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R E P O R T
of the
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1390.

Cyaniding of SAE 9255 Track Pins
to Eliminate Decarburization.



BUREAU OF MINES
DIVISION OF METALLIC MINERALS
ORE DRESSING AND
METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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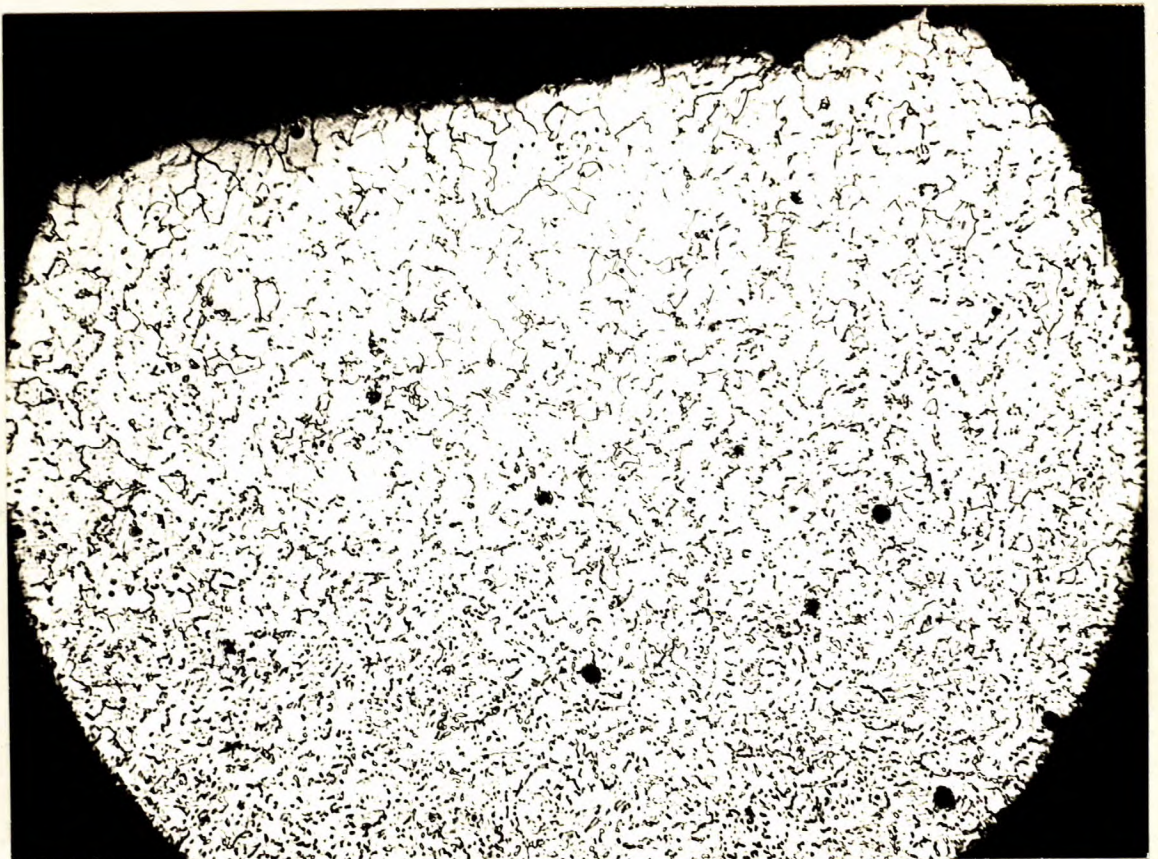
Origin of Material and Object of Investigation:

On April 16th, 1943, eight pieces of 1 3/16-inch-diameter SAE 9255 steel bar were received from the Cockshutt Plow Company, Brantford, Ontario, for investigation. It was requested by telephone that the surface condition of these samples be examined under the microscope. It was reported that two of the pieces were of bar stock and that of the remainder two had been cyanided for 45 minutes, two for 60 minutes, and two for 75 minutes. A 44 per cent cyanide bath was used, at a temperature of 1625° F.

Microscopic Examination:

Transverse specimens were examined under the microscope after polishing and etching in 2 per cent nital. Figure 1 illustrates the structure and the decarburized area of the bar stock. The steel had been spheroidized and the decarburization was approximately 0.010 inch thick. Figures 2 and 3 are of the two specimens which had been cyanided for 45 minutes. Figures 4 and 5 are of samples cyanided for 60 and 75 minutes respectively. All of the photomicrographs were taken at X250 magnification.

Figure 1.



X250, nital etch.

BAR STOCK.

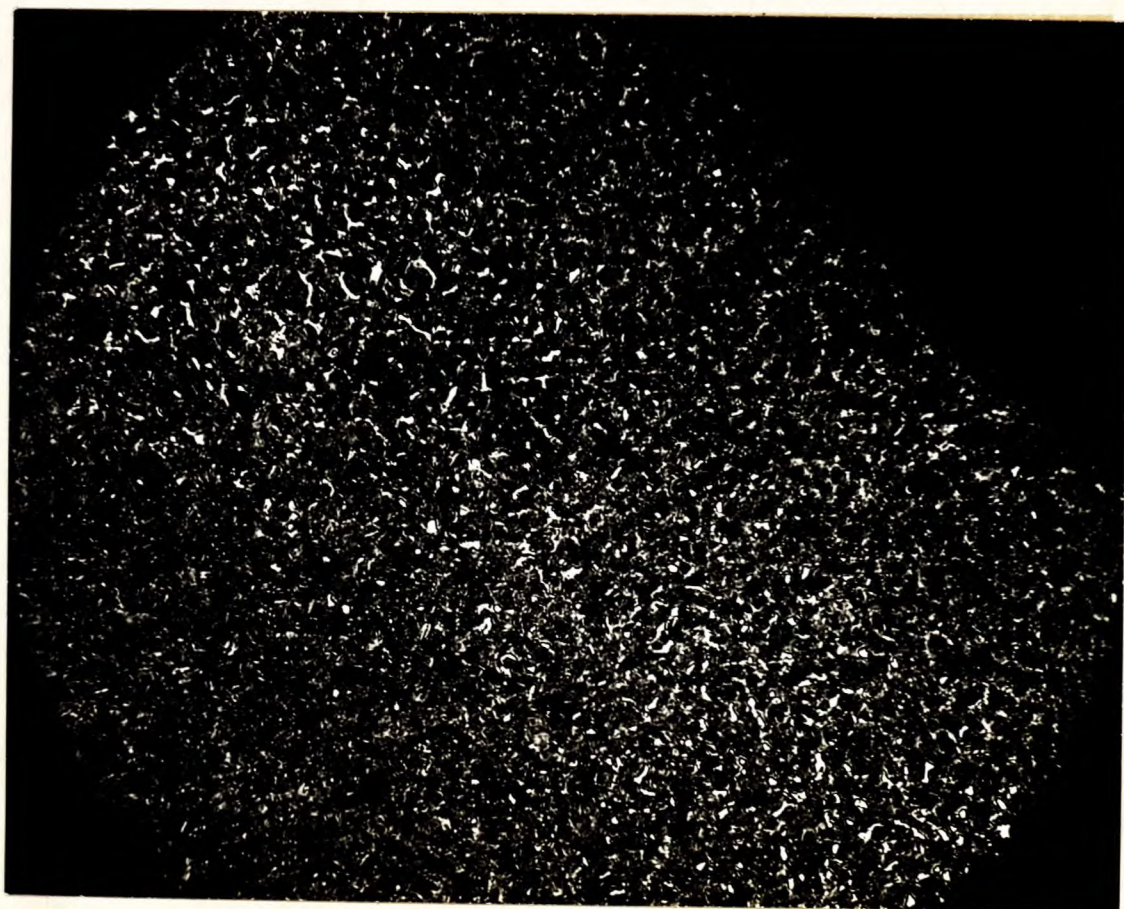
Note spheroidization and decarburization
at the surface.

Figure 2.



X250, nital etch.
45 MINUTES IN CYANIDE BATH.

Figure 3.



X250 nital etch.
45 MINUTES IN CYANIDE BATH.
Note ferrite - white constituent.

Figure 4.



X250, nital etch.
60 MINUTES IN CYANIDE BATH.
Note ferrite at grain boundaries.

Figure 5.



X250 nital etch.
75 MINUTES IN CYANIDE BATH.

Discussion:

It can be seen from the photomicrographs that 45 minutes in 44 per cent cyanide eliminated to a reasonable extent the decarburized area shown in Figure 1. No further advantage was obtained by cyaniding for the longer period of time. Ferrite is evident in Figures 3 and 4. This suggests that the samples may have been quenched from below the upper critical temperature of the steel.

In order to establish this, one sample which had been cyanided for 45 minutes was reheated in the Vapocarb furnace to 1625° F. and then quenched in oil at 110° to 140° F. Depth hardness readings were made both on this sample and on the other original specimen that had received a 45-minute cyanide treatment. This latter specimen was in the condition as received from the firm. The Vickers machine and a 10-kg. load were used. Readings were taken at 0.050-inch (approx.) distances starting from the core and proceeding toward the surface. The results were as follows:

<u>Reheat-treated Specimen</u> (Not drawn back)	<u>Specimen 'As Received'</u>
<u>V. P. N.</u>	<u>V. P. N.</u>
634	413
634	390
642	413
657	425
690	455
698	478
734	478
743	464
743	401
752	
792	
782	
792	

It will be noted that the 'as received' specimen's hardness drops from 464 to 401 at the surface. The reheat-treated specimen follows a fairly regular increase in hardness

(Discussion, cont'd) -

as the surface is approached. Examination under the microscope showed that the ferrite had been eliminated in the reheat-treatment operation. It appears that the quenching temperature of the pins 'as received' had been too low.

CONCLUSIONS:

1. The decarburization of the bar stock was approximately 0.010 inch.
2. The stock was spheroidized.
3. Forty-five minutes in 44 per cent cyanide appears to be sufficient time for recarburization.
4. Ferrite was visible in a number of the specimens.

Recommendations:

1. A higher quench temperature should be used. Since 1625° F. was the temperature reported employed, a check should be made on the pyrometer.
2. Since it is expected that 18 per cent cyanide will be used in actual production, similar tests using cyanide of this strength should be carried out.

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