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O T T A W A · July 19th, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1683.

Investigation to Determine the Cause of Cracks in Manganese Steel Castings.

(Copy No. 10.)

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Origin of Request and Object of Investigation:

Three samples of manganese steel were received from the Sorel Steel Foundries Limited, Sorel, Quebec, on July 11th, 1944. A covering letter, dated July 7th, 1944, stated that these were cut from placer dredge buckets, cast from three different heats of steel. These castings had cracked immediately after being removed from the mould.

An investigation to determine the cause of this trouble was requested.

Macro-Examination:

The specimens were identified by the numbers 40, 43, and 45. Sample No. 40 showed a crack, and when the specimen was cut this crack expanded considerably, indicating the presence of internal stresses.

Chemical Analysis:

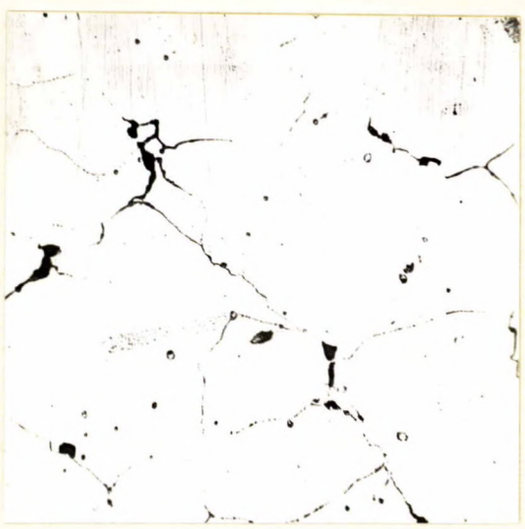
The chemical analyses were found to be as follows:

	Sample No. 40	Sample No. 43	Sample No. 45
	- Per cent -		
Carbon -	1.06	1.03	1.00
Manganese -	12.04	10.57	11.75
Silicon -	0.82	0.96	0.96
Chromium -	0.89	1.27	0.68
Phosphorus -	0.055	0.037	0.064
Sulphur -	0.008	0.007	0.014

Microstructure:

Figure 1 is a photomicrograph, at X100 magnification, of the structure of Sample No. 40. It consists of austenite with carbide grain boundaries.

Figure 1.



X100, nital etch.

MICROSTRUCTURE OF SAMPLE NO. 40.

Austenite with carbide grain boundaries.

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Discussion:

The expansion of the crack in Sample No. 40 after it was cut indicates that the failure was caused by internal stresses. The cause of these stresses could not be determined from the specimens submitted. This is not surprising, as trouble of this nature is more likely to be caused by the moulding and pouring practice than by the use of off-standard metal.

CONCLUSIONS:

Chemical analysis and microstructure examination do not give any indication of the cause of cracking. Moulding conditions should be investigated. Mould hardness, hot strength and collapsibility of sand have some effect on cracking. Experimenting with foundry procedure will probably result in the elimination of this defect.

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AEM:LB.