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June 13th, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1664.

Examination of Armoured Snowmobile Wheel Assembly.

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Origin of Request and Object of Investigation:

On April 26th, 1944, the Inspection Board of the United Kingdom and Canada, Ottawa, Ontario, submitted one armoured snowmobile wheel assembly for metallurgical examination. Analysis Requisition No. O.T. 4181 (reference 12/4/4, Investigation No. 40), accompanying the material, requested an examination to determine the following:

- (1) If hub metal meets the specification for SAE 1020 steel.
- (2) Identification of steel used on discs and rim.
- (3) Metallurgical structure of welds.

Chemical Analysis:

The chemical analysis of the various parts are shown below, together with the nominal analysis for SAE 1020 steel:

	AS FOUND			Nominal analysis, SAE 1020 steel
	Hub metal	Disc metal	Rim metal	
Carbon	0.09	0.03	0.01	0.18-0.23
Manganese	0.49	0.27	0.30	0.30-0.50
Silicon	0.11	Trace.	Trace.	
Phosphorus	0.014	0.007	0.007	0.040 max.
Sulphur	0.036	0.020	0.022	0.050 max.
Chromium	N.D.	N.D.	N.D.	N.D.
Nickel	Trace.	0.07	0.07	
Molybdenum	Trace.	Trace.	Trace.	

N.D. - None detected.

Examination of Welds:

Figure 1 is a photograph of the welded sections examined. These samples were etched in 10 per cent nitric acid in an attempt to show some difference between the weld metal and the parent metal. Sections B, C and D show a slight coarsening of grain in the weld metal, but there was a very little difference to be noted.

Microscopic Examination:

Sections of hub, disc and rim metal, including welds, were cut from the assembly, mounted in bakelite, hand polished, and etched in 2 per cent nital.

Figures 2, 3 and 4, at a magnification of 100 diameters, show respectively the normal structure, the heat-affected zone and the weld metal of the section of hub examined. The hub metal in the heat-affected zone appears to be low-carbon martensite with some ferrite.

Figures 5 and 6, at a magnification of 100 diameters, show the disc and rim metals respectively. These structures, ferrite with some free carbides, are normal for steel having a carbon content of less than 0.05 per cent.

Discussion of Results; Conclusions:

The chemical analysis shows that the material used in the hub does not meet the specifications for SAE 1020 steel but does agree with the nominal specification for SAE 1010 steel. Chemical analysis also shows that the disc and rim sections were made from a very low carbon steel. This indication is further borne out by the microstructure.

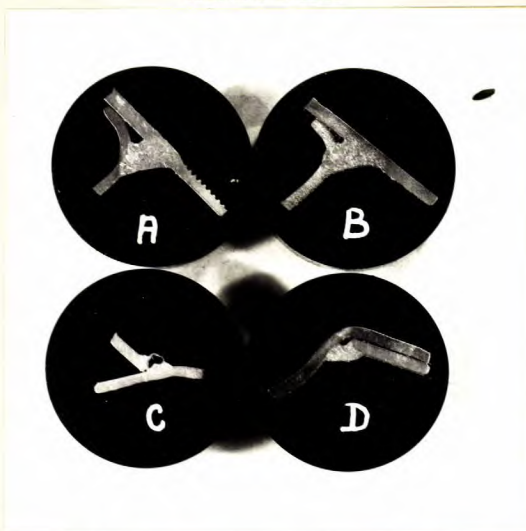
The structure of the weld metal is very similar to that of the hub, both being low-carbon material.

The welding is generally fair, some improvement being possible. Section C (see Figure 1) shows a tack weld with a large gas inclusion. This was the only gross welding defect noted.

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MLC;GHB.

Figure 1.

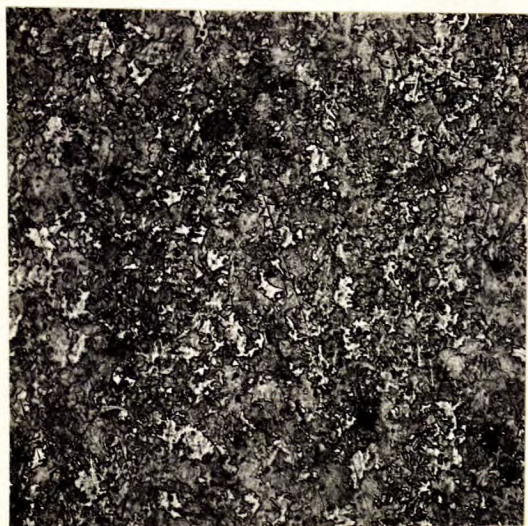


PHOTOGRAPH OF WELDED SECTIONS EXAMINED.

(Approximately 4/5 actual size).

A and B, hub section; C, disc section; and D, rim section.

Figure 2.



X100, nital etch.
NORMAL STRUCTURE,
HUB METAL.

Figure 3.



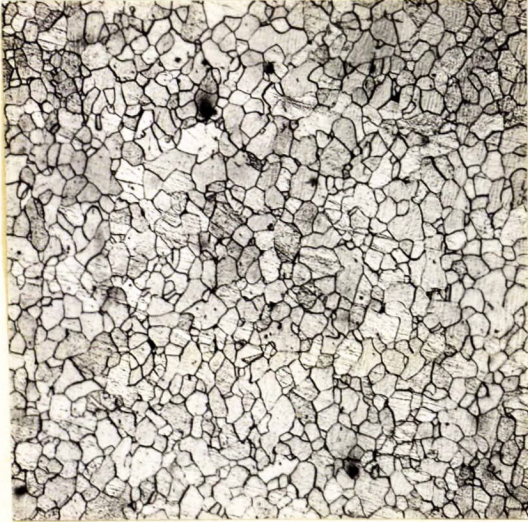
X100, nital etch.
HEAT-AFFECTED ZONE,
HUB METAL.

Figure 4.



X100, nital etch.
WELD METAL, HUB SECTION.

Figure 5.

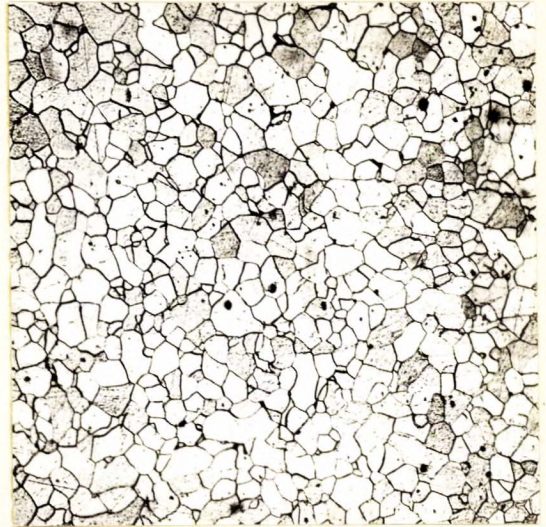


X100, nital etch.

DISC METAL.

Ferrite with some
free carbides.

Figure 6.



X100, nital etch.

RIM METAL.

Ferrite with some
free carbides.

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ELC:GMB.