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O T T A W A November 6th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1523.

Examination of Six Malleable Iron Universal Carrier Track Links.

(Copy No. 11.)

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:

Six malleable iron universal carrier track links were submitted by Dr. C. W. Drury, Director of Metallurgy, Army Engineering Design Branch, Department of Munitions and Supply, Toronto, Ontario, for examination, in March, 1943. This request was covered by the following requisition order:

Requisition No. 389, AEDB Lot No. 428, Report No. 20, Test 19, dated February 23rd, 1943.

The links were shipped from the Ford Motor Company of Canada Limited, Windsor, Ontario, where they were taken from a track which was installed to run in a direction opposite to that which is normally used.

It was requested that their physical properties be determined for comparison with those of regular-production universal carrier track links.

Physical Tests:

Impact Tests -

Link No.	BARREL Blows	Ft-lb.	Remarks	LUGS Blows	Ft-lb.	Remarks
1	1	200	Failed.	1	200	Passed.
				1	300	Failed.
2	1	200	Failed.	1	200	Passed.
				1	300	Failed.
3	1	200	Failed	1	200	Passed.
				1	300	Failed.

Bend Tests -

Link No.	Breaking load, pounds	Angle after breaking
4	10,700	5.0°
5	11,250	4.0°
6	11,750	6.0°

Hammer Test -

Three links were tested. All passed.

Hardness Surveys -

Transverse sections were cut through eye-hole wall and grouser of three links. Hardness surveys were made, using the Vickers hardness testing machine and a 10-kilogram load.

The results were plotted and the values at each 0.01 inch of distance from the eye-hole surface are tabulated on the following page.

(Continued on next page)

(Hardness Surveys, cont'd) -

Link No.	VICKERS HARDNESS NUMBER Distance from Eye-hole Surface (inches) Surface	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	258	193	148	138	140	142	143	144	145	153	168	207	200	200
2	200	178	161	151	141	133	131	130	129	126	126	150	190	227
2	230	190	148	159	170	184	222	230	230	230	230	230	230	230
3	258	230	200	180	160	163	166	170	174	177	180	216	221	236
xx2	-	-	-	-	134	-	-	-	134	-	123	123	-	-

xx Readings taken across eye-hole wall, on link that was heavily decarburized.

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Macroscopic and Microscopic Examination:

Transverse sections were cut through eye-hole wall and grouser of three links. After the sections were polished and etched with 2 per cent nital, the decarburized areas were clearly distinguishable since they etched lighter than the higher-carbon material.

The depth of the lower-carbon areas, measured visually, appeared to vary from 0.015 inch in Link No. 3 to 0.100 inch in Link No. 2. Two of the links were decarburized completely across the eye-hole wall.

The microstructures at these sections are shown in Figures 1 to 3, photomicrographs at X200 magnification.

Discussion:

Bend properties are comparable to those of normal-production links. Impact values, however, are low. This type of link will normally withstand a 400-foot-pound blow on the barrel. However, it must be remembered that manufacturers' specifications only require resistance to a 112-foot-pound blow. The hardness in the eye-hole wall and grouser is according to specifications (i.e., 200 V.H.N. maximum in the

(Discussion, cont'd) -

former and 350 V.P.H. in the latter).

Irregular decarburization, as shown by hardness surveys and macro-examination, indicates that the decarburizing process is not completely controlled. Such lack of uniformity, which is most evident in the eye-hole wall because of its thin section, would make link stretch more probable; also, rapid wear would be expected once the case is worn away.

Microscopic examination revealed that the links had typical structures at the surface, i.e., an outer cyanide layer backed by an area of ferrite. (See Figure 1).

The structure of the remainder of the eye-hole wall and the grouser was also typical, consisting of a zone of mixed ferrite and pearlite bordering an area composed of temper carbon in a background of pearlite containing small particles of cementite. These structures are shown in Figures 2 and 3.

CONCLUSIONS:

1. Bend and hardness properties are comparable with those of regular malleable iron production links. Impact properties, however, are lower than usually found in this type of link.

2. Decarburization is irregular, particularly in the eye-hole wall. This could result in rapid wear once the case is worn away, and makes more probable "link stretch" during service.

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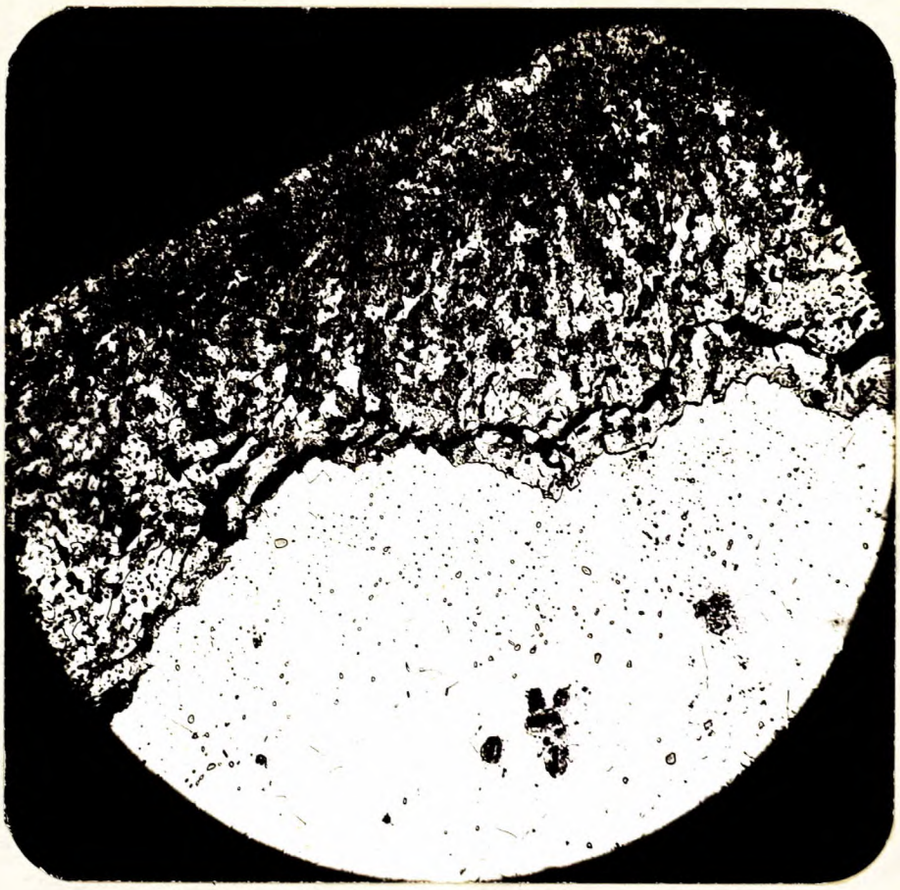
Figure 1.



X200, nital etch.
CASE AND FERRITE AREA.

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Figure 2.

X200, nital etch.
ZONE OF MIXED FERRITE AND PEARLITE.

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Figure 3.

X200, etched in 2 per cent nital.

TEMPER CARBON IN BACKGROUND OF PEARLITE
AND SMALL PARTICLES OF CEMENTITE.

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