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OTTAWA June 29th, 1943.

REPORT

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1439.

Examination of SAE 9255 Canadian
Dry Pin Track Pins.

(Copy No. 10.)

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 June 29th, 1943.

[redacted]

R E P O R T

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ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1439.

Examination of SAE 9255 Canadian
Dry Pin Track Pins.

Origin of Material and Object of Investigation:

On June 25th, 1943, five SAE 9255 Canadian Dry Pin track pins were received from the Dominion Rubber Company Limited (Dominion Tire Factory, Metal Products Division), Kitchener, Ontario, and a complete examination was requested.

General Information Supplied with Samples:

In the request letter, which is dated June 24th, 1943, and signed by Mr. D. A. Macdonald of the Metal Products Division, the following information was supplied:

1. These samples have been prepared from SAE 9255 steel, whereas the steel to be used in production will be SAE 9260.

2. The raw steel for these samples was obtained from the Steel Company of Canada in the form of cold-drawn bars. The steel to be used by this company will be obtained from a different source and will be centreless-ground at the steel plant so as to eliminate all but a maximum of 0.005 inch of decarburization.

3. These samples were ground on a cylindrical grinder whereas production pins will be centreless-ground. Due to this method of grinding, it is possible that unequal amounts may have been removed at different points on the surface. This will be overcome by centreless-grinding.

4. As the raw steel for these samples was cold drawn to 0.812 inch diameter, it is understood that these samples are all under size.

The method of preparation and the size of each sample are shown in the following table:

Sample No.	Diameter of raw bar, in.	Amount removed before heat treatment, in.	Amount removed after heat treatment, in.	Diameter of finished pin, in.
8	0.812	0.035	0.010	0.767
1	0.812	0.030	0.010	0.772
9	0.812	0.025	0.010	0.777
6	0.812	0.015	0.010	0.787
2	0.812	0.010	0.010	0.792

Heat Treatment: The pins were hardened at 1625° F. and drawn at 750° F.

DETAILS OF INVESTIGATIVE WORK.

Bend Tests:

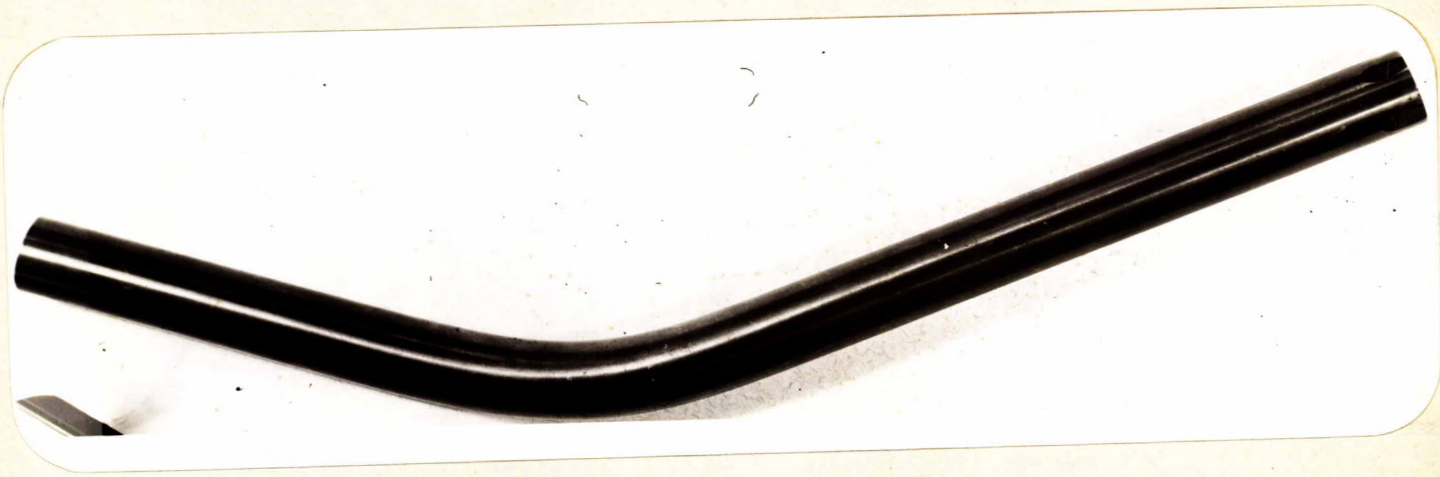
Bend tests were carried out on the Amsler Universal machine, using a 12-inch radius block and 12-inch centres. Table I shows the results obtained:

Table I.

Pin No.	Surface hardness, Rockwell 'C'	Core hardness, Rockwell 'C'	Load, pounds	Deflection, in inches
1	46 - 50	53	9,750	2.4, unbroken.
8	48 - 52	53.5	9,800	2.4, unbroken.

Figure 1 illustrates Pin No. 1 after the bend test:

Figure 1.



(Approximately ½ actual size).

Impact Tests:

Pins Nos. 6 and 9 were subjected to the drop impact test, a 50-pound weight dropped from certain heights. Pin No. 9, having a surface hardness of 45-48.5, received two blows. The first was 350 foot pounds and the second, 400 foot-pounds. This pin was unbroken after both of these impacts. Pin No. 6 (surface hardness of 43.5-51) was given one blow of 400 foot-pounds and it also was unbroken.

Hardness Tests:

Pins Nos. 6 and 2 showed varying surface hardness. Readings were made around the circumference of the pin, using the Rockwell machine and the 'C' scale. Pin No. 6 showed values between 43.5-44 on one side and 47-51 on the other. Pin No. 2 showed 43-44 on one side and 49-51 on the other. Depth hardness readings were taken on transverse micro-specimens cut from Pins Nos. 6 and 9, using the Vickers hardness machine and a 10-kg. load. The results were:

PIN NO. 6. V.P.N.	PIN NO. 6. Distance from surface, in inches	PIN NO. 9. V.P.N.	PIN NO. 9. Distance from surface, in inches
560	0.36	536	0.37
514	0.11	548	0.15
514	0.08	598	0.13
483	0.05	560	0.11
446	0.02	525	0.09
429	0.01	473	0.06
405	Surface.	413	0.03
		413	0.015
		421	Surface.

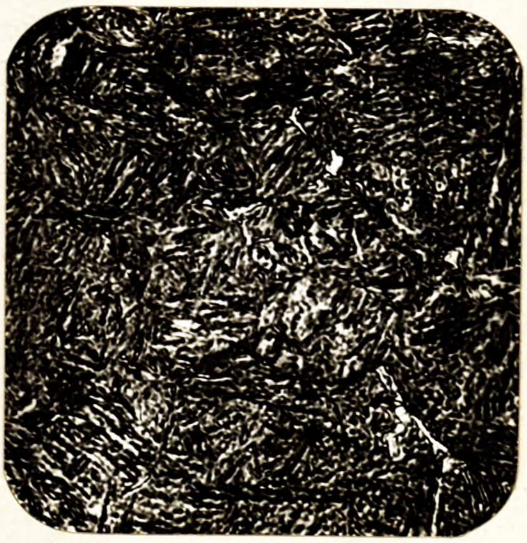
Microscopic Examination:

A transverse specimen was cut from Pin No. 8. This specimen was polished, and then etched in 2 per cent nital. Figure 2, taken at X1000 magnification, illustrates the core structure. Figure 3 (X500) shows the structure of the pin

(Microscopic Examination, cont'd) -

at the surface.

Figure 2.

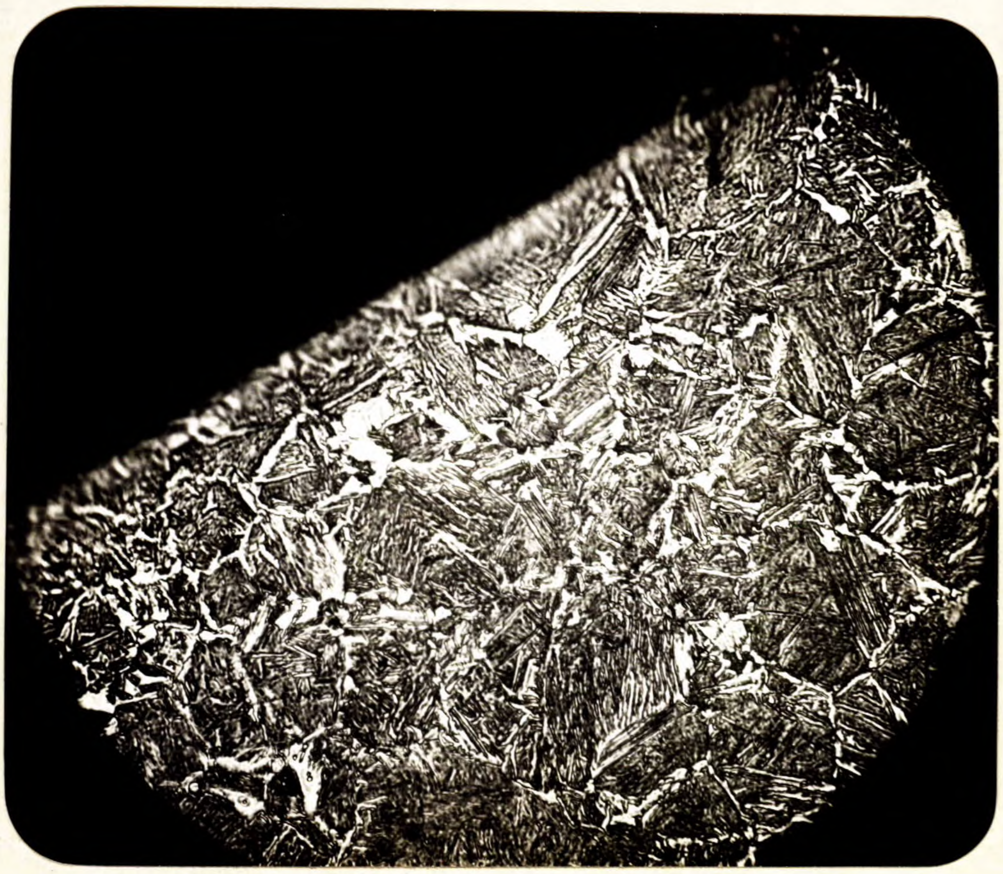


X1000, nital etch.

CORE OF PIN.

Tempered Martensite.

Figure 3.



X500, nital etch.
STRUCTURE OF PIN AT THE SURFACE.
Note presence of ferrite.

Discussion:

The pins gave excellent bend and impact results.

The surface hardnesses of the pins varied considerably. This, of course, is due to the varying amounts which were machined off the surface prior to heat treatment. It must be noted that the decarburization was not removed in any one of the samples. Pin No. 8, which had 0.035 inch taken off prior to heat treatment and 0.010 inch after heat treatment, still showed decarburization at the surface. Figure 3 illustrates the presence of ferrite in the outer zone of this pin.

Care will have to be exercised in order to obtain the minimum of decarburization in the preparation of the bar stock. Also, in the heat treatment of the centreless-ground pin, a carburizing atmosphere should be employed, to ensure that there will be no further decarburization. A check on the heat-treating furnace with heavily machined stock would readily show the effect of the furnace atmosphere.

CONCLUSIONS:

1. Good bend and impact results were obtained with the pins.

2. Varying surface hardness was observed.

3. Decarburization was not effectively eliminated, even in the most heavily ground specimen.

Recommendations:

1. The bar stock should be carefully handled, to give a minimum of decarburization.

2. The furnace atmosphere should be carburizing, to prevent further decarburization in the heat treatment of the pins.

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