O T T A W A July 10th, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1047.

Examination of Drill Heads for Land Mine Laying.

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

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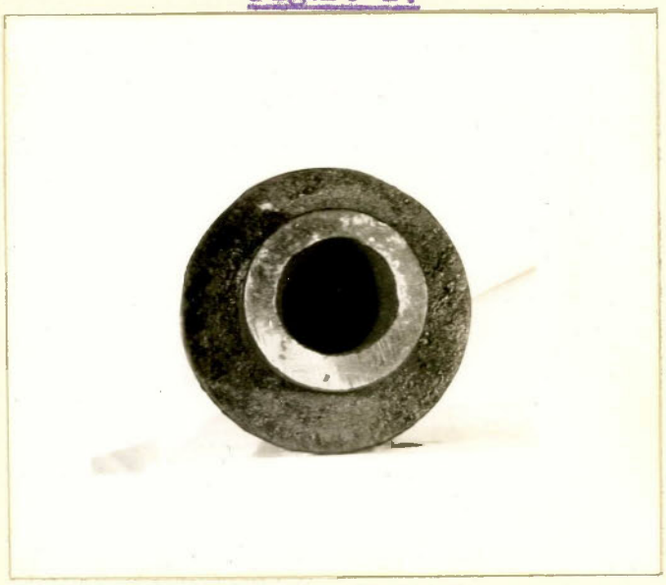
Origin of Request:

A drill head reported to have been made in England was received from Col. N. D. Lambert, Director of Engineering Services, Department of National Defence, Ottawa, Ontario, on July 2nd, 1941. In a letter (dated July 4th, 1941) Colonel Lambert requested that this drill head be examined and a report be made so that sufficient information would be available from which to draw a specification for Canadian manufacture.

Nature of Land Mine Drill Heads:

According to information received from Lieut. H. Latimer, these heads are pounded down through the earth about six feet and remain there. Figures 1 and 2 show the nature of the cast head.

Figure 1.



Drill Head.

Figure 2.

Drill Head.

It is stated in Col. Lambert's letter that the British specification calls for whiteheart malleable cast iron.

Microstructure:

On examination under the microscope it was immediately evident that the drill head submitted was cast of ordinary stove-plate or sash-weight cast iron. This is the lowest quality cast iron made and is quite weak and brittle.

(Continued on next page)

(Microstructure, cont'd) -

Figure 3.

Drill Head. X100, Nital etch.

The cellular pattern of hard brittle steadite (a) is very pronounced. Free ferrite (b) also contributes to lower the strength of the metal. Graphite flakes (c) are coarse.

Chemical Analysis:

		Per cent
Carbon	-	3.13
Silicon	-	2.40
Manganese	-	0.52
Sulphur	-	0.167
Phosphorus	-	0.83

Hardness:

Brinell Hardness Number - 228.

This type of metal cannot be improved by heat treatment, therefore hardness is dependent upon rate of cooling in the mould (i.e., section size determines hardness).

DISCUSSION OF RESULTS:

We have learned through official channels that the choice of an alloy for military use in England depends upon the metals which are available. Hence an alloy ordinarily considered unsuitable may have to be used because nothing else is available. Therefore, the practice of blindly following British specifications should be avoided. Since all the steel in England is tied up, whiteheart malleable is used as a temporary but undesirable substitute for some parts that are not severely stressed. The drill head examined is a case of substitution of an inferior material in the place of whiteheart because of shortage of higher strength material.

It is doubtful whether the metal in this casting would meet A.S.T.M. Specification A48-36 Class 20 for grey iron castings, which is the lowest grade covered by specification. If it is considered advisable to duplicate the metal in this casting, ordinary stove-plate iron, or iron made to the above specification should be specified.

NOTE: Class No. 20 requires a minimum tensile strength of 20,000 p.s.i.

Malleable iron would be more suitable for this application since it is stronger, tougher and more ductile. In Canada malleable iron is readily available. A.S.T.M. Specification A47-33 Grade No. 32510 calls for:

Tensile strength, minimum p.s.i.	-	50,000.
Yield point, " "	-	32,500.
Elongation in 2 inches	-	10 per cent.

This type of metal should prove satisfactory for use in land mine drill heads.

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