O T T A W A October 19th, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1723.

Induction Normalizing of 2-Inch Trench Mortar Bomb Tail Units.

(Copy No. 10.)

Bureau of Mines
Division of Metallic
Minerals
-
Physical Metallurgy
Research Laboratories

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
Mines and Geology Branch

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Origin of Request and Object of Investigation:

On October 4th, 1944, under Analysis Requisition O.T. 4286 (File Reference 12/4/1, Investigation #98), Mr. J. M. Gilmartin, I.O.M., for Inspector of Materials, Inspection Board of United Kingdom and Canada, 70 Lyon Street, Ottawa, Ontario, submitted six samples of 2-inch trench mortar bomb tail units for metallurgical examination to determine the condition of the tubes and also the time cycle required to completely normalize by induction.

Chemical Analysis:

The chemical analysis gave the following results:

		Per Cent
Carbon	=	0.24
Manganese	=	0.43

Microscopic Examination:

(a) "As Received" -

The microstructure "as received" is coarse spheroidite, as shown in Figure 1.

(b) After Heat Treatment -

The following heat treatments were given in a Lepel high frequency induction furnace (after stripping the fins off the bomb tail):

> The power ($\simeq$ 3 kilowatts) was sufficient to bring the piece up to 1800° F. within 10 seconds. The steel was held at this temperature by intermittent heating for periods of 15, 25, 35, 50, 110 and 290 seconds.

The microstructure was examined after each of these heat treatments. The constituents were in all cases ferrite and pearlite with a decreasing amount of free carbides as the time at approximately 1800° F. increased. After 290 seconds some residual carbides were still observed (see Figure 2).

Discussion and Conclusion:

In the "as received" condition the bomb tails were coarsely spheroidized. This type of microstructure makes the austenitizing reaction sluggish.

The results of the investigation have shown that it is not possible to completely normalize these bomb tails from their coarse spheroidized structure within 5 minutes. The time required to completely dissolve the carbides would thus seem to be too long for economical operation in commercial practice. Moreover, since no provision is made for protective atmosphere

(Discussion and Conclusion, cont'd) -

in the usual induction heat treatment practice, the steel is exposed to oxidation and also decarburization. This condition has been observed in the present case (see Figure 3).

It is therefore concluded that, from the economical point of view, induction methods are not to be recommended. Moreover, the surface condition of the tails after a treatment of 5 minutes (which is not severe enough) would not seem to be satisfactory.

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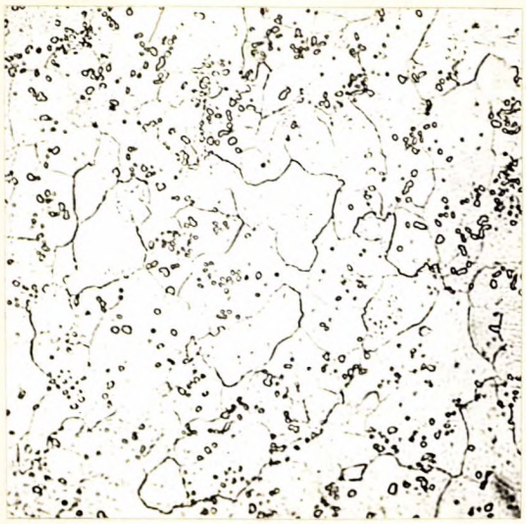
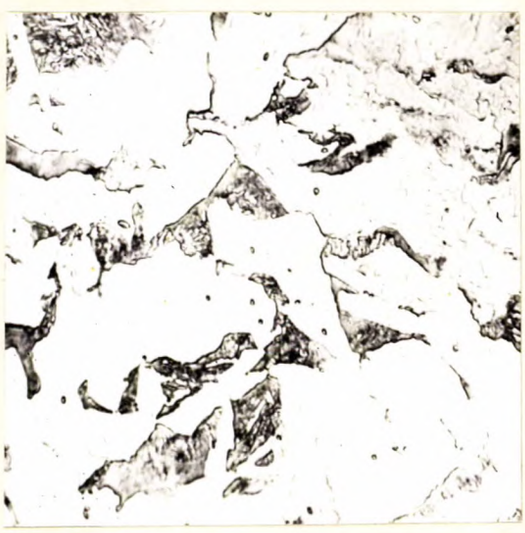
Figure 1.



X500, nital etch.

SHOWING THE MICROSTRUCTURE OF THE BOMB TAILS "AS RECEIVED".

Figure 2.



X1000, nital etch.

SHOWING THE MICROSTRUCTURE DEVELOPED AFTER INDUCTION NORMALIZING (290 SECONDS AT APPROXIMATELY 1800° F.).

Figure 3.

X100, nital etch.

SHOWING DECARBURIZATION AFTER INDUCTION NORMALIZING (290 SECONDS AT APPROXIMATELY 1800° F.).

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