File

FILE COPY

O T T A W A February 10th, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1593.

Investigation of Rivetting Tips for the Canadian Dry Pin.

(Copy No. 15.)

Bureau of Mines
Division of Metallic
Minerals
-
Ore Dressing
and Metallurgical
Laboratories

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
Mines and Geology Branch

O T T A W A February 10th, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1593.

Investigation of Rivetting Tips for the Canadian Dry Pin.

Origin of Material and Object of Investigation:

On January 22nd, 1944, Mr. C. V. Hacker, Superintendent, Hull Iron and Steel Foundries Limited, Hull, Quebec, submitted five pins, the tips of which had cracked on rivetting, for examination.

It was reported that these pins represented a lot received from the Cockshutt Plow Co., Brantford, Ontario, on January 19th. This shipment was giving about 10 to 15 per cent tip cracking during the rivetting operation, as compared with 1 per cent for previous shipments.

Hardness:

Hardness readings were taken of the tip core, with the following results:

Pin No.		Rockwell 'C'
1	-	25-26
2	-	21-23
3	-	25.5-26.5
4	-	35-37
5	-	31-33

A depth-hardness survey was made of Pins Nos. 1 and 2, using the Vickers machine and a 10-kg. load. Table I lists the results obtained.

TABLE I. - VICKERS HARDNESS NUMBERS (10-kg. load).

Pin No.	At depths, in inches, from the surface						
	0.020	0.040	0.060	0.080	0.10	0.20	0.30
1	306	306	304	276	276	274	263
2	314	300	272	269	267	253	253

Microscopic Examination:

The transverse sections used for hardness were ground slightly to eliminate the hardness penetrations. They were then polished and etched in 2 per cent nital. Figures 1, 2, and 3 are taken at X500 magnification. These show the typical structures obtained for these pins.

(Continued on next page)

(Microscopic Examination, cont'd) -

Figure 1.

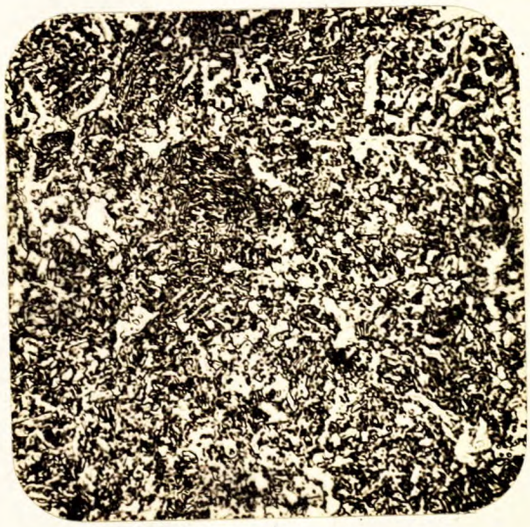
X500, nital etch.

PIN NO. 2.

Note spheroidal structure.

—

Figure 2.



X500, nital etch.

PIN NO. 1.

Note nodular carbides, islands of pearlite, and ferrite.

—

Figure 3.

X500, nital etch.

PIN NO. 5.

Note tempered martensite and ferrite.

—

Discussion:

The hardnesses of the tips vary from 21 to 37 Rockwell 'C'. The hardness survey across the face of the transverse sections indicates that the hardness increases as the surface is approached. This may be due to work-hardening, since these pins were removed from the links after they had been peened. Pin No. 2 has a spheroidal structure and is also soft (21-23 R. 'C'). It is difficult to explain why this tip should have cracked on rivetting. It is, of course, possible (1) that the grinding marks were extremely deep, or (2) that cracks occurred on quenching, or (3) that the rivetting hammer was poorly manipulated by the operator.

The tip-softening process is obviously out of control, as is indicated by the photomicrographs. The spheroidal structure (Figure 1) indicates alternate heating above and below the lower critical (1400° F. approximately). Figure 2 shows a tendency toward spheroidization but it has only started. Large islands of unbroken pearlite are present. Figure 3 is the typical structure obtained by quenching from below the upper critical temperature. It is evident that no attempt at spheroidization has been made for this tip. It is strongly recommended that more control be exercised on the tip-softening process.

CONCLUSIONS:

1. The hardnesses of the tips vary from Rockwell 'C' 21 to 37.

2. There is an increase in hardness over the face of a transverse section as the surface is approached.

3. The photomicrographs indicate lack of control in the tip-softening process. Greater care must be employed to ensure spheroidization.

oooocooooooo
oooooo
oo

SLG:GHB.