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O T T A W A

January 4th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1340.

Examination of a Weld Test Bar.

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(Copy No. 10.)



CANADA

BUREAU OF MINES
DIVISION OF METALLIC MINERALS

ORE DRESSING AND
METALLURGICAL LABORATORIES

DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Origin of Material and Object of Investigation:

On December 23rd, 1942, Sub.-Lieut. A. E. Wilson, R.C.N., of the Shipbuilding Division, Department of National Defence (Naval Services), Ottawa, Ontario, submitted a weld test bar which had been machine-welded on one side and hand-welded on the other. It was requested that an examination of the two welds be made.

Chemical Analysis:

It was impossible to determine the analysis of the weld metals inasmuch as only very small portions of the welds remained on the piece of the test bar.

Macro-Examination:

Figure 1 is a photograph of the weld test piece. A line divides the two welds, the upper being a fine-grained hand weld and the lower a coarse-grained machine weld.

Figure 2 indicates the manner in which the welds were made.

Microscopic Examination:

A section of metal was cut from the test piece and the face ABC was polished. See Figure 3.

Four photomicrographs were taken in the positions shown in Figure 4.

The polished specimen was etched in a solution of 2 per cent nitric acid in alcohol and then examined under the microscope.

Figure 5 is a photomicrograph taken at the edge of the hand weld. Figure 6 is a photomicrograph taken of the central portion of the hand weld. Figure 7 is a photomicrograph of the parent metal. A portion of the hand weld may be seen in the upper left section.

Figure 8 is a photomicrograph of the machine weld, taken near the parent metal.

CONCLUSIONS:

It may be seen from Figures 5 and 6 that, although the outer edge of the hand weld is almost carbonless, the weld as a whole is uniform and has the same structure as the parent metal.

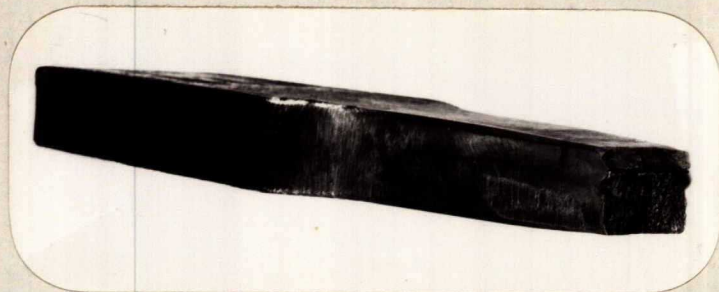
The photomicrograph of the machine weld (Figure 8) indicates that the weld has a coarse-grained dendritic structure.

Adjustments of current, voltage, and rate of travel of the machine should produce a satisfactory weld. It should not be necessary to make use of a follow-up flame if the above-mentioned conditions are complied with.

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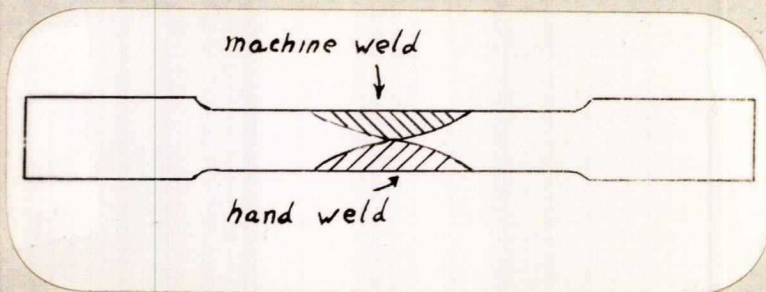
HLL:GNB.

Figure 1.



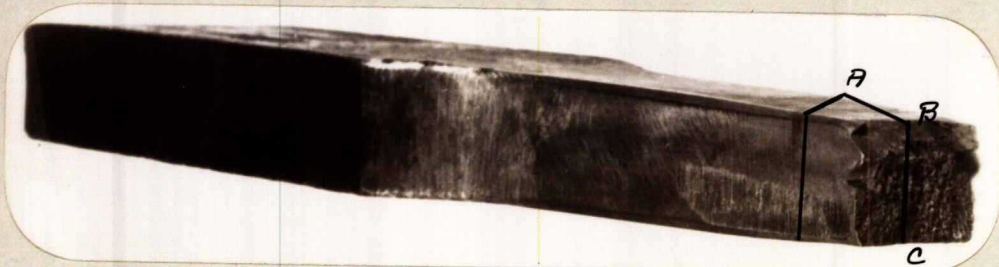
WELD TEST PIECE AS RECEIVED.
(Approximately 1/3 size).

Figure 2.



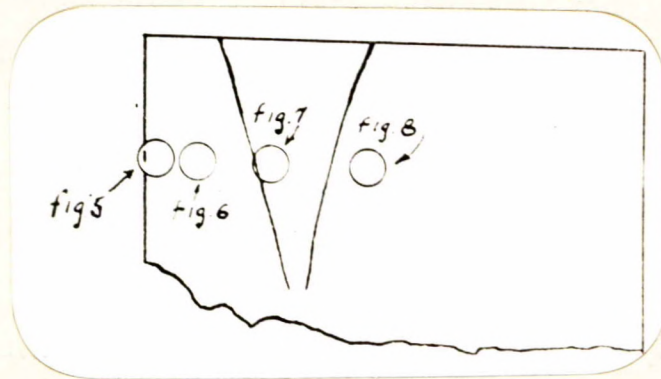
METHOD OF WELDING.

Figure 3.



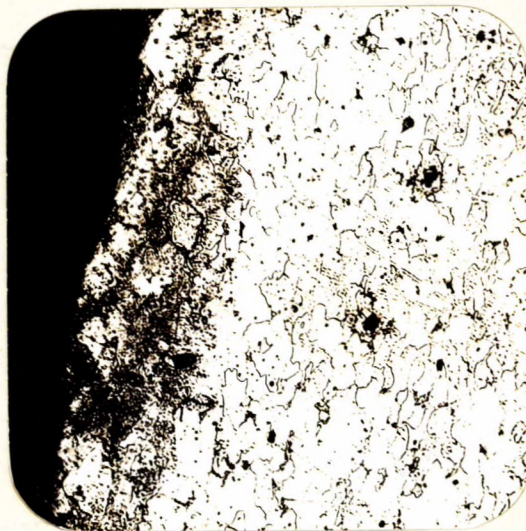
Position from which microscopic
examination sample was cut.
(Approximately 1/2 size).

Figure 4.



POSITIONS AT WHICH PHOTOMICROGRAPHS WERE TAKEN.

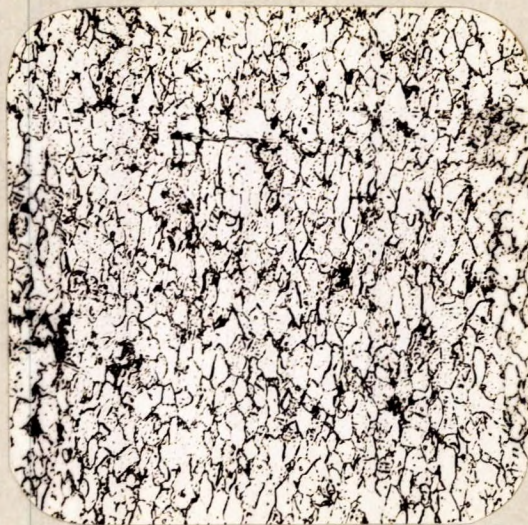
Figure 5.



X200, nital etch.

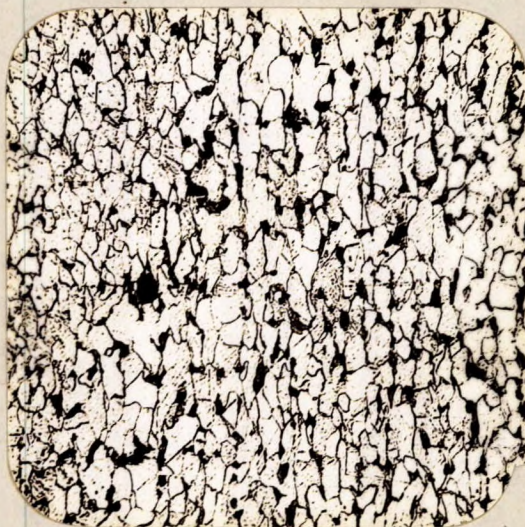
OUTSIDE EDGE OF HAND WELD.

Figure 6.



X200, nital etch.
CENTRAL PORTION OF HAND WELD.

Figure 7.



X200, nital etch.
PARENT METAL.

Upper left corner shows portion of hand weld.

Figure 8.



X200, nital etch.

MACHINE WELD.

Note coarse-grained dendritic structure.

Micrograph showing a coarse-grained dendritic structure, likely a machine weld, viewed at 200x magnification after nital etching.

HLL:GHB.