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R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1587.

Determination of Extent of Decarburization of Three T51 Track Pins.

(Copy No. 10.)

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Origin of Material and Object of Investigation:

On January 22nd, 1944, three T51 track pins (Drawing B.146235, Analysis Requisition C.T. 4124) were submitted by Mr. J. E. Gilmartin, I. O. M., for Inspector of Materials, Inspection Board of the United Kingdom and Canada, Ottawa, Ontario. An accompanying memorandum, from Mr. F. C. Wilson, I. O. Tanks, stated that the pins represented a lot of approximately 12,000 from which the rubber had been removed by heating. It was requested that an examination be made to determine the extent of decarburization resulting from this treatment.

Hardness Survey:

Hardness readings were made from the core to the surface of three sections of one pin. The sections were cut from the centre and 3 inches from each end of the pin. A Vickers hardness testing machine was used, with a 10-kilogram load. Readings and the distance from the surface at which they were taken were plotted. Hardness readings at various distances are shown in Table I.

TABLE I. - VICKERS HARDNESS NUMBERS.

	Sur-face	Distance from the surface, inches											
		0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.15	0.20	0.25
1	238	340	352	370	385	400	400	400	400	400	400	390	390	
2	228	344	368	392	400	419	419	419	419	419	419	419	419	
3	240	373	382	388	396	398	396	395	395	395	396	400	405	405

Chemical Analysis of Step-Cut Samples:

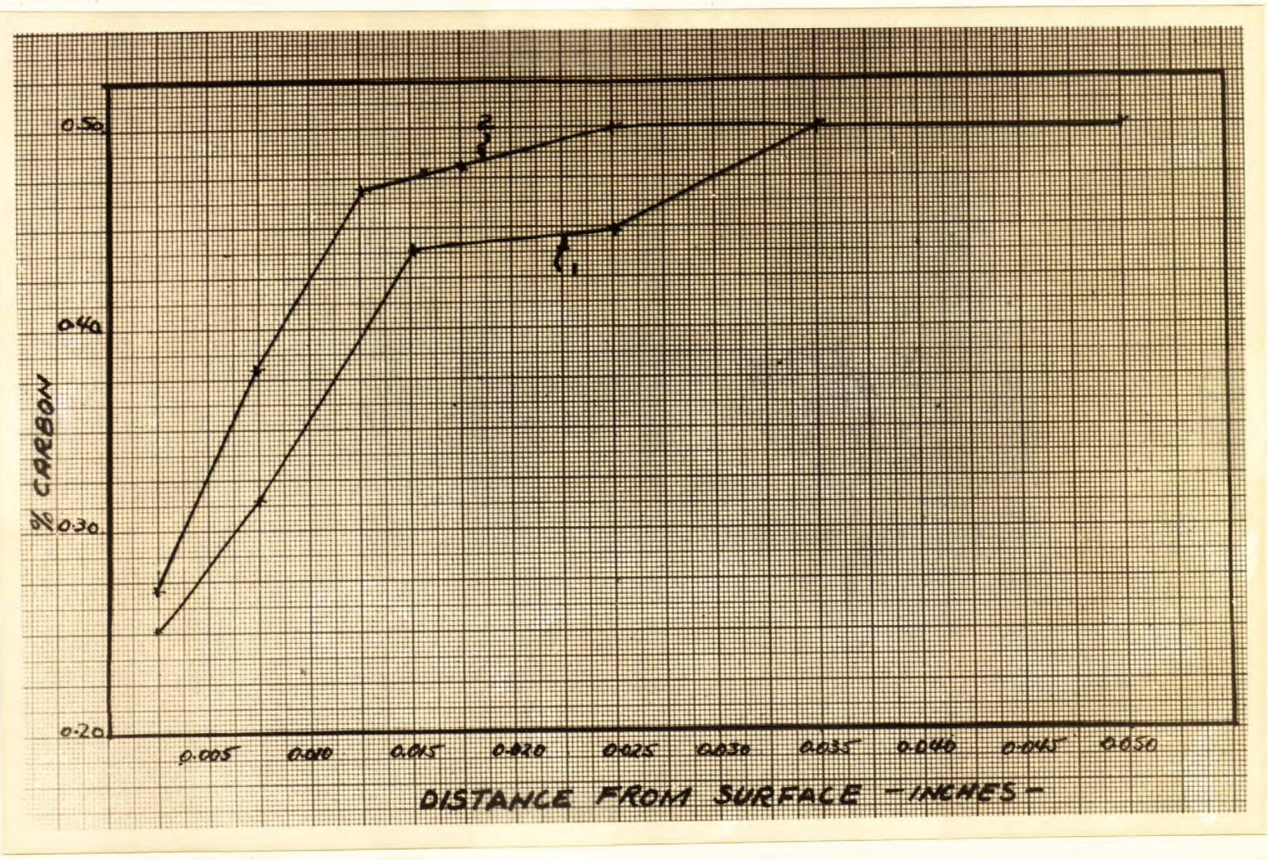
Carbon determinations at the surface of two pins were made by carbon analysis of step-cut samples taken consecutively at 5, 10, 15, 20, 30, 40, and 50 thousandths of an inch from the surface.

The carbon content was plotted against the mean distance of each cut from the surface (see Figure 1). Data scaled from these curves are tabulated in Table II.

(Continued on next page)

(Chemical Analysis of Step-Cut Samples, cont'd) -

Figure 1.



DEPTH-% CARBON CURVES,
SHOWING TOTAL DEPTH AND DEGREE
OF DECARBURIZATION.

TABLE II. - PER CENT CARBON.

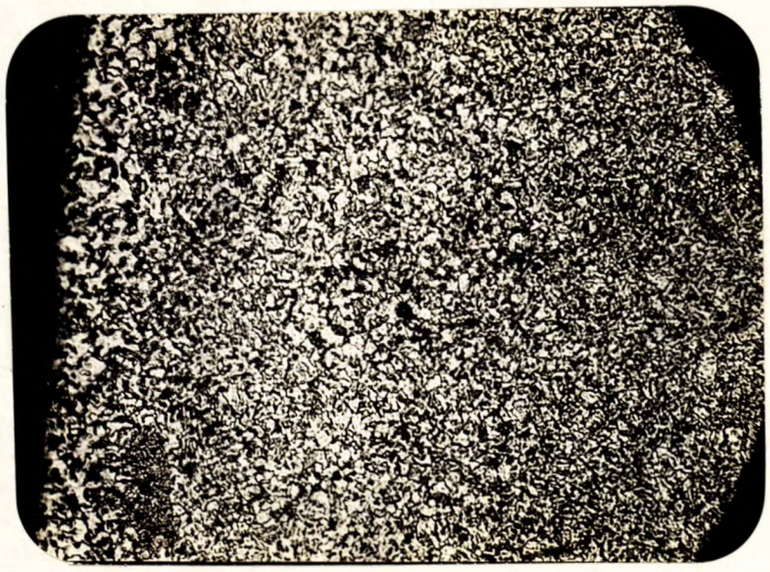
Pin	Distance from the surface, Inches									
	0.005	0.010	0.015	0.020	0.025	0.030	0.035	0.040	0.045	0.050
1	0.29	0.36	0.44	0.45	0.45	0.47	0.50	0.50	0.50	0.50
2	0.32	0.42	0.47	0.49	0.50	0.50	0.50	0.50	0.50	0.50

Microscopic Examination:

A transverse section cut from the centre of one pin was annealed in lead at 1500° F. and cooled in lime. Microscopic examination of this section revealed a partially decarburized zone of approximately 0.020 inch in depth.

The microstructure at the surface of the section is shown in Figure 2, a photomicrograph at X300 magnification.

Figure 2.



X200, nital etch.

Discussion:

Hardness surveys, carbon analysis and microscopic examination substantiate each other in indicating a partially decarburized zone 0.015 to 0.025 inch depth at the pin surfaces. This decarburization will lower the fatigue strength of the pin and should be considered serious if the pin, in service, is subject to such alternate stresses as might cause fatigue failure. If recarburization of the pins is attempted it would be advisable to use a gas carburizing medium or, if the facilities are available, some controlled pack-carburizing method such

(Discussion, cont'd) -

as is outlined in O.D.M.L. Report of Investigation No. 1573, issued on January 18th, 1944.

Three methods were used, in this investigation, to determine the extent of decarburization: (1) hardness surveys, (2) carbon analysis, and (3) microscopic examination. Of these three methods, carbon analysis of step-cut samples is considered the most accurate.

CONCLUSIONS:

1. The pins are partially decarburized to a depth of 0.015-0.025 inch.

2. The fatigue strength of the pins is lowered because of surface decarburization.

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