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December 4th, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1333.

Examination of Austenitic Manganese Steel
Test Bars and Track Links from
the Beach Foundry Limited,
Ottawa, Ontario.

(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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Examination of Austenitic Manganese Steel
Test Bars and Track Links from
the Beach Foundry Limited,
Ottawa, Ontario.

Origin of Samples:

On November 30th, 1942, Mr. R. Caskie, metallurgist of the Beach Foundry Limited, Ottawa, Ontario, submitted three test bars and two Mark III tank track links as samples for investigation.

All of these specimens were reported to be made of austenitic manganese steel. The three test bars, numbered 1, 4 and 7, were quenched in water after being heated in

(Origin of Samples, cont'd) -

different parts of an oil-fired furnace held at 1850° F. A radiograph (made at Hull Iron & Steel Foundries Ltd., Hull, Quebec), of the two track links, identified as Nos. 1 and 2, revealed the presence of cavities in these castings.

Object of Study:

An investigation of the microstructure of the test bars and a determination of the nature of cavities in the track links were requested.

Microstructures:

Micro-examination of the three test bars revealed that each of them had globular particles of free carbide. The arrangement of these carbides conforms to a dendritic pattern. In Test Bar 4, some of the carbide constituent has been rejected to the grain boundaries. Photomicrographs, at 250 diameters, of Test Bars 1, 4 and 7 are given in Figures 1, 2 and 5, respectively.

Physical Examination:

The two track links were sectioned through areas which the radiograph had shown to be defective. Figure 5 is a photograph of Link No. 1 after a small eyehole had been removed. The surfaces of the two cavities in the upper right hand corner are smooth, while those of the others are dendritic.

The defects shown in Figure 6 were present in a large eyehole in Link No. 1. These cavities have symmetrical outlines and smooth lined surfaces. The cavities illustrated in Figure 7, from a large eyehole of Link No. 2, have irregular outlines and rough surfaces.

Discussion of Results:

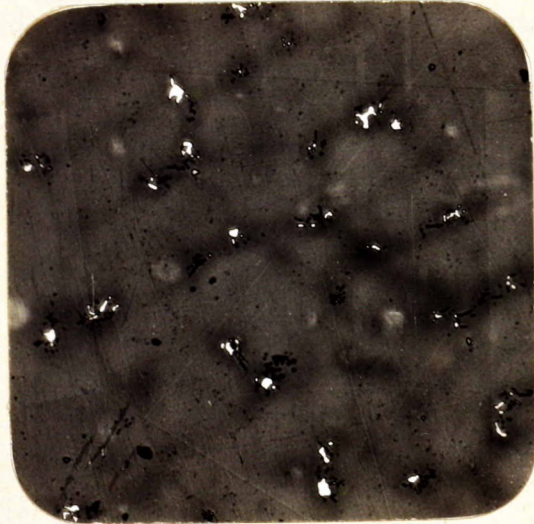
The nature of the carbide particles present in the heat-treated test bars indicates that these specimens were quenched from too low a temperature, the carbide never being completely in solution. This condition could also have resulted from insufficient soaking time but this possibility is considered less likely. The carbide at the boundaries of the austenite grains in Test Bar 4 shows that some delay occurred in the quenching of this sample.

The two cavities in the upper right hand corner of Figure 5 were caused by gas from the chill situated at this point. The others in this picture are shrinks. The location and nature of the defects shown in Figure 6 indicate that these were probably caused by gas. The defects in Link No. 2 (Figure 7) seem to be shrinkage cavities.

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LPT:GHB.

Figure 1.



X250, nital etch.

TEST BAR 1.

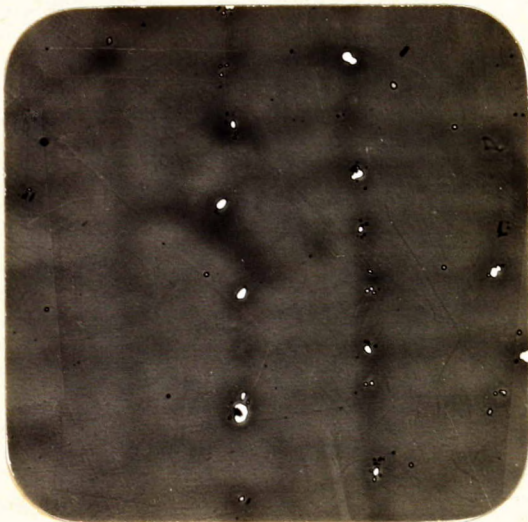
Figure 2.



X250, nital etch.

TEST BAR 4.

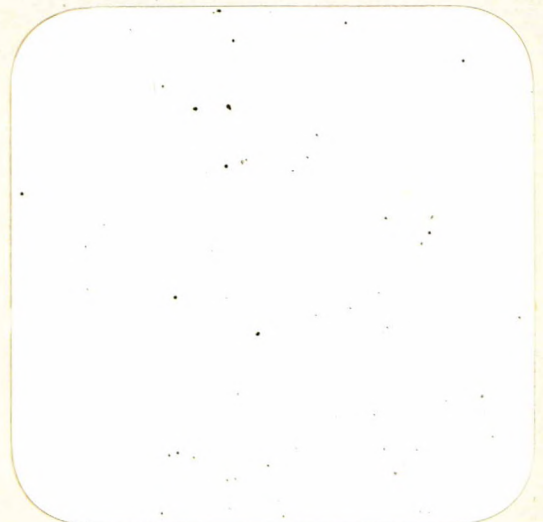
Figure 3.



X250, nital etch.

TEST BAR 7.

Figure 4.



X100, unetched.

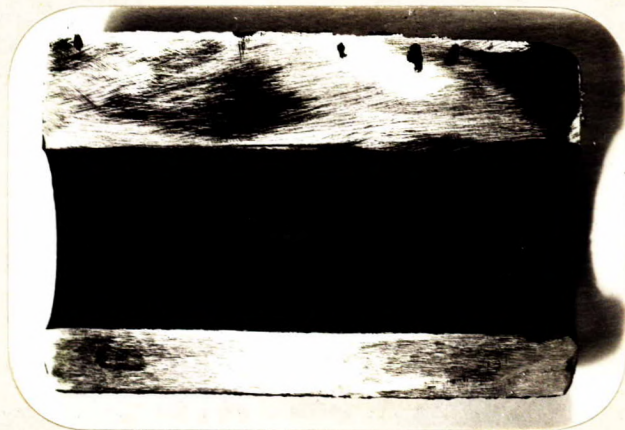
TEST BAR 7.

Note inclusions in the steel.



DEFECTS IN LINK NO. 1.
(Approximately $\frac{3}{4}$ size).

Figure 6.



DEFECTS IN LINK NO. 1.
(Approximately to size).

Figure 7.



DEFECTS IN LINK NO. 2.
(Approximately to size).