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O T T A W A November 13th, 1944.

R E P O R T
of the
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1741.

Metallurgical Examination of Failed
Carrier Idler Wheel.



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Origin of Request and Object of Investigation:

On October 10th, 1944, under Requisition No. 673, A.E.D.B. Lot No. 566, Report No. 9, Section D, Test No. 7, a carrier idler wheel was submitted by the Division of Metallurgy, Army Engineering Design Branch, Department of Munitions and Supply, Ottawa, Ontario, for metallurgical examination.

The wheel was reported to be made of malleable iron and to have failed after 4,964 miles of operation.

Examination:

The rim had completely disappeared in some places, although, from the accompanying drawing (CTL 13452-B), it was supposedly a minimum of 0.55 inch thick at the centre. See Figure 1.

Figure 1.



NOTE FRACTURE IN SIDEWALL,
AS SHOWN WITH ARROWS.

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The sidewall had fractured along a line just below the rim (marked by arrows in Figure 1). Figure 2 shows a general view of the idler wheel.

Figure 2.



GENERAL VIEW OF IDLER WHEEL.
(Approximately 1/3 full size).

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Chemical Analysis:

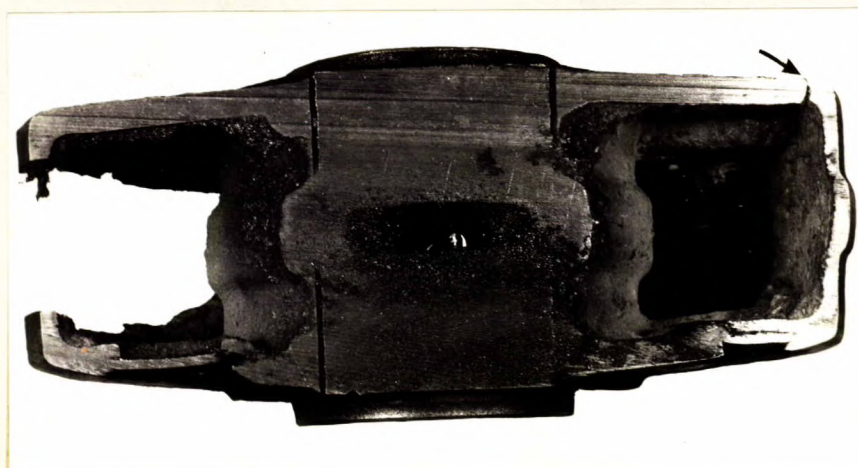
	<u>Per Cent</u>
Total carbon -	1.63 [Ⓢ]
Temper carbon -	<u>1.60[Ⓢ]</u>
Combined carbon -	0.03
Manganese -	0.23
Silicon -	0.96
Sulphur -	0.031
Phosphorus -	0.108
Molybdenum -	0.01
Chromium, Nickel -	Trace.

[Ⓢ] Values probably none too reliable, owing to difficulty of sampling malleable iron.

Micro-Examination:

A decarburized zone approximately 0.05 inch thick was seen around the edge of the samples examined. No pearlite was seen, and the interior of the samples had the appearance of good malleable iron--ferrite with nodules of temper carbon. A crack was observed at the juncture of the rim and sidewall (see Figure 3). This was the only fault discernible in the wheel.

Figure 3.



NOTE CRACK AT JUNCTURE OF
RIM AND SIDEWALL.

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(Continued on next page)

(Micro-Examination, cont'd) -

A section across the crack was examined microscopically. Since the surface of the fracture had been exposed to the atmosphere for some time, however, nothing could be learned from this examination. The microstructure at this point did not differ from that of the other samples examined.

Discussion:

The analysis is that of a good grade of malleable iron. The phosphorus content indicates that good performance could be expected at low temperatures.

The crack might have been due to one or both of the following causes:

1. The core used in casting might have been too hard. In solidifying and cooling, the metal rather than the core would be forced to yield and a "hot tear" would result. The position of the fracture on the idler wheel is a natural place for "hot tears".
2. Excessive loads may have been applied to the wheel. The location of the crack, however, does not appear to substantiate this supposition.

It would appear, then, that the crack occurred during casting and that possibly further cracking occurred in service. With no support on one side the rim of the wheel would then collapse.

Conclusions:

1. The metal is a malleable iron of good quality.
2. Failure was due to the presence of "hot tears", and further cracking probably occurred in service.

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