graphic printer

3. EXPERIMENTAL RESULTS

Under the organizational preparations and testing measuring equipment is made during the experiment to work loads reductor axis [4]. The measurement results are obtained in the form of diagrams as in Figures 4, 5 and 6, which represent distortions in cross-cutting function of the time axis. These diagrams represent the Y-axis can be well worth the effort tangential, normal and torque axis.

Figure 4. Diagram of measured deformations and the rotor moment of Excavator

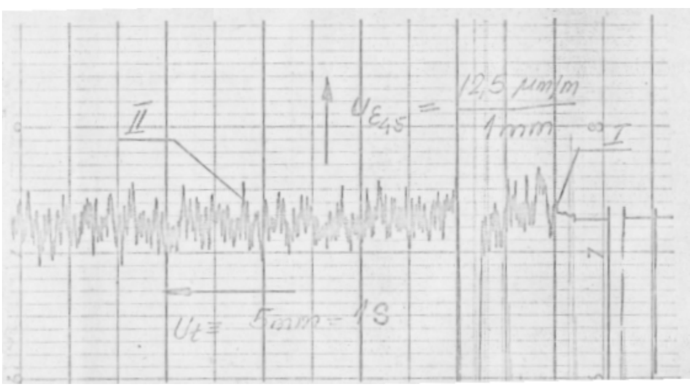

Figure 5. Excavator moment diagram of the rotor

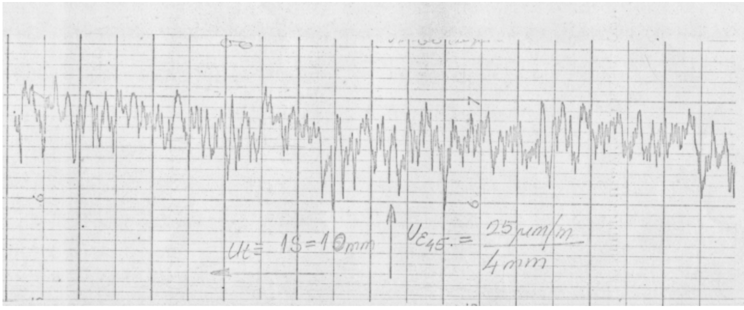

Figure 6. Oscilogram measuring the deformation in the axis countries during the mining

4. ANALYSIS OF RESULTS AND FINDINGS

Based on the analysis of diagrams can be concluded:
Maximum surface deformation axis measuring countries be at:
From 67 to 73 [mm / m] - when Excavator work release,
From 45 to 81 [mm / m] - the maximum mining capacity Excavator.
During this should be noted that the diagrams are not Excavator observed differences in changes of deformation during the extraction and movement of the arm from left to right, respectively vice versa.
Based on the sizes of the deformation measured in the respective transverse cutting, the constructive characteristics using cross-axis cutting and quality of material that proved well worth the effort tangential measuring countries calculated by the expression:

$$\tau = \frac{E \cdot \varepsilon_{45}}{1+\mu}$$

Reaches values:
From 108 to 118 [daN/cm2] - at the time of issuance of Excavator work,
From 73 to 131 [daN/cm2] - the maximum mining capacity Excavator.
Based on deformations measured sizes, shaft torque of the work calculated by the expression[4]:

$$T = \frac{E \cdot \varepsilon \cdot W_o}{1+\mu}$$

Reaches values:
- From 3899 to 4260 [nm] - at the time of issuance of Excavator work,
- From 2635 to 4729 [nm] - the maximum mining capacity Excavator.

5. CONCLUSION

Based on the results of the experiment and their analysis found that:
• Tangential Strain during the experiment does not exceed a value of 131 daN/cm^2, which means it is significantly below the permitted well worth the effort, which indicates that the axis has a high degree of safety in terms of twisting.
• Moment of twisting the axis reaches the maximum value of 4729 Nm, which represents the upper limit that can create device drivers.
• Spectrum of changing loads in terms of exploitation of Excavator and their frequencies shown in oscilogram, brought to the limits allowed.
• Tangential Strain and twisting moment of the axis can be used to form kapriate carrying constructions.

6. REFERENCES

[1] Howard I., Shapiro P.: Cranes and Derricks, McGraw-Hill, New York, 1999.
[2] Verschoof J.: Cranes – Design, Practice, and Maintenance, London 2002.
[3] Visual MSC: Nastran 4D User Guide, MacNeal-Shwendler Corporation, Santa Ana, 2003.
[4] Hamidi B.: Contribution of dynamic analysis research excavation with rotor, doctoral dissertation, Faculty of Mechanical Engineering, Pristina, 2000.