O T T A W A August 25th, 1941.

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of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1077.

Pickling of Austenitic Manganese Helmet Steel.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
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CANADA
DEPARTMENT
OF
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Foreword:

It has been reported by Lieutenant-Colonel R. A. H. Galbraith, of the Inspection Board of the United Kingdom and Canada, 479 Bank Street, Ottawa, Ontario, that a quantity of sheet steel for fabricating into helmets is magnetic, due to a very thin coating of scale. Removal of this scale leaves the metal with the desired low magnetic properties and

(Foreword, cont'd) -

apparently satisfactory ballistic properties.

It is the purpose of the inspection department to see not only that the helmets pass a standard of minimum quality but also to make sure that the highest possible quality of helmet is made. Therefore any process of reclamation must be carefully checked to be sure that an inferior product will not result.

Although helmets pickled at the Canadian Motor Lamp Company, in Windsor, Ontario, passed the minimum ballistic standard, they had a very rough surface.

It is our opinion that pickling can be performed leaving a smooth surface, therefore producing a higher-quality helmet.

Electrolytic Pickling:

Scale can be removed without any attack on the base metal and with no danger of hydrogen embrittlement if electrolytic pickling is employed.

The metal is made cathodic in a 10 per cent solution of sulphuric acid. A current density of 50 amperes per square foot is used. This is followed by an anodic treatment using 100 to 150 amperes per square foot.

Room temperature solutions should leave bright, smooth surfaces, with little or no pitting.

Sulphuric Acid with Inhibiter:

A 10 per cent solution of sulphuric acid containing the proper inhibiter will remove the scale without etching the base metal. An operating temperature of 140° F. is

(Sulphuric Acid with Inhibiter, cont'd) -

recommended.

One inhibiter which might be used is ACITROL-100, available from the E. F. Houghton Company, Toronto, Ontario. This inhibiter is used in about 1/300th of the acid concentration.

Muriatic (Hydrochloric) Acid:

High concentrations of this acid are likely to cause pitting. Five to 15 per cent acid concentration should be sufficient.

If the metal is removed immediately after the scale is dissolved, attack on the base metal will be minimised.

Phosphoric Acid:

This acid will dissolve iron oxides with no attack on the base metal, but its cost makes it unpractical to use.

GENERAL PRECAUTIONS:

1. The best pickling methods are electrolytic and are covered by patents, therefore we would recommend that the supplier of the steel be required to deliver the sheet with a bright silvery finish.

2. The rate of acid attack should be kept low by: (a) using low acid concentrations; (b) using low operating temperatures.

3. With a slow rate of acid attack it is easier to remove the metal at the exact point where scale removal

(General Precautions, cont'd) -

is complete.

4. If the metal is left in the pickling bath after the scale is removed, attack on the base metal is to be expected.

5. Hydrogen embrittlement may be removed by soaking the steel in boiling water for a short time (about 20 to 30 minutes).

6. Acid removal is effected by alkaline rinse baths.

7. Any temperature over 500° F. will cause a break-down of the austenitic structure with a resulting embrittlement of the material.

8. A certain degree of skill is necessary in carrying out bright pickling operations. Therefore, if possible, this work should be done by the steel supplier rather than by the purchaser, unless the purchaser has had considerable experience along this line.

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