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ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1332.

Examination of a "Newhouse Crusher Mantle"
Manganese Steel Casting.

(Copy No. 5.)

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 a "Newhouse Crusher Mantle" Manganese Steel Casting.

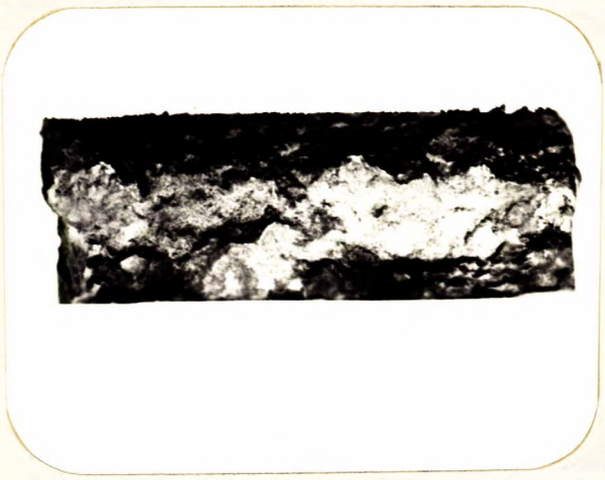
Source of Material and Object of Investigation:

On November 27th, 1942, Mr. J. R. Blais, Sales Department, Sorel Steel Foundries Limited, Sorel, Quebec, sent in a piece of austenitic manganese steel casting, marked "Newhouse Crusher Mantle," which had failed in service. Request was made for a chemical analysis and a microscopic examination in order to determine, if possible, the cause of failure.

Macro-Examination:

Figure 1 is a photograph showing the fracture of the casting in the "as received" condition. A section cut for microscopic examination revealed a deep shrinkage cavity.

Figure 1.



FRACTURE OF THE CASTING.

(Approx. ½ size).

Chemical Analysis:

Drillings from the casting were analysed and the following results were obtained:

	As Found - Per cent -	Recommended Specification - Per cent -
Carbon (C) =	1.05	1.00 - 1.40
Manganese (Mn) =	12.67	10.00 - 14.00
Silicon (Si) =	0.50	0.30 - 1.00
Sulphur (S) =	0.033	0.05
Phosphorus (P) =	0.014	0.10
Chromium (Cr) =	0.19	-

Microscopic Examination:

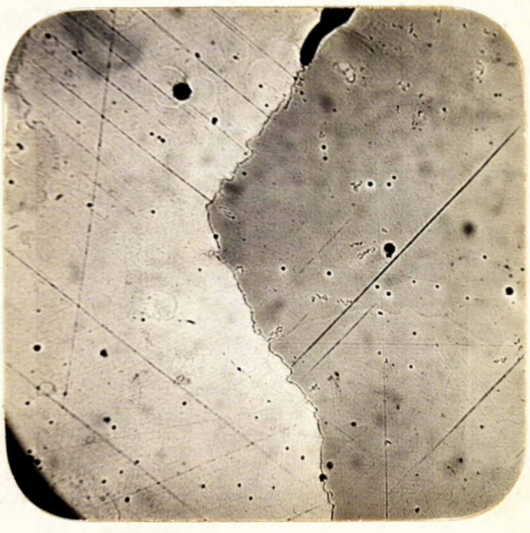
A sample of the steel was cut from the casting and given a metallographic polish. It was first examined under the microscope in the unetched condition. The steel was found to be fairly clean but shrinkage cavities were present. These are illustrated in Figure 2, a photomicrograph taken at X100 magnification. The structure of the material, after etching in a solution of 2 per cent nitric acid in alcohol, is shown in Figure 3, also at X100 magnification. In this structure, no free carbides were observed. However, it will be noted that the grain size is fairly large.

Figure 2.

X100, unetched.

SHOWING SHRINKAGE CAVITIES.

Figure 3.



X100, etched in 2 per cent nital.

SHOWING GRAIN SIZE.

Discussion of Results:

The steel had the composition specified by the A.S.T.M. for austenitic manganese steel. The steel was found to be fairly coarse-grained, an indication that it was poured from a fairly high temperature. The presence of shrinkage cavities would lower the physical properties of the steel,

(Discussion of Results, cont'd) -

especially when subjected to impact stresses. Their presence is due to faulty foundry technique. The heat treatment of this casting appears to have been satisfactory, as no free carbides were found in the steel.

CONCLUSION:

The failure of this casting can be attributed to the presence of shrinkage cavities in the steel.

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