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DETERMINATION OF RATIONAL PARAMETERS OF THE LEVER

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Abstract
This article examines the influence of adverse investigative factors resulting from the recoil forces of the excavator and bucket, as well as the trajectory of the bucket in the working area. The lever must be made of durable material, taking into account the tension forces on the gear and the identification of many malfunctions of the lever.

Introduction

Today, mining industry is characterized by the development of mining operations in every aspect of the manufacturing industry. Effective, safe, reliable operation of excavators leads to an increase in productivity and a decrease in the cost of minerals. However, excavators, as a result of the impact of forces of tension during exploitation, lead to the failure, exhaustion of excavator working members, a decrease in service life. Fig 1 depicts excavator working members in a chimney, a ledge, an arrow, where the forces of tension falling on the ledge are marked through a red line. Fractures are observed a lot in the specified line of the handle and are determined by accounting work and Ansys programs, taking into account this.

Figure 1. Excavator lever

The reliable operation of excavators, equipment is characterized by strength, light weight, low cost, and how long the parts work, conditions, strength levels can be determined through tests. The working equipment of a single-chimney excavator consists of a trellis with a lever, a pressure mechanism and a head block, and a chimney-raising duct.

In order to calculate the maximum values of the forces that are given on the lever and given to the rock through the handle, the maximum forces exerted on the ascent of the chimney with the rock and the forces exerted on the lever through the kremalier gear, which gives pressure to the handle, the state is considered.

When the pressure mechanisms in the position of the chimney are horizontal, the lifting ropes from the head blocks to the chimney are in a vertical position.

To determine the maximum voltage values, the forces on the lifting ropes are multiplied by the dynamic coefficient, which takes into account the potential energy of the chimney and rope, the increase in the kinetic energy of the rotating masses.

To calculate the maximum voltages, the movements $S_{ko't}$ on the lifting steel rope are taken into account in relation to the balance and calm states.

$$S_{ko't} = \frac{k_d \cdot M_m \cdot \eta_p \cdot u_p}{R_b}$$

M_m - maximum torque of lifting loop, η_p - useful working coefficient of lifting reducer, u_p - lifting reducer transmission speed, R_b - lifting drum radius.

The maximum digging force given to the chimney teeth by the maximum force on the steel ropes carrying the chimney is determined by the calm state of the row relative to the axis of the pressure mechanism.

At the time of movement, part of its weight is distributed in the direction of the arrow relative to the shaft of the saddle bearing. Fig. 2 signs must be entered to calculate the forces of tension being exerted on the shaft and gear and the forces of lifting the chimney. To calculate the coordinates of points A, B, S, the effects of forces are determined in the equilibrium equation.

The equation of tension equilibrium with respect to the shaft of the mechanism

$$\sum M_c = 0$$

$$-\frac{q_d \cdot l_{d^1}^2}{2} + \frac{q_d \cdot l_{d^2}^2}{2} + G_{dg} \cdot R_{dg} + G_{ch+f} \cdot r_{G_{ch}} + P_{01} \cdot Ls_{ch} - S_{ko't} \cdot Ls_d \cdot \sin\left(\beta_{sp\,x} - \beta_{bp\,x}\right) = 0$$

$l_{d^1}^2$ - The length of the part that protrudes beyond the saddle bearing.

$l_{d^2}^2$ -The length from the place where the rod attaches to the chimney, to the part where it enters the saddle bearing.

$r_{G_{ch}}$ - The radius of force of weight movement, which is full of the chimney with a mountain ridge.

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q_d - The distributed weight of the lever.

Ls_{ch} - P_{01-} - the length of action of the pressure mechanism of the tangential component of the drilling force.

Ls_d - The length of the blade of the saddle bearing to the coromisla axis.

β_{sp_x} - *BP*- slope angle of the line relative to the horizon

β_{bp_x} - *SP* - slope angle of the line relative to the horizon

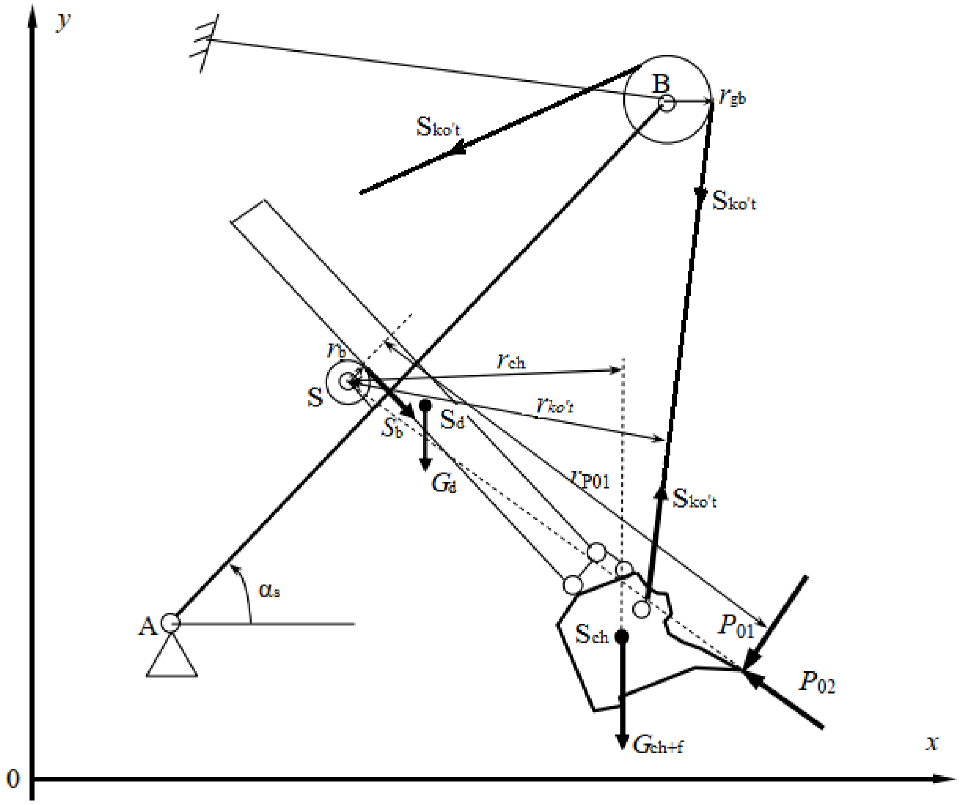

Figure 2. S_b **Excavator scheme for calculating pressure force and P_{01} anti-digging forces**

Equation for determining the resistance forces that falls on the gum teeth under the maximum lifting force.

$$P_{01} = \frac{S_{ko't} \cdot L_{SP} \cdot \sin\left(\beta_{sp_x} - \beta_{bp_x}\right) - G_{ch+f} \cdot r_{G_{ch}} + G_{sg} \cdot R_{dg} + \frac{q_d \cdot l_{d^2}^2}{2} - \frac{q_d \cdot l_{d^1}^2}{2}}{Ls_{ch}}$$

When digging, the force of tension in the lever will depend on the forces of digging, that is, the position of the chimney and its weight with the rock of the mountain.

At the maximum pressure force acting on the retraction of the column, the digging force P_{02} is determined from the equilibrium equation.

$$P_{02} = \frac{S_b + S_{ko't}\cos(\varphi_d - \beta_{bp_x}) + P_{01}\cdot\sin(\beta_{SKx} - \varphi_d) - G_{ch+f}\sin\varphi_d - (G_d + G_{dg})\cdot\sin\varphi_d}{\cos(\beta_{SKx} - \varphi_d)}$$

The time of movement of the chimney and its equipment without load, digging and fullness with the rock of the mountain differ in the time of movement, since the teeth of the chimney do not have digging forces, but inertial and centrifugal forces are added at the time of turning the movement.

The equilibrium equation of the steel rope carrying the chimney with respect to the head block spout will be as follows.

$$S_{ko't} = \frac{G_{ch+f}\cdot r_{G_{ch}} + G_{dg}\cdot R_{dg} + \frac{q_d l_{d^2}^2}{2} - \frac{q_d l_{d^1}^2}{2}}{L_{SP}\cdot\sin(\beta_{SPx} - \beta_{bPx})}$$

To calculate the force of pressure, the sum of the projections of the forces of the cremaler acting on the gear register in the lever is drawn up and determined by the equation as follows.

$$S_b = S_{ko't}\cdot\cos(\varphi_d - \beta_{bPx}) - G_{ch+f}\cdot\sin\varphi_d - (G_d + G_{dg})\cdot\sin\varphi_d$$

Based on the equations presented, it was determined through calculations and the ANSYS program, which part of the lever will fail mainly as a result of the force that puts pressure on the lever and the tensile forces that are given when digging the mountain range Fig 3.

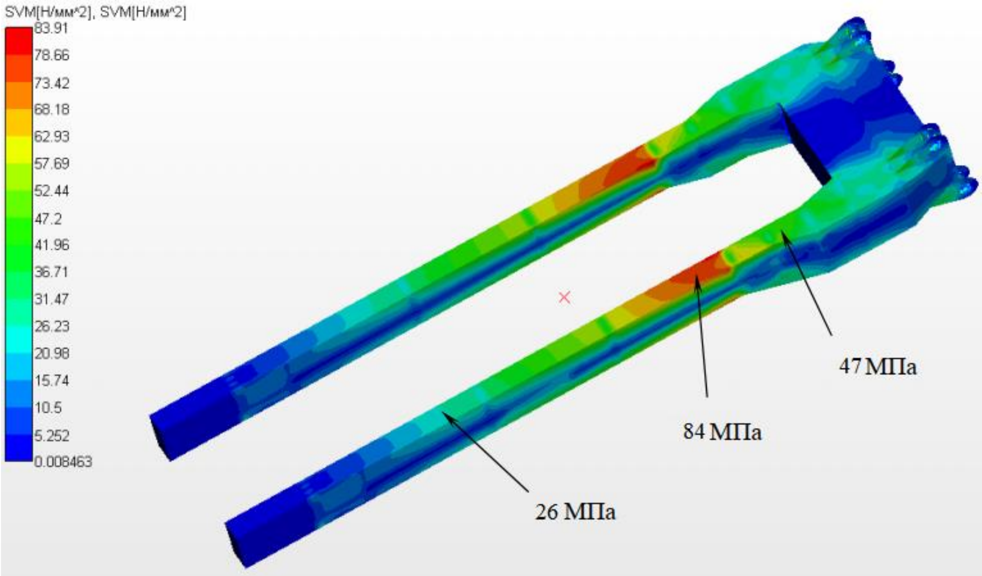

Figure 3.The results of the strain that the pressurizing mechanism and the sink lifting mechanisms give to the lever.

Based on the Ansys program, the maximum strain point on the lever was 84 MPa. When making and using the lever, the areas at the maximum tension points will have to be made of a strong, thick, light and long-lasting material.

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