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O T T A W A April 9th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1386.

Investigation of Four SAE 9255 Homogeneous
Universal Carrier Track Pins.

(Copy No. 10.)

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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Origin of Material and Object of Investigation:

On March 30th, 1943, Dr. C. W. Drury, Director of Metallurgy, Army Engineering Design Branch of the Department of Munitions and Supply, Ottawa, Ontario, submitted four Universal carrier track pins obtained from the Ford Motor Company of Canada Limited. Requisition No. 451, AEDB Lot Nos. 454, 455, 456, and 457, was received requesting that the impact resistance should be checked along with surface hardness, core hardness and depth of decarburization.

Chemical Analysis:

	As Found	Specification Limits
	- Per cent -	
Carbon -	0.51	0.50 - 0.60
Manganese -	0.66	0.60 - 0.90
Silicon -	1.97	1.80 - 2.20
Phosphorus -	0.007	0.040 max.
Sulphur -	0.024	0.050 max.

Hardness and Impact Results:

Hardness readings were taken across the surface of the pins, using the Vickers machine and a 50-kg. load. Core hardnesses were taken with the same load. Table I lists the results obtained and shows whether the pins passed or failed specified impact:

Table I.

AEDB LoT No.	Case Hardness	Core Hardness	Impact
454 -	478	573	Passed.
455 -	511	652	Passed.
456 -	589	620	Failed.
457 -	567	648	Failed.

Microscopic Examination:

Microspecimens were cut from one of the failed and one of the passed pins and were then examined under the microscope. Figure 1 (at X500 magnification) was taken at the surface. This shows that recarburization of the decarburized zone was completely effected to a depth of about 0.0015 inch. Figure 2 (X1000 magnification) illustrates ferrite around the grain boundaries. This is a photomicrograph of the zone immediately below the totally recarburized surface layer. This zone extents to a depth of approximately 0.010 inch from the surface. Figure 3 (X1000) illustrates the structure of the case. These pictures were all taken from one specimen.

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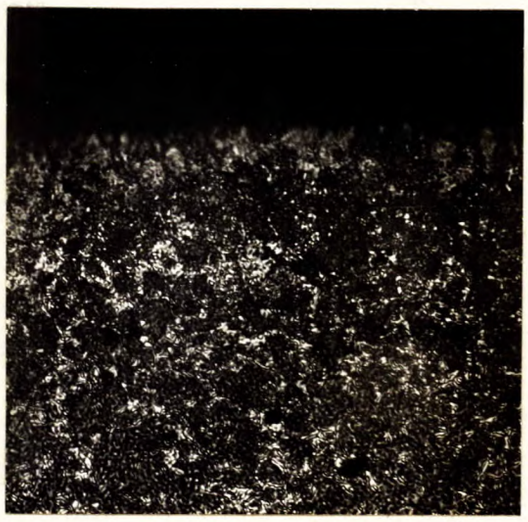
(Microscopic Examination, cont'd) -

Figure 1.



X500, nital etch.

SURFACE STRUCTURE.

Figure 2.

X1000.

ZONE BELOW SURFACE
NOT FULLY RECARBURIZED.

Figure 3.

X1000.

CORE STRUCTURE.

Discussion:

Two of the four pins failed the impact tests. High hardness results were obtained, which explains the tendency towards brittleness. The surface hardnesses were lower than the core hardnesses in all the pins. The microscopic examination indicates the probable reason for this feature. A lower carbon material appears to be present immediately under the surface skin. This is indicated by the presence of ferrite around the grain boundaries. Although this zone might not have any deleterious effect upon the service properties of the pin, it might be advisable to increase the carburizing time slightly, which would eliminate the remaining ferrite. The producers should draw the pins at a higher temperature, in order to meet the specified hardness range of 43 ± 3 Rockwell "C".

RECOMMENDATIONS:

1. The pins should be drawn at a higher temperature.

2. A slightly longer carburizing time could be used, to eliminate the remaining ferrite near the surface.

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SLG:GHB.