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Aspects of the movement of the rocks using the low-rotor

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ABSTRACT

In this article we present the cases in which the use of Improving the system of cutting the rotor loading backhoes Figure 2. Examples of charts recorded involves the use of methodologies for calculating well-grounded and results obtained under experimental laboratory tests. This approach eliminates to a large extent arbitrary empiricism in the field of research, intended for the improvement of the low rotor.

KEYWORDS

Transport;
Optimizations;
Mechanics.

EXPERIMENTAL RESEARCH CONCERNING ENERGY PROFILING

To verify the results obtained through the methodology of analytical calculation based on experimental tests of laboratory were undertaken experimental research in conditions career at E-Lupoaia demolition 04 type SRs 1300 in sterile gear II (grey blackish clay). Measurements in the quarry were made in March 2015 in the existing conditions when the front of the stage work of sterile, containing two thin lignite layers, as shown in Figure 1.

It was performed a set of metrics, of which 17 11 in 1 slice (upper side) step 6 in the slice 3 (between the two layers of lignite), where in addition to the records of active power, reactive power Q, power absorbed and the power factor cos φ, measured were: the width of the block excavated B; cutting height H; slewing RADIUS Rp; maximum thickness of ho şpanului (chip) in main vertical and horizontal plane, during the excavation of a full-wool Board and have been taken into account for purposes of the slewing of the impeller (right or left). In Figure 2 is shown on the computer screen were made records, current and power factor.

Present charts for P, Q, I and φ cos the measurements no. 4. No. 8, respectively No. 16, 17, 19, 22, 23 and 24 and charts recorded for P, Q, I and φ cos the measurements no. 25, 26, 28, 29, 30 and 31. From the analysis of the records it is noted that the active power P absorbed current and power factor cos φ have similar diagrams with dash, and reactive power Q differs from them. It is observed that the operation of the propulsion engine wheel bucket under the rated power factor decreases and the consequent increase in reactive power circuit. (Sample 4 Sample 6) sees that as you absorb engine power close to 500 kW, PN = power factor lies in the amount of 0.9, i.e. power factor close to neutral. C records made in the slice 1, having regard to the scheme of work shown in Figure 3, and the following were performed in the slice 3, having regard to the scheme of work shown in Figure 4. Are presented in TABLE c1 measurands for the recordset in both situations

Figure 1 : Working front where measurements have been carried out

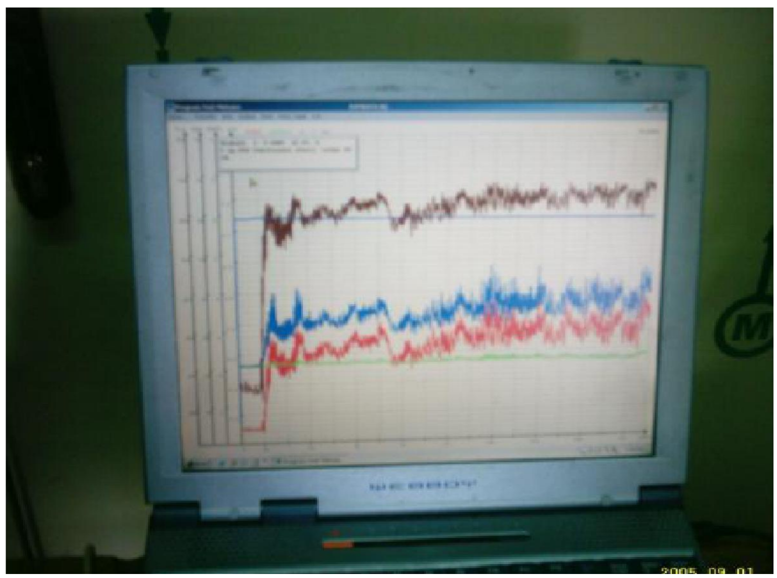

Figure 2 : Examples of charts recorded

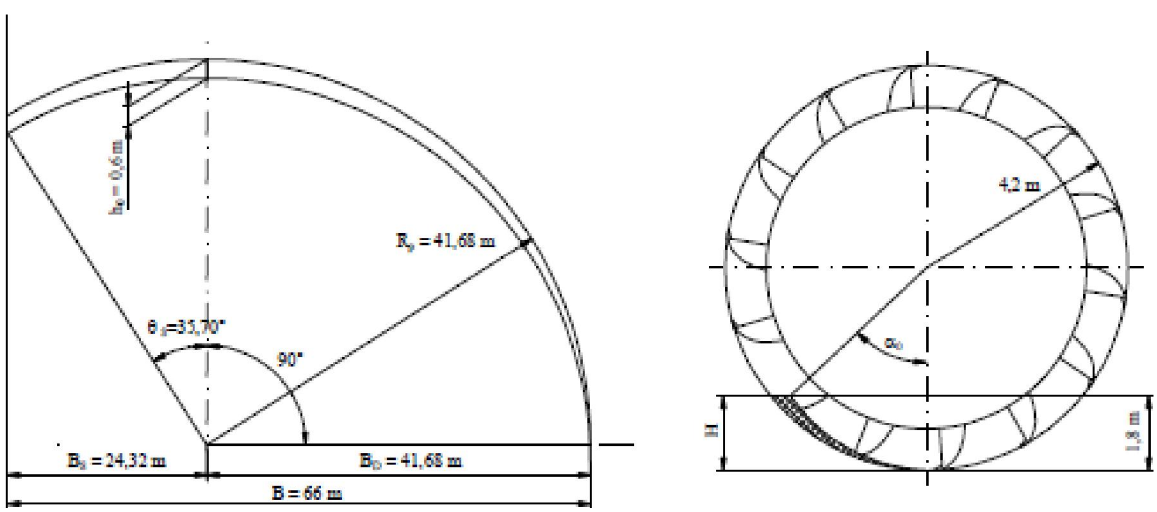

Figure 3 : Excavator work scheme E-04 in gear, 1 slice

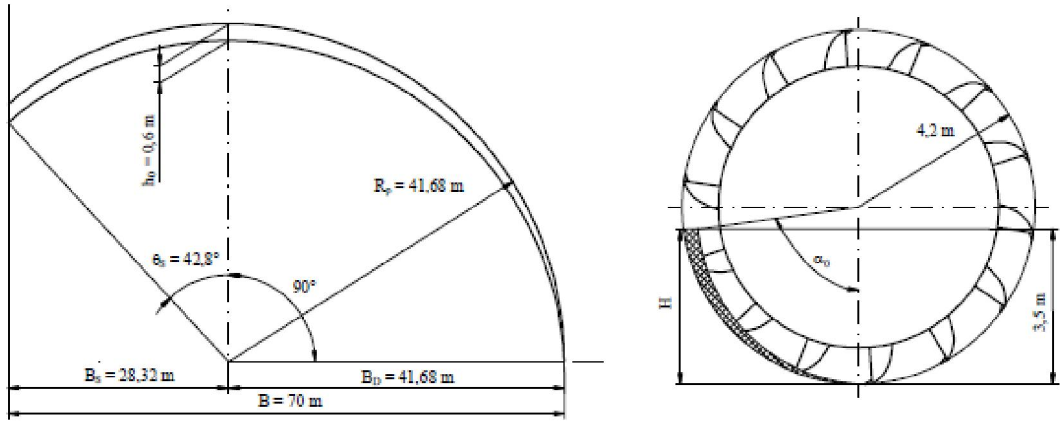

Figura 4 : Excavator work scheme E-04 in gear, slice 3

TABLE 1 : Measurand during experiments

Nr. crt.	Swivel effect	Test no.	The width of the block B, m	Cutting height H, m	Slewing RADIUS, m	Maximum thickness of španului ho,	During excavation T, s	Slewing speed vp, m/s
1.	right	16	66	1,8	41,68	0,6	168	0,54
2.	left	17	66	1,8	41,68	0,6	168	0,54
3.	right	19	66	1,8	41,68	0,7	174	0,53
4.	left	22	66	1,8	41,68	0,7	174	0,53
5.	right	23	66	1,8	41,68	0,8	178	0,51
6.	left	24	66	1,8	41,68	0,8	178	0,51
7.	right	25	70	3,5	41,68	0,6	428	0,23
8.	left	26	70	3,5	41,68	0,6	428	0,23
9.	right	28	70	3,5	41,68	0,7	434	0,222
10.	left	29	70	3,5	41,68	0,7	434	0,222
11.	right	30	70	3,5	41,68	0,8	438	0,22
12.	left	31	70	3,5	41,68	0,8	438	0,22

(1 slice, slice 3).

For comparison of the calculated values, based on laboratory test results and values measured in real working conditions was chosen an example, namely the registration No. 25. Chart of the variation of active power in function of time is given in Figure 4, and for a time was 275. Based on the data of TABLE 1 and in Figure 4 was drawn up TABLE 2 with sizes directly measured at the test no. 25. By applying the methodology follows the data presented in TABLE 3, partially calculated with the relations indicated in the chart and partial results posted. From the analysis of these data shows that between power calculated, based on the results of experimental researches of laboratory recorded average power and there is a relatively small difference (16 kW), which leads to a deviation of about 5%. Given the random nature of the process of cutting the scratchy material, represented by the grey clay quarry Lupoaia, constant deviation is relatively small, acceptable conditions in anyway lignite quarries. This supports the contention that the methodology of calculation used is usable in the study of cutting systems-load of classic low-rotor.

Improving the system of cutting the rotor loading backhoes involves the use of methodologies for calculating well-grounded and results obtained under experimental laboratory tests. This approach eliminates to a large extent arbitrary empiricism in the field of research, intended for the improvement of the low rotor.

THE RESULTS OF EXPERIMENTAL RESEARCHES HAROON SRS 1300 EQUIPPED WITH TEETH UP CONCEPTION

Based on the research and design work undertaken, were manufactured by S.C. UREX S.A.

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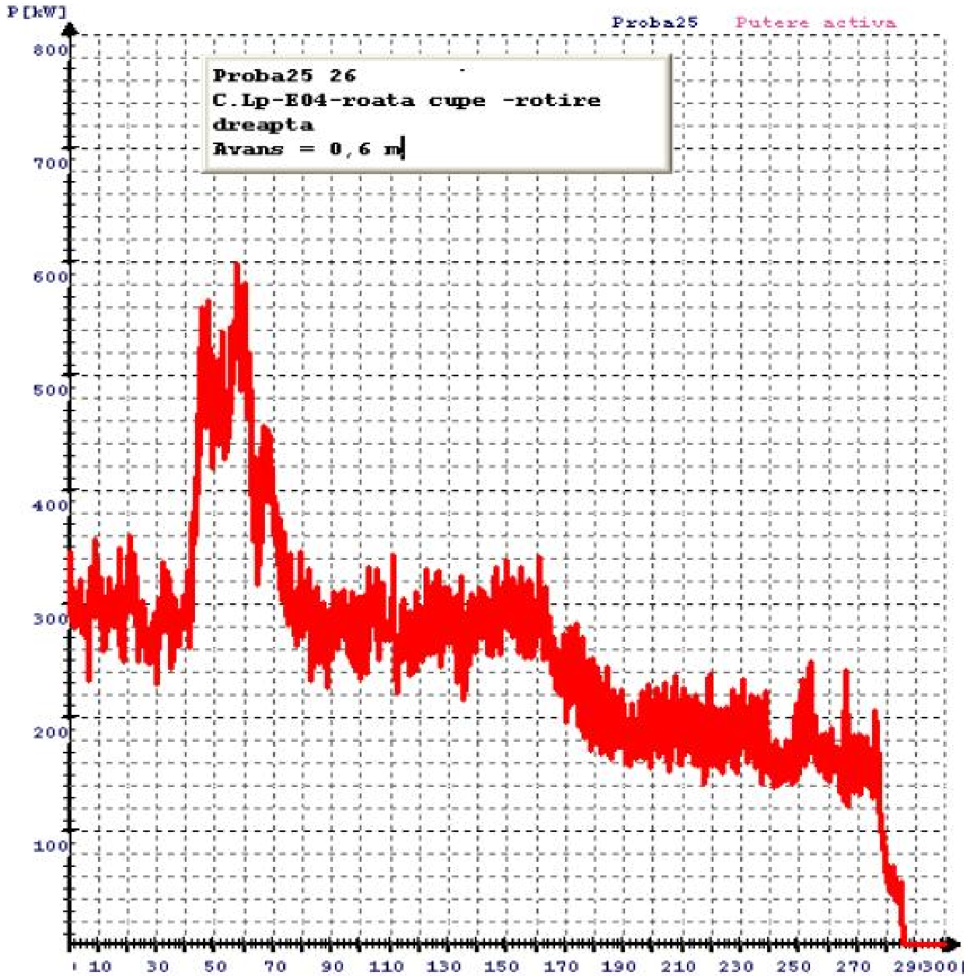

Figure 5

TABLE 2 : Directly measured sizes

Nr. crt.	The size of the	Symbol	The unit of measure	Values for the test no. 25
1.	Maximum thickness of chip	h_o	m	0,6
2.	Time required excavating a-wool Board	T	s	428
3.	The sense of rotation	-	-	right
4.	The excavated block width	B	m	70
5.	Swivel RADIUS	R_p	m	41,68
6.	The height of the chip	H	m	3,5
7.	The condition of the teeth	-	-	new teeth
8.	The extent of wear of teeth	k_{uz}	-	1

Rovinari a set of teeth for a complete demolition of the rotor to E-04 type SRs 1300 Lupoaia career. Experimentation with new types of teeth was held in September 2005 and was carried out under the same conditions as the research undertaken to verify the results obtained by analytically computing methodology based on experimental laboratory tests, carried out in March 2005 on the same rung of sterile (dull blackish clay), same excavator and roughly the same structure of the front. Figure 6; 7; 8; 9 and 10, are given different stages of experimentation and conduct measurements.

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It was performed a set of measurements in step 6, the 3rd, with the active power P, reactive power Q, I graduated and power factor (cos. Figure 11; 12

TABLE 3 : Sizes calculated based on measurements

Nr. crt.	The size of the	Symbol	The unit of measure	The relationship of computation	The amount of synthetic ropes-Ministers	OBS.
1.	Average chip thickness	h_m	m	(2.18)	0,257	
2.	Width spanului	b	m	(2.19)	0,164	
3.	Slewing speed	v_p	m/s	L_H/T	0,23	
4.	Cross-sectional area of chip	S_{am}	m^2	(2.28)	0,042	
5.	The average number of active cups	n_{ca}	buc.	(2.49)	3,11	
6.	Slewing angle left	θ_s	grade	(2.31)	42,8°	
7.	Slewing angle right	θ_D	grade	(2.32)	90°	
8.	The total angle of swivel	θ	grade	(2.33)	132,8°	
9.	Cutting angle	α_o	grade	(2.22)	80°	
10.	The length of the main chip in a horizontal plane	L_H	m	(2.34)	96,6	
11.	The length of the main vertical plan chip	L_V	m	(2.23)	5,86	
12.	Medium cutting force on a bucket	F_{xm}	N	(6.1)	30.346	
13.	The resultant cutting force	F_{xR}	N	(6.3)	94.378	
14.	The power required for the excavation	P_{ex}	kW	(6.11)	200	
15.	Power required for lifting	P_r	kW	(6.18)	67	
16.	The power required to drive the rotor	P	kW	(6.20)	314	
17.	Momentary capacity of excavation	Q_m	m^3/h	(2.41)	1389	massive
18.	Debitul de excavare	Q	m^3/h	$Q_m \cdot k_a$	1736	mellow
19.	Registered average power	P_i	kW	Din prelucrare diagramă	298	
20.	The difference between the calculated and measured	ΔP	kW	$P - P_i$	16	
21.	Deviation calculated values and measured	ε_p	%	$\frac{\Delta P}{P}100$	5,09	

TABLE 4 : The data necessary for determining the dependence between power and flow

Nr. crt.	H m	h_o m	b m	z s^{-1}	Q_{med} m^3/h	$P_{i\ med}$ kW	Nr. înregistrare	v_p m/s	Obs.
1.	1,8	0,6	0,482	1,12	2099	340	16; 17	0,54	
2.	1,8	0,7	0,473	1,12	2403	327	19; 22	0,53	
3.	1,8	0,8	0,455	1,12	2642	345*	23; 24	0,51	
4.	3,5	0,6	0,205	1,12	1736	347	25; 26	0,23	
5.	3,5	0,7	0,198	1,12	1956	300	28; 29	0,222	
6.	3,5	0,8	0,196	1,12	2213	325	30; 31	0,22	

Figure 7 : The rotor is equipped with new teeth in front

Figure 8 : Front cut

Figure 9 : Cutting front right

and 13 are presented electrical panel, measuring equipment and a screenshot from carrying records of power, current, and power factor. Were measured: the width of the excavated block B; cutting height H; slewing RADIUS Rp; maximum thickness of ho şpanului (chip) in main vertical and horizontal plane, during the excavation of a full-wool Board and have

Figure 10 : Cutting to the left front

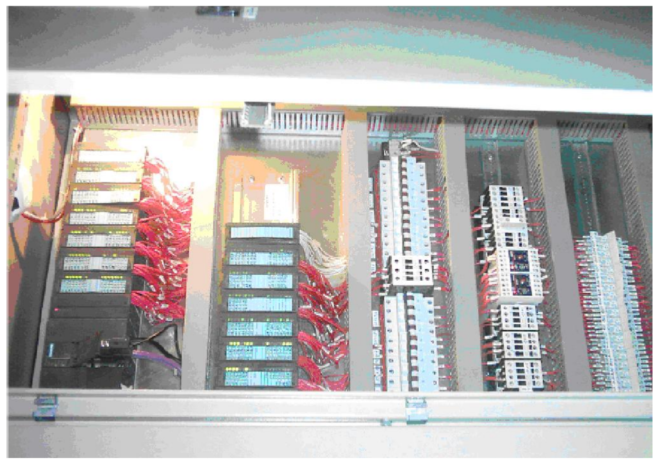

Figure 11 : Electric panel of the excavator

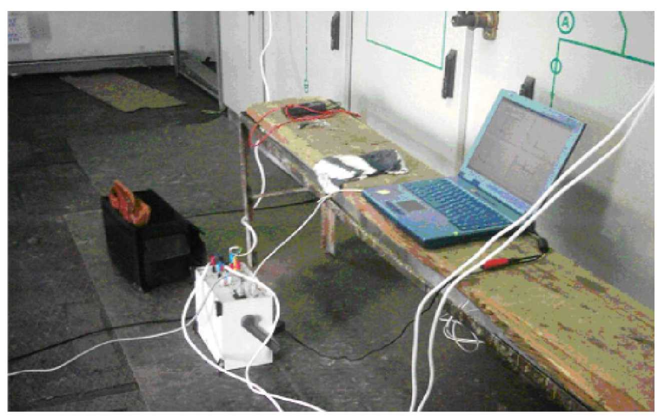

Figure 12 : Measuring apparatus

been taken into account for purposes of the slewing of the impeller (right or left).

Are shown diagrams of P, Q, I and (for measurements no. 41 ... 46. With regard to the measurements and observations arising from the analysis of the charts you can draw the same conclusions. Are presented in TABLE 5 measurands for the recordset in the conditions mentioned.

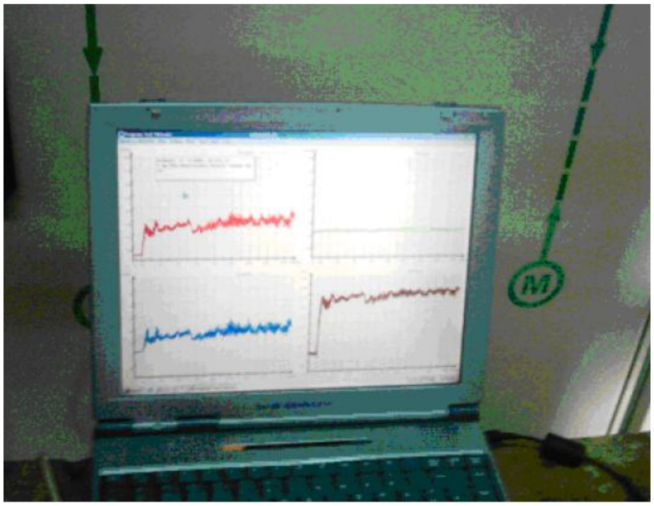

Figure 13 : Screen capture during the measurements of power

For comparison of synthetic running regime if the excavator teeth begotten, design and produce in the context of this paper, with the situation of using the existing teeth, will be used like index performance power consumption at the excavation. Specific energy consumption at the excavation can be determined with the relation:

$$E_s = \frac{P_i \cdot T}{3600 V_a},\ kWh/m^3 \qquad (1)$$

where: Pi represents the strength of the active medium recorded cutting a complete shavings, kW;

T – during the excavation, it was measured; Va – a complete volume of chips, m3.

A comprehensive volume on the same slice chips shall be determined by the relationship:

$$V_a = H \cdot h_m \cdot L_H,\ m^3 \qquad (2)$$

where the thickness of the chip's average will be calculated and the distance traveled by a Cup to a full swivel is LH). Substituting this result:

$$E_s = \frac{P_i \cdot T}{3600 \cdot H \cdot h_m \cdot L_H},\ kWh/m^3 \qquad (3)$$

Taking into account the data in TABLE 1 for measurements and recordings made in his career Lupoaia Haroon SRs 1300 equipped with existing teeth, it follows:

$$E_s = \frac{P_i \cdot T}{491.732 h_o},\ kWh/m^3 \qquad (4)$$

Using this relationship and corresponding data excavating height H = 3.5 m of TABLE 1 shows the specific energy consumption for each test, as shown in TABLE 6.

Specific energy consumption of the environment resulting from the arithmetic mean of the values calculated on the basis of the measured data, whereas the share of tests carried out was pleased about. In this case:

$$E_{smed} = 0{,}429\ kWh/m^3.$$

Similarly, for the data presented in TABLE 2 and measurements performed in similar conditions with your Digger SRs equipped with 1,300 new teeth, it appears the expression calculation:

$$E_s = \frac{P_i \cdot T}{783.576 \cdot h_o},\ kWh/m^3 \qquad (5)$$

Using the relationship (5) yields the data in TABLE 7.

Specific energy consumption average in this case is

$\mathbf{E_{s\,med} = 0{,}292\ kWh/m^3}$.

TABLE 5 : Measurand in experimenting new teeth

No. crt.	Swivel effect	Test no.	The width of the block B, m	Cutting height H, m	Slewing RADIUS, m	Maximum thickness of spanului ho,	During excavation, s	Slewing speed vp, m/s
1	dreapta	41	76	4	41,68	0,6	371	0,285
2	stânga	42	76	4	41,68	0,6	418	0,253
3	dreapta	43	76	4	41,68	0,7	410	0,258
4	stânga	44	76	4	41,68	0,7	729	0,145
5	dreapta	45	76	4	41,68	0,8	652	0,162
6	stânga	46	76	4	41,68	0,8	724	0,146

TABLE 6 : Measurand and calculated for the case existing teeth

Nr. crt.	Test no.	Time measured T, s	Maximum thickness of slice H_o, m	Registered average power P_i, kW	Specific energy consumption E_s, kWh/m^3
1	25	428	0,6	298	0,435
2	26	428	0,6	422	0,609
3	29	434	0,7	303	0,378
4	30	438	0,8	337	0,377
5	31	438	0,8	313	0,345

TABLE 7 : Results and calculated sizes for new teeth

Nr. crt.	Test no.	Time measured T, s	Maximum thickness of slice H_o, m	Registered average power P_i, kW	Specific energy consumption E_s, kWh/m^3
1	41	371	0,6	221	0,173
2	42	418	0,6	199	0,177
3	43	410	0,7	302	0,224
4	44	729	0,7	343	0,451
5	45	652	0,8	265	0,270
6	46	724	0,8	401	0,462

CONCLUSIONS

Analyzing the data obtained, resulting in a reduction of the specific energy consumption by 32% compared to using existing teeth. One can notice that the experimental tests with existing teeth were made after a number of hours when they had a relatively small degree of wear, and experiment with new teeth were made immediately after fitting the rotor, so with sharp teeth able. However it can approximate that a reduction of the specific energy consumption occurs at least 20 ... 25%, which confirms the wisdom on one hand values calculated from the results of laboratory experiments, and on the other hand the fact that the shape and geometric parameters you teeth have been thus begotten, respectively elected as to lead to a great work of cutting system bootstrap backhoes rotor.

Improving the process of excavation reserves, if we take into account the benefits from new and constructive geometric solutions regarding the placement of the teeth on the cups, and the cups. In addition, the depth study of the phenomenon of wear of the teeth and the cups would in a whole stage possibilities of improvement of cutting system-loading, including from the point of view of sustainability, winners and the impeller. The results of his research in the field of lignite and deployment using the teeth of excavator, in conjunction with those of the research concerning the excavation parameters in front of work, ensures increased efficiency cutting system-low rotor loading in general with the Customizing for the particular case of Motru basin.

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