O T T A W A July 16th, 1941.

# R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1052.

Examination of a Ground Anchor-Bar.

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 Object of Investigation:**

A ground anchor-bar that was not giving satisfactory service, due to its tendency to bend when being used, was submitted for examination by R. L. Martin, Director of Inspection, Motor Transport Division, Inspection Board of United Kingdom and Canada, 58 Lyon Street, Ottawa. Mr. Martin asked that the bar be examined in order to obtain information to be used in writing a new specification for this material.

The anchor-bar was received here on July 8th, 1941.

Description of Anchor-Bar:

The ground anchor-bar submitted was made from hexagonal bar stock measuring 13/16 inch across the flat and 15/16 inch across the corners, approximately 3 feet in length, one end being tapered to a point and the other end having a hook, made of $\frac{1}{2}$ inch round steel bar approximately 7 inches long, welded to it on opposite flat faces. The anchor-bar was stamped JRK - 1941 - DRG. No. 10017.

Chemical Analysis:

| | | Per cent |
|---|---|---|
| Carbon | - | 0.32 |
| Manganese | - | 0.97 |
| Silicon | - | 0.20 |
| Copper | - | 0.18 |
| Nickel | - | None detected |
| Chromium | - | " |
| Molybdenum | - | " |

Microstructure:

Figure 1.

X 100, nital etch.

(Continued on next page)

Physical Tests (Anchor-Bar as received):

| | | |
|---|---|---|
| Yield point, | - | 53,000 p.s.i. |
| Ultimate tensile strength, | - | 86,250 p.s.i. |
| Elongation, | - | 31.0 per cent in 2 inches. |
| Reduction of area, | - | 55.0 per cent. |
| Brinell hardness, | - | 163. |

Discussion of Results:

The chemical composition shows this material to be similar to S.A.E. Steel No. 1030, with the exception that its manganese content is higher than the usual range of 0.60 - 0.90 and that it contains copper. This amount of copper would not affect the physical properties to any appreciable extent but is beneficial in assisting to resist atmospheric corrosion.

The microstructure shows that this material has been properly made and has been given a normalizing treatment.

The physical tests on this material conform closely to what may be expected from this class of steel. However, as this was not satisfactory, it was considered desirable to raise the yield point to lessen susceptibility to bending. Accordingly, it was given a heat treatment, as follows:

(1) Heat to 1550° F.

(2) Water quench.

(3) Draw at 900° F. for 1 hour.

The physical tests obtained on the heat treated section of the bar were:

| | | |
|---|---|---|
| Yield point, | - | 96,000 p.s.i. |
| Ultimate tensile strength, | - | 118,250 p.s.i. |
| Elongation, | - | 24.0 per cent in 2 inches. |
| Reduction of area, | - | 63.0 per cent. |
| Brinell hardness, | - | 255. |

Conclusions:

It is recommended that a steel quenched and drawn from a Brinell hardness of 235 to 260 be used in this service. If the use of the present grade of steel is to be continued, care should be taken that the manganese content is on the high side of the specification.

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