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O T T A W A

March 11th, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1176.

Examination of "Nitralloy" Bushings.

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BUREAU OF MINES  
DIVISION OF METALLIC MINERALS  
ORE DRESSING AND  
METALLURGICAL LABORATORIES



CANADA  
DEPARTMENT  
OF  
MINES AND RESOURCES  
MINES AND GEOLOGY BRANCH

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ORE DRESSING AND METALLURGICAL LABORATORIES.

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Origin of Request and Object of Investigation:

On February 27th, 1942, two bushings and their respective drawings were received from The Inspection Board of the United Kingdom and Canada, 58 Lyon Street, Ottawa, Ontario. One of the bushings was made from U. S. Ordnance Department Drawing No. B 153966 and the other from U. S. Ordnance Department Drawing No. A 164248.

The material specified on these drawings is "Nitralloy, Grade G, the surfaces to be nitrided." The prime contractor on this job is the Montreal Locomotive Works, Montreal, Quebec.

It was requested that the Rockwell hardness value

(Origin of Request and Object of Investigation, cont'd) -  
of the case be determined and also that chemical analyses  
be obtained.

This work is covered by Analysis Requisition  
No. O.T. 134, dated February 24th, 1942.

Macro-Examination:

The bushings appeared to be badly scored.

Physical Tests:

Hardness values were determined, using the  
Vickers hardness tester with a 5-kilogram load. These  
values are translated into the corresponding Rockwell 30N  
superficial hardness numbers.

Bushing No. E 153966 -

Surface: 71 Rockwell 30N - 56 Rockwell 30N.  
Average, 65 Rockwell 30N (426 Vickers).

Interior of  
section: 213 Vickers.

Average depth  
of case: 0.01 inch.

Bushing No. A 164248 -

Surface: No case - 259 Vickers.

Interior of  
section: 249 Vickers.

Chemical Analysis:

Table I gives the chemical analyses of the two  
bushings and also the specifications for Nitralloy C.

(Continued on next page)

(Chemical Analysis, cont'd) -

Table I.

	<u>Bushing No.</u> <u>B 153966.</u>	<u>Bushing No.</u> <u>A 164248.</u>	<u>Nitralloy,</u> <u>Grade G.</u>
	((P e r c e n t))		
Carbon	- 0.26	0.26	0.30-0.40
Manganese	- 0.60	0.58	0.40-0.60
Silicon	- 0.070	0.070	0.20-0.30
Aluminium	- None detected.	None detected.	0.90-1.40
Chromium	- Trace.	Trace.	0.90-1.40
Molybdenum	- Trace.	Trace.	0.15-0.25
Sulphur	- 0.024	0.023	
Phosphorus	- 0.008	0.007	

Microscopic Examination:

Figures 1 and 2 are photomicrographs of the structures obtained in the case on Bushing B 153966. These are characteristic of a rather poorly quenched carburized case.

Discussion of Results:

Evidently SAE 1025 steel was substituted for Nitralloy G, and an attempt was made at carburizing rather than nitriding. A case of about 0.01 inch is evident on the one bushing that was carburized. If there was a case put on Bushing A 164248 it was all ground off afterwards.

A nitrided case would have Vickers hardness values in the order of 900 to 1100, which would be equivalent to a Rockwell superficial 30N value of 80 to 82.

There are apparently some irregularities in the manufacturing practice, since none of the specifications for material, process, or physical properties was adhered to.

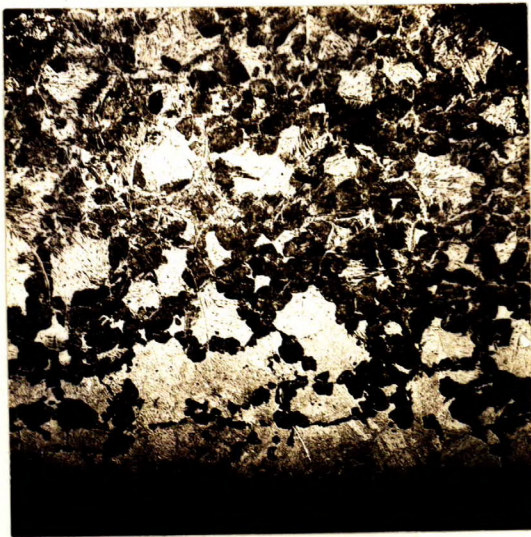
Conclusions:

1. The material is not Nitralloy G, as specified, but rather SAE 1025 steel.
2. The hardness of the case is not Rockwell 30N 81.5, as specified, but Rockwell 30N 65.
3. The case is only 0.01 inch deep, and not 0.02 to 0.036 inch as specified.
4. The case is carburized, and not nitrided as specified.
5. One bushing does not appear to have been case-hardened at all.

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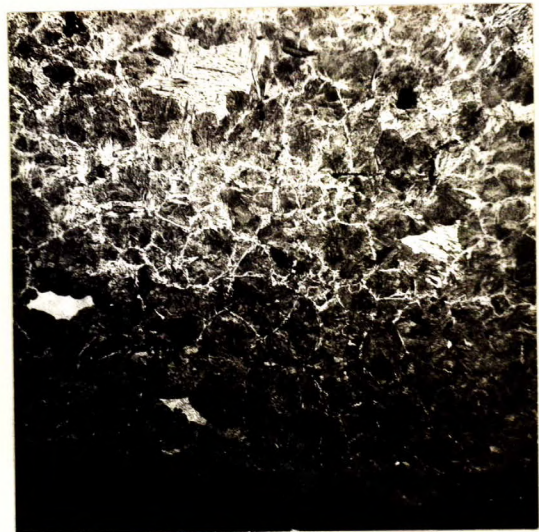
HVK:PES.

Figure 1.



X100, picral etch.

Figure 2.



X100, picral etch.

STRUCTURES IN CASE OF BUSHING  
NO. B 153966.

THIS DOCUMENT CONTAINS NEITHER RECOMMENDATIONS NOR  
CONCLUSIONS OF THE NATIONAL BUREAU OF STANDARDS  
AND IS INTENDED TO SERVE AS A GUIDE TO INFORMATION  
ON THE SUBJECT MATTER DISCUSSED THEREIN.

HVK:PES.