O T T A W A November 27th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 932.

Report on Drive Sprocket
for Universal Carrier.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
ORE DRESSING AND
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CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Origin of Material and Nature of Investigation:

A letter (No. 179) from the office of the D.C.I.A.(G), Department of National Defence, 479 Bank Street, Ottawa, Ontario, requested a report on the suitability for service of a drive sprocket for the Universal Carrier.

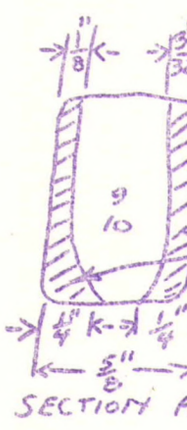
Hardness Tests:

A sample drive sprocket of English manufacture was available. Therefore it was decided to compare its properties with those of the Canadian-made sprocket.

(Continued on next page)

(Hardness Tests, cont'd) -

Canadian-made sprocket -



SECTION THROUGH SPROCKET TOOTH

Figure 1.

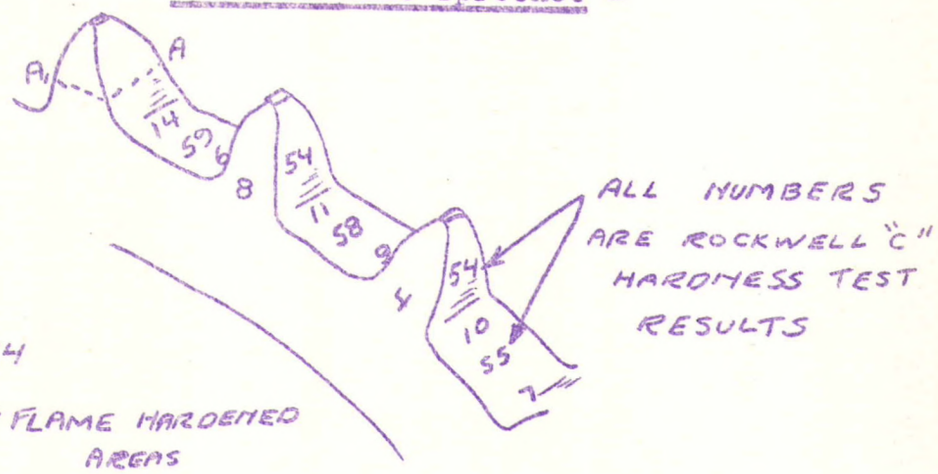


Figure 2.

British-made sprocket -

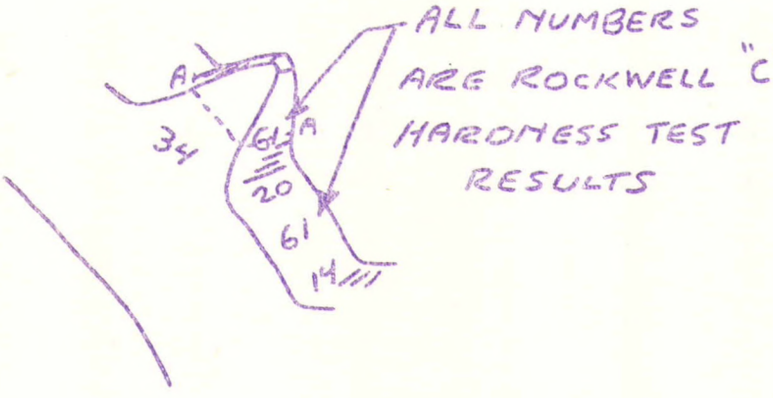
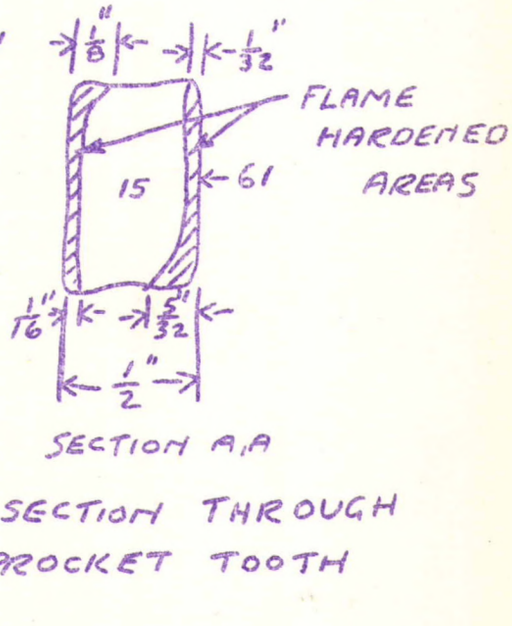


Figure 3.



SECTION THROUGH SPROCKET TOOTH

Figure 4.

(Continued on next page)

(Hardness Tests, cont'd) -

The British sprocket was worn down considerably, so that the hardness of the original surface could not be obtained. The wearing surface probably has been work hardened in service.

The sides as well as the face of the teeth on the British sprocket have been worn away. No flame hardening has been done on either sprocket to counteract the wear on the sides of the tooth.

Microstructure:

Figure 5. Figure 6.

100X (Nital Etch)
British Sprocket Core.

100X (Nital Etch)
Canadian Sprocket Core.

Fine pearlite grain size exists in the British product. The Canadian steel has very coarse-grained pearlite.

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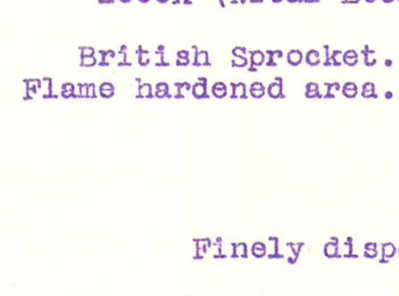
(Microstructure, cont'd) -

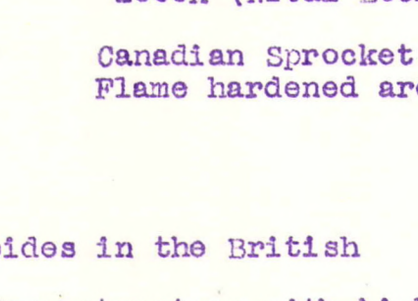
Figure 7.



1000X (Nital Etch).

British Sprocket.
Flame hardened area.

Figure 8.



1000X (Nital Etch).

Canadian Sprocket.
Flame hardened area.

Finely dispersed carbides in the British sprocket form a continuous uniform structure with high strength, hardness, and resistance to wear. In the Canadian product the ferrite structure remains unaltered, the grains of hardened steel being embedded in a coarse network of ferrite.

DISCUSSION OF RESULTS:

Core -

The British steel is finer-grained and tougher than the Canadian steel.

Flame Hardened Areas -

Coarse-grained steel does not respond to flame hardening treatment as quickly as fine-grained steel (see Figures 7 and 8). The presence of a network of free

(Continued on next page)

(Discussion of Results, cont'd) -

(Flame Hardened Areas, cont'd) -

ferrite makes the steel weak in resisting tension, torsion, or shearing stresses, and limits the fatigue properties to a low value. Poor results in service would be expected from this type of structure.

Controlling Grain Size:

In order to get the proper pearlite grain size in the Canadian steel, normalizing was carried out on sections of it, as follows:

Treatment.	Grain Size.
Untreated - -	½ grain per sq. in. (at X100).
1550° F. for 30 minutes, and air cooled - -	3 grains " " " (" ").
1500° F. for 40 minutes, and air cooled - -	16 " " " " (" ").

Sixteen grains per square inch (at X100 magnification) may be considered as satisfactory.

Recommendation:

Before flame hardening, the sprocket blanket should be normalized to produce a pearlite grain size equivalent to A. S. T. M. grain size No. 5 or finer.

Normalizing at 1500° F. produced a satisfactory grain size in the piece of steel submitted.

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