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REGARDING ON NEW BALL-BEARINGS HAVING A MODIFIED INTERNAL GEOMETRY (Part 3)

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ABSTRACT
In this paper there are presented some considerations regarding ball-bearings' rings construction, assembling conditions, loading capacities, new constructions of ball-bearings having other number of balls or other dimensions of them in the way to have improved loading capacities. There are also presented experimental researches in the field of materials used in on rings construction having thick dimensions.
Keywords: ball-bearings, geometry, capacities, material

1. INTRODUCTION
In this paper there are presented some experimental aspects regarding the behaviour of materials used in ball-bearings rings construction, the experimental stand used in researches.

2. THE INSTALLATION USED IN EXPERIENCES
The experimental researches were done using a machine with 4 contact points and presented schematically in Figure 1.

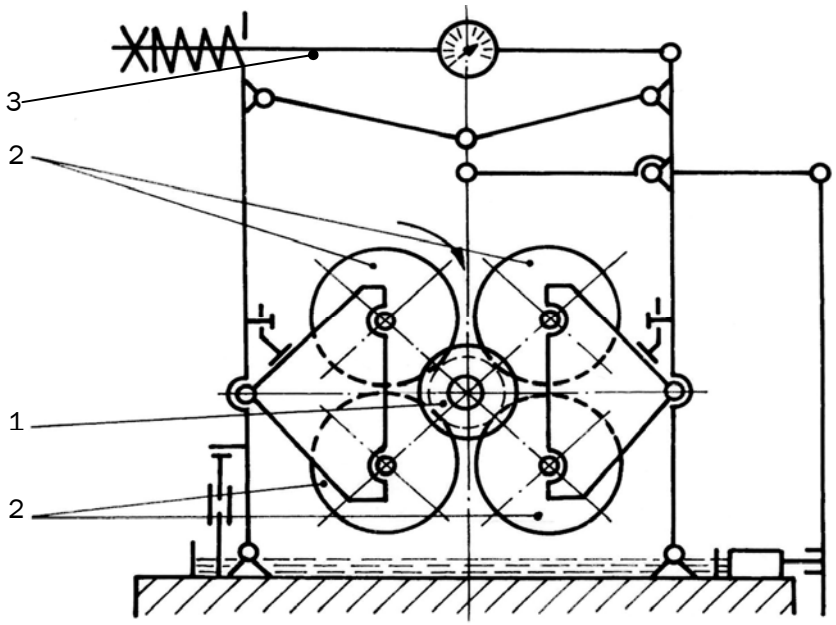

Figure 1. Machine scheme

The signification of the positions is: 1 - internal ball-bearing ring; 2 - roles; 3 - articulated charging system.
The articulated bars charging system permit a symmetrical charge for the 4 rolls on the internal ball-bearing ring. In Figure 2 there are presented some photos of the installation used in experimental researches, designed and realised in Braşov.

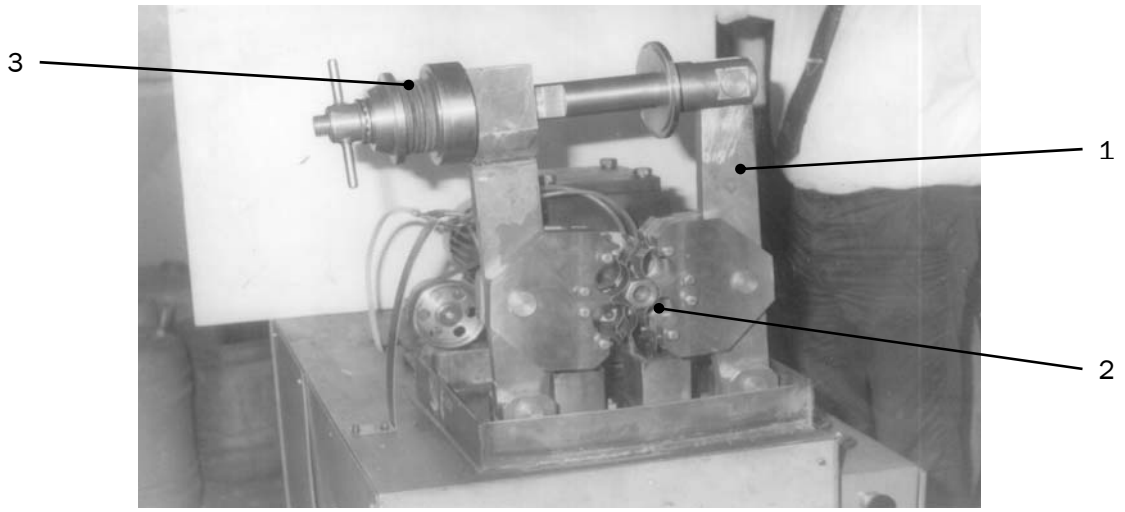

Figure 2a. Experimental installation.

In Figure 2a, is presented the charging system (1) and, in the middle, is the internal ball-bearing ring (2). The charge is made using the plate spring (3).
In Figure 2b is presented the engine (1), the belt transmission (2) with a 6.25 ratio and the housing (3).

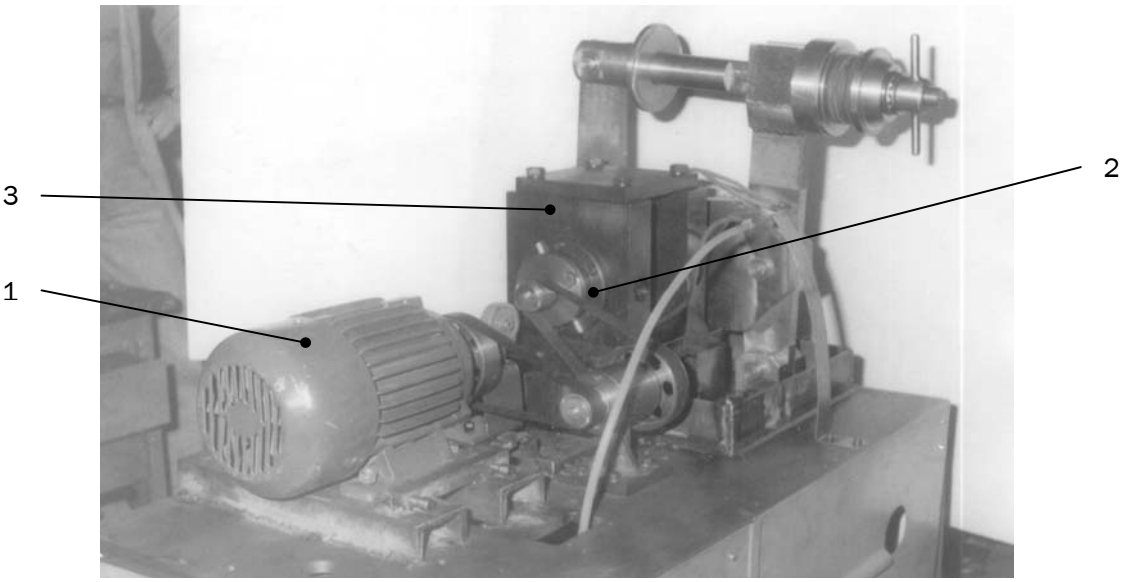

Figure 2b. Experimental installation.

In Figure 2c. is presented the cycles numbering system (1) using a worm reducer having the internal ratio $u = 60$.

3. TESTING CONDITIONS

There were built 5 internal rings of 6309 M4 ball-bearing using RUL1, RUL2 and 15Cr08Mo materials.
The dimensions of the rings and their hardness are 62 … 63 HRC.
Testing conditions used in the experiments are:

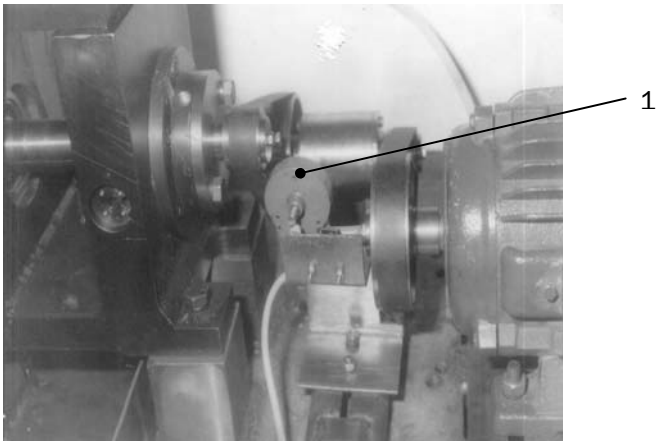

Figure 2c. Experimental installation.

- the charging force: $F = 4000$ N;
- contact frequency: $v = 35160$ min^{-1};
- oil type: M30;
- oil temperature: $t_u = 67$ºC.

All the 4 rolls were made by RUL1 material, having 65 … 66 HRC.
The experimental results are presented in Table 1.

Table 1. Experimental results.

Ring no.	Material					
	RUL 1		RUL 2		15Cr08Mo	
	time [min]	$\times 10^7$ cycles	time [min]	$\times 10^7$ cycles	time [min]	$\times 10^7$ cycles
1	865	3.07	520	1.82	830	2.91
2	920	3.23	683	2.40	1125	3.95
3	984	3.45	855	3.02	1250	4.39
4	1294	4.54	1190	4.18	1525	5.36
5	1445	5.08	1274	5.32	1772	6.23

As it can be seen, durability obtained is between 520 and 1172 min (appreciatively between 8.66 and 29.5 hours).
Taking into consideration the materials used and the number of cycles, the dependence is presented in Figure 3.

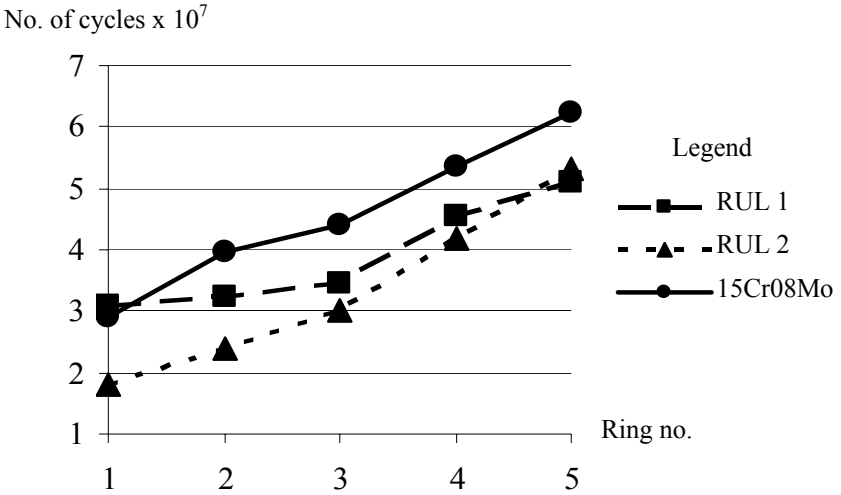

Figure 3. Dependences between materials and no. of cycles.

On the material importance in durability, greatest values are obtained for the 15Cr08Mo alloy steel, face hardening steel (6.23 x 10^7 cycles) in comparison with RUL1 or RUL2 (1.82 x 10^7 cycles).
In Figure 4 and Figure 5 are presented the testing rolls and the internal ball-bearing ring, and also some pitting forms obtained on rings.

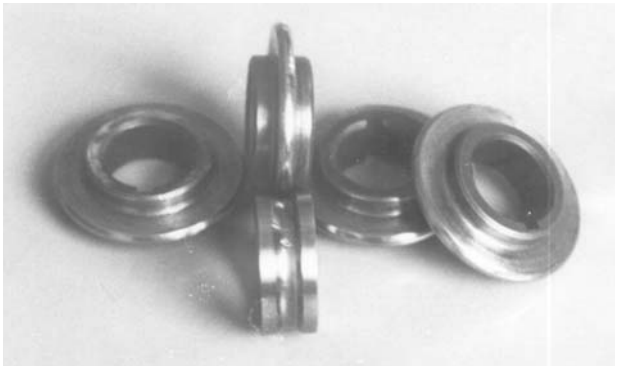

Figure 4. Rolls and rings.

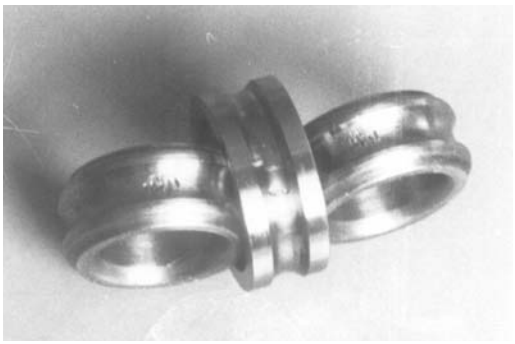

Figure 5. Pitting forms.

4. CONCLUSIONS

The experimental results give us a good dimension about the material behavior, a comparison between alloy steels presents the superiority of the 15Cr08Mo steel (6.23 x 10^7 cycles).
Finally there are presented some rolls and rings, and pitting forms obtained on rings.

5. REFERENCES

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