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November 1st, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1729.

Examination of Four Samples of Manganese Steel.

(Copy No. 10.)

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Origin of Request and Object of Investigation:

On October 13th, 1944, a request was received from the Sorel Steel Foundries Limited, Sorel, Quebec, for an analysis and comments on the quality of four samples of manganese steel. The samples, marked 18, 58, 110 and 124, were received on October 17th.

Chemical Analysis:

The chemical analyses were found to be as follows:

	<u>Sample</u> <u>No. 18</u>	<u>Sample</u> <u>No. 58</u>	<u>Sample</u> <u>No. 110</u>	<u>Sample</u> <u>No. 124</u>
	- Per Cent -			
Carbon -	1.14	1.19	1.10	1.01
Manganese -	10.30	13.16	10.16	7.77
Silicon -	0.41	0.77	0.33	0.06
Phosphorus -	0.067	0.060	0.060	0.053
Sulphur -	0.027	0.027	0.026	0.026

Microstructure:

Photomicrographs at X100 magnification are shown in Figures 1 to 4.

Figure 1 shows that Sample No. 18 contains free carbides. These appear in the dark areas as small white particles surrounded by a dark grain boundary.

The photomicrographs of Samples Nos. 58, 110 and 124 show that these steels have the normal austenitic structure of manganese steels.

Discussion:

Although the chemical composition of Sample No. 124 lies within the range for austenitic manganese steel, the manganese content is far below the 10 per cent minimum of the specifications. The American Society for Metals Handbook, 1939, says (p. 567): "The more experienced makers set a lower limit of 11.00 per cent manganese instead of 10.00 per cent, as the steels containing less than 11.00 per cent manganese are somewhat lacking in toughness and strength." Sample No. 58 is the only one of those submitted which has over 11 per cent manganese.

The silicon content of Sample No. 124 is below the 0.30 per cent minimum of the specifications. This steel has not been sufficiently deoxidized. Possibly the steel was

(Discussion, cont'd) -

allowed to reoxidize after the silicon and manganese additions. This could also account for the low manganese, as some of it may have been allowed to burn off.

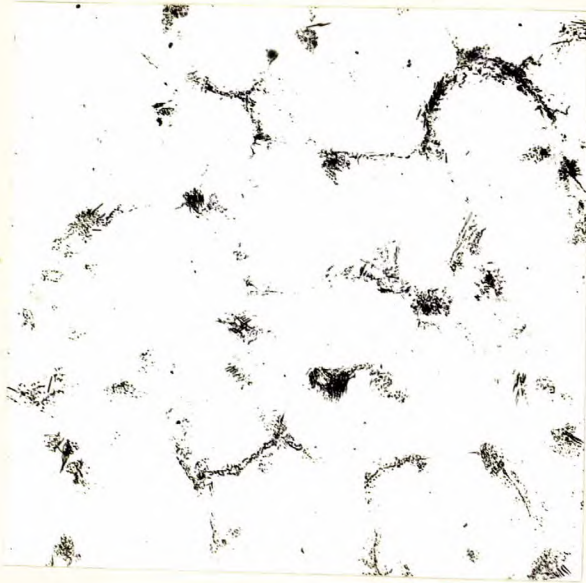
The chemical composition of the other three samples is normal, with the exception of the fairly low manganese content of Samples Nos. 18 and 110.

The carbides in Sample No. 18 would make this steel too brittle for service. It has not received the normal heat treatment for austenitic manganese steel.

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AEM:GHB.

Figure 1.



X100, nital etch.

SAMPLE NO. 18.

Carbides appear as light spots surrounded by dark grain boundaries.

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Figure 2.



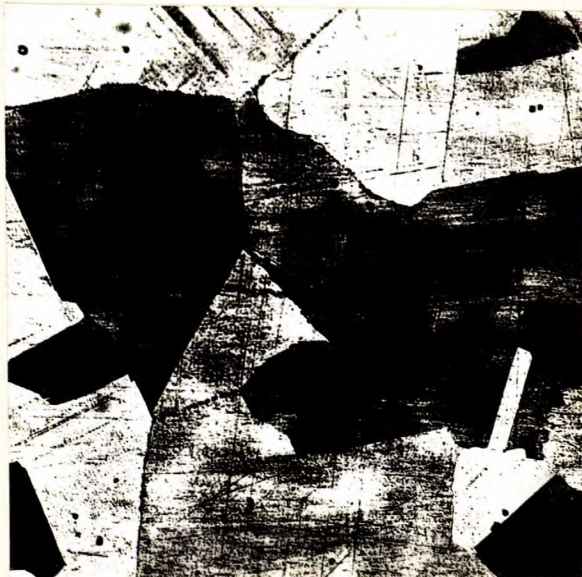
X100, nital etch.

SAMPLE NO. 58.

Normal austenitic structure.

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Figure 3.



X100, nital etch.

SAMPLE NO. 110.

Normal austenitic structure.

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Figure 4.



X100, nital etch.

SAMPLE NO. 124.

Normal austenitic structure.

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