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O T T A W A

August 9th, 1943.

R E P O R T  
of the  
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1473.

Optimum Quenching Temperature for a Heat of Steel  
from which Canadian Armour-Piercing Shot  
are Manufactured.

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Abstract.

- (a) The optimum quenching temperature for this heat of steel lies between 1500° F. and 1550° F.
- (b) For quenching temperatures above 1500° F. this steel shows no increase in hardenability.
- (c) This steel can be fully hardened to martensite (maximum hardness) by a cooling rate as slow as 4° F. per second at 1300° F.
- (d) Since this heat is fairly representative of heats used to manufacture Canadian A/P shot it is recommended that a quenching temperature between 1500° F. and 1550° F. be used.

Origin of Request:

This is another phase of the investigation of the Canadian armour-piercing shot, begun during February, 1943, at the request of Mr. G. J. Manson, of the Ammunition and Gun Production Branch (Shell Division), Department of Munitions and Supply, Ottawa, Ontario.

Analysis of Steel Used:

17-pounder A/P shot, taken from current production, supplied the material for this investigation. The analysis is as follows:

- Per cent -		
Carbon	-	0.68
Silicon	-	0.33
Manganese	-	0.81
Phosphorus	-	0.026
Sulphur	-	0.018
Chromium	-	0.73
Nickel	-	0.80
Molybdenum	-	0.21
Vanadium	-	0.033

Method of Determining Optimum Quenching Temperature:

Standard one-inch-diameter hardenability test bars were machined from 17-pounder A/P shot.

Each test bar was packed in cast iron turnings to prevent decarburization and heated to temperatures of 1450° F., 1475° F., 1500° F., 1550° F., and 1600° F. (one hour at each temperature). The bars were then end-quenched in the standard hardenability fixture until they were cold.

A flat surface was wet-ground (to prevent tempering) on each bar. Each flat was polished and Vickers hardness readings taken using a 50-kg. load. The results are recorded in the charts on Page 3.

Conclusions:

Maximum hardness (852 Vickers) is not obtained at quenching temperatures below 1475° F.

At quenching temperatures above 1500° F. there is no increase in hardenability.

It is recommended that a quenching temperature between 1500° F. and 1550° F. be used for this steel.

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