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RESEARCH

Applying of Al-TiN Bronze on the Sealing Elements of the Rubber Production Plant

Machines for production of rubber compounds have a problem of sealing elements wear in time. Sealing elements are divided rings and bushings whose function is to provide sealing between the chamber and the rotor of the mixer. Contact surfaces of rings and bushings are in the direct contact thus causing these sealing elements to suffer wear in the run. Contact surfaces must be with high anti-wear properties and with high quality surface machining. It is also necessary to perform lubrication with appropriate oil in order to lower the wear to the smallest possible extent.

This paper deals with analysis of influence of these sealing elements regeneration procedures on production expenses. Analysis of influence on production expenses have been done for contact surfaces made of stellite (original rings and bushings), for surfaces regenerated with hard electrode and for surfaces regenerated with special aluminium – TiN brass.

Keywords: *sealing elements, rotor, mixer, bushings*

1. INTRODUCTION

Mixer (puddler) is a central machine at plant for production of rubber compounds at DD HK "Kablovi" – Jagodina with the function to deposit insulation and mantle on cables. Sealing elements are placed at mixer rotors made of rings and bushings with a function to provide sealing between the chamber and the mixer rotor that way preventing falling out of various charging (powder materials) that is added to the rubber mixture.

Contact surfaces of rings and bushings are in a direct contact causing the wearing of these sealing elements during the work of the machine.

In order to minimize the wear to the smallest possible extent, contact surfaces must be with high antiwear properties and with high quality surface machining and also to be lubricated with appropriate oil. Lubrication is necesssary because without it, wear would be more intensive and falling out of powder materials (chalk, soot and other various materials) from mixer chamber would occure at the same time.

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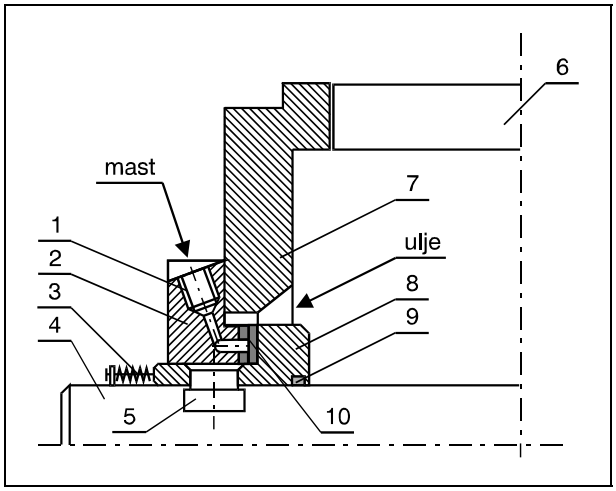

Figure 1. Block assembly: Sealing rings at mixer chamber; 1. central lubricator for grease, 2. divided ring, 3. mechanism for clearance adjusting, 4. mixer armature shaft, 5. plug for ring locating, 6. mixer piston, 7. mixer chamber side, 8. divided bushing, 9.sealing ring, 10. contact surfaces

2. INFLUENCE OF THE REGENERATION PROCEDURE ON LUBRICANT CONSUMPTION

This paper deals with analysis of influence of sealing elements (divided rings and bushings) regeneration procedure on production expenses, that is, influence on production expenses have been

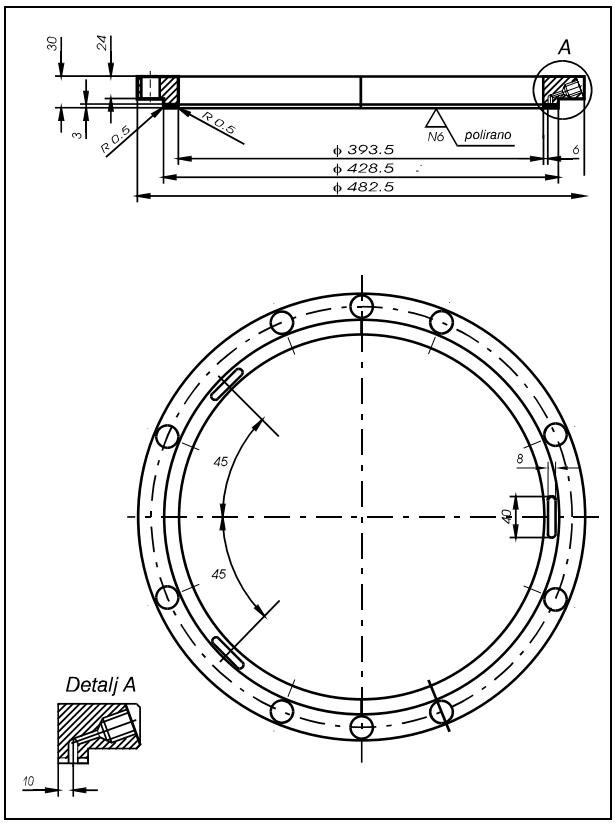

Figure 2. Divided ring

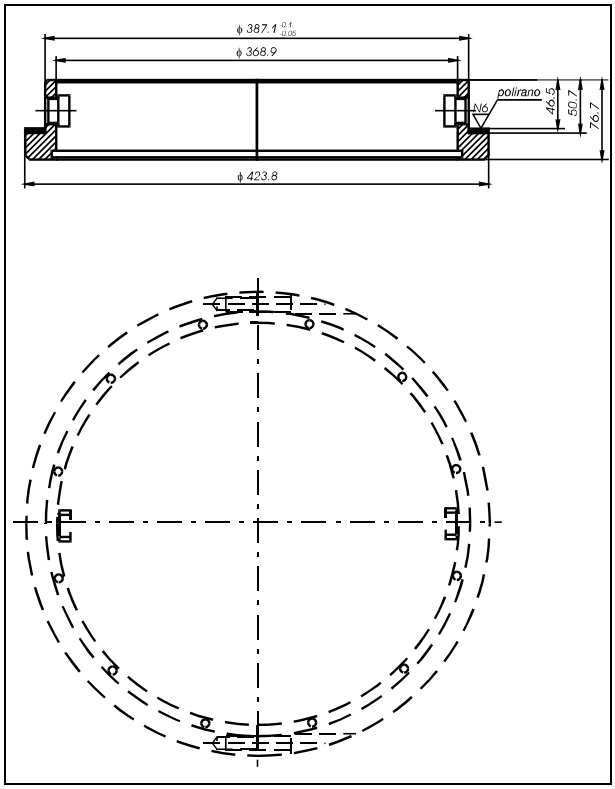

Figure 3. Divided bushing

analyzed for contact surfaces with stellite on it (original rings and bushings), for surfaces regenerated with hard electrode and for surfaces regenerated with special aluminium – tin brass.

Namely, type of the material deposited on contact surfaces of sealing elements, and also the quality of machined contact surfaces have influence on production costs through consumption of lubricants and charging (powder materials).

Stellite No. 20, with hardness somewhat beyond 60HRc was on contact surfaces of initial (original) sealing elements from manufacturer "BRIGE", Manchester, England. Surface roughness given by parameter Ra (average arithmetic profile digression from profile median) was in interval from 0.012 to 0.02μm.

Average daily lubricants consumption with these sealing elements was within granted limits during a three years period (as anticipated by the mixer instruction manual) and it was:

Table 1:

	Average lubricants consumption			
Time	Grease (kg/day)		Oil (l/shift)	
(year)	Forepart	Rearpart	Forepart	Rearpart
3	1.5	1.5	10	5

After the critical wearing out of these sealing elements (after the break-down, when abrupt wear of sealing elements occurred and consumption of process oil was increased in more then ten times), regeneration was done of contact surfaces at sealing rings and bushings by deposition of the stellite which is used for motor valve seats. Deposited stellite did not have hardness more then 36HRc and Ra was 1.6 μm.

Lubricants consumption with sealing elements that had been regenerated in such a way was more then allowed right away and the way it varied in certain time intervals is shown in the following table 2:

Table 2:

	Average lubricants consumption			
Time	Grease (kg/day)		Oil (l/shift)	
(months)	Forepart	Rearpart	Forepart	Rearpart
	2	1.7	10	6
8	3	2	12	8
13	4	2.5	15	10
19	5	3	20	10

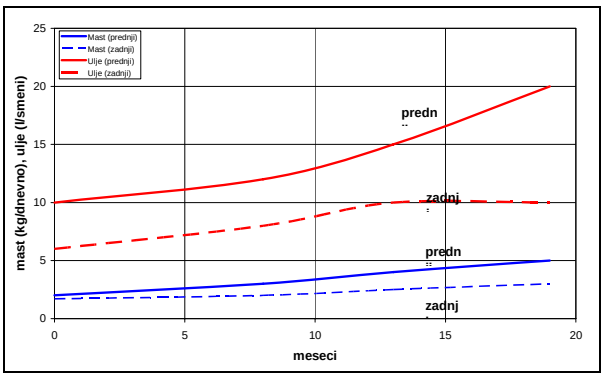

Figure 4.

After that, regeneration was again attempted with face welding by TN 60 hard electrode on contact surfaces. This way regenerated surface had hardness below 60 HRc and Ra from 6.3 until 12.5μm.

Table 3:

	Average lubricants consumption			
Time	Grease (kg/day)		Oil (l/shift)	
(months)	Forepart	Rearpart	Forepart	Rearpart
	2.8	1.7	11	7
6	3.5	2.5	13	9
14	4	2.5	15	10
22	5	3	20	10

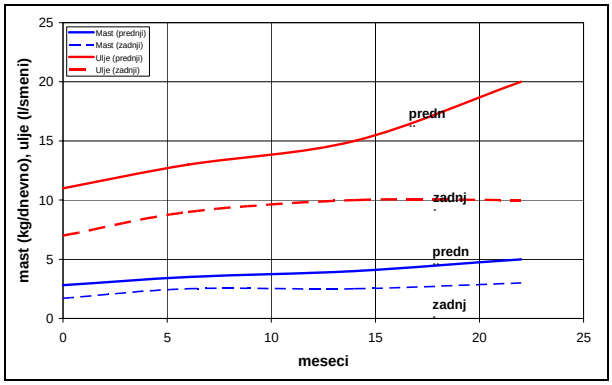

Figure 5.

During exploitation of these sealing elements lubricants consumption was satisfactory in the beginning but in time it significantly increased (probably because of the low quality of surface machining), what can be seen in table 3.

This kind of lubricant consumption (grease over 5 kg per day and oil over 20 l per shift) at sealing rings is a positive sign that a critical wearing out of rings occurred and that they should be replaced by new ones.

Since all previous regeneration attempts were relatively unsuccessful because of the rapid wear of contact surfaces, new sealing elements were obtained directly from the equipment manufacturer. These sealing elements had contact surfaces made of stellite with hardness around 60 HRc and with polished contact surfaces.

Lubricants consumption for these sealing elements is given in the following table:

Table 4:

	Average lubricants consumption			
Time	Grease (kg/day)		Oil (l/shift)	
(months)	Forepart	Rearpart	Forepart	Rearpart
	1.3	1.2	8	3
7	2	1.5	10	6
11	2.5	1.8	11	7
15	3	2	12	8
28	4	3	14	9

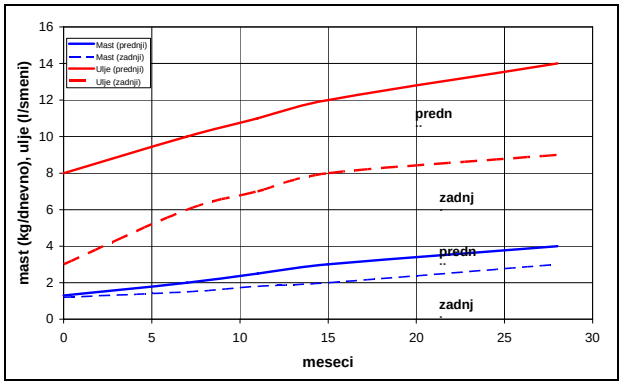

Figure 6.

After wearing out of these surfaces, because of the impossibility to obtain new sealing elements, regeneration of contact surfaces was done by depositing the special aluminium tin brass. This way regenerated surfaces had relatively low hardness (around 40 HRc) and surface quality of Ra=0.2 mμ, but they appeared to be very resistant to wear.

Table 5:

	Average lubricants consumption			
Time	Grease (kg/day)		Oil (l/shift)	
(years)	Forepart	Rearpart	Forepart	Rearpart
3	1.5	1.3	9	4

Average lubricants consumption is very satisfactory and within foreseen limits for this kind of regenerated sealing elements (table 5).

3. CONCLUSIONS

Comparative review of average lubricants consumption depending on a type of contact surfaces of sealing elements (rings and bushings) is given in a table 6.

Table 6:

Sealing elements	Grease (kg/day)	Oil (l/shift)	Work life (year)
New I	1.5	7.5	3
Stellite*)	5.8	11.4	1
Hard electrode *)	6.8	11.9	1
New II	2.3	8.7	2
Brass*)	1.4	6.5	>3
*) Regenerated			

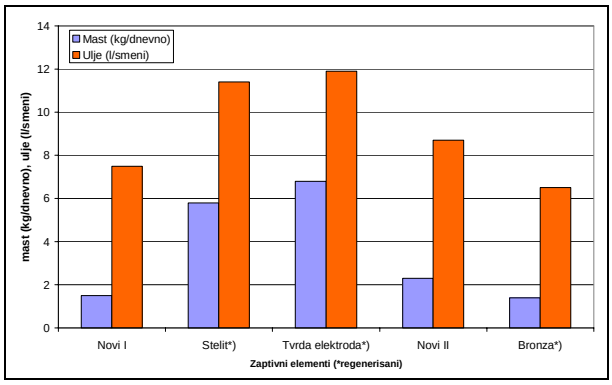

Figure 7.

According to the previous table it can be clearly seen that regeneration of contact surfaces of sealing elements by depositing aluminium tin brass was very successful and that surfaces regenerated this way have exceptional characteristics – high wear resistance and lubricants consumption is lowered to the smallest possible extent. It should also be emphasized that the regeneration cost for these elements is far below the price of new ones.

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