OTTAWA September 30th, 1941.

# REPORT

# of the

# ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1102.

Report on Fisch Case-Hardening Compound and Isolating Faste.

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

DEPARTMENT OF MINES AND RESOURCES MINES AND GEOLOGY BRANCH

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Source of Material and Object of Investigation:

On September 3rd, 1941, Major E. D. B. Kippen, Commandant, Camp "A", Department of National Defence (Army), Farnham, Quebec, sent in a sample of a case-hardening compound and also an isolating paste for examination. These materials were prepared by a Mr. Julius Fisch, an internee at this camp, who prior to the war had been engaged in manufacturing these products in Italy from 1932 to 1939, in

(Source of Material and Object of Investigation, cont'd) association with the Indiana Limited, Venice. It was requested that they be tried out in order to see if Mr. Fisch's claims were correct.

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# Composition of Steels:

In conducting this investigation the following steels were used:

Carbon,	Manganese,	Chromium,	Nickel,	Molybdenum,
per cent	per cent	per cent	per cent	Der cent
0.10	0,60	Ċ,	(7)	٤.*
0,21	0,37	(7)	67.78	<b>C7</b>
0,24	0,68	<b>F</b> <sup>0</sup>	3,12	n51
0,25	0,66	0,68	1,30	8
0,10	0.37		0,71	0.15
	Carbon, <u>per cent</u> 0.10 0.21 0.24 0.25 0.10	Carbon, Manganese, <u>per cent</u> <u>per cent</u> 0.10 0.60 0.21 0.37 0.24 0.68 0.25 0.66 0.10 0.37	Carbon, Manganese, Chromium,   per cent per cent per cent   0.10 0.60 -   0.21 0.37 -   0.24 0.68 -   0.25 0.66 0.68   0.10 0.37 -	Carbon, Manganese, Chromium, Nickel,   per cent per cent per cent per cent   0.10 0.60 - -   0.21 0.37 - -   0.24 0.68 - 3.12   0.25 0.66 0.68 1.30   0.10 0.37 - 0.71

#### Procedure:

Steel samples  $\frac{1}{2}$ -inch thick were cut from l-inch round bars and the following tests carried out:

# Test No. 1.

Pack-hardened in 100 per cent new Fisch carburizing compound.

Test No. 2.

Pack-hardened in carburizing compound used in

Test No. 1, plus 15 per cent new Fisch compound.

# Test No. 3.

Pack-hardened in 100 per cent new Houghton's activated charcoal compound,

## Test No. 4.

Pack-hardened in carburizing compound used in Test No. 3, plus 15 per cent new Houghton's activated charcoal compound.

(Continued on next page)

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(Procedure, cont'd) -

#### Test No. 5.

Pack-hardened in 100 per cent new Houghton's hydrocarbonated bone meal carburizing compound.

#### Test No. 6.

Pack-hardened in carburizing compound used in Test No. 5, plus 15 per cent new Houghton's hydrocarbonated bone meal carburizing compound.

> <u>NOTE</u>: All tests were carried out at 1650° F. for eight hours and the steels ellowed to cool in the furnace.

#### Test No. 7.

Gas-carburized at 1650° F. for 45 minutes in the Leeds & Northrup "Vapocarb-Hump" furnace.

## Test No. S.

Selective pack-carburizing was carried out on a piece of  $\frac{1}{2}$ -inch diameter steel bar. One section of the steel was covered with a half-inch layer of the isolating paste and the romainder was left uncoated. The bar was carburized at 1650° F. for eight hours and then quenched in water from 1450° F.

#### Depth of Case:

The steels were all given a metallographic polish and then etched in a solution of 2 per cent nitric acid in alcohol. The steels were found to have the following average cases:

(Continued on next page)

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Depth of Case:

	ŝ		$:\mathbb{N}$	Ο,	6	No.	40	No. :	NO.:	DUNICO	
Test	90	Carburizing Materials	:5	5,	00	6,	ş	1-B. 8	31, :	sample,	
No.	6 0		្ទំឃ	11).	0	mm.	0 0	mm, s	11013.; <u>:</u>	DWG o	
	0	enten en e	C C		perio e		Of Grapher	10-10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-00 - 10-	an a fallen som e stand at 12 mile		
1	00	Fisch Now	:1	00		100		100	130	85	
2	ŝ	" Residuo, 15% New	31	00		100		75	130	75	
Š	00	Houghton's Charcoal New	90	85		90		100	120	90	
4	20	" Residue, 15% New	ŝ	85		90		80	180	70	
5	ŝ	" Bone Meal	ŝ	70		80		70	100	60	
6	5	" Old Bone Meal 15% New	ŝ	70		80		70	90	60	
7	00	Vapocarb-Hump furnace	ŝ	60		70		50	60	60	
	6	····	ö			11/12/12/12/12/12/12/12/12				، ۲۵۵۵ میروند (۲۰۰۰ میروز) (۲۰۰	

# Microscopic Examination:

The metallographic specimens were given a deep etch in 2 per cent nital in order to show up any carbides present in the case. The examination under the microscope showed some of the steels to have a thin layer of carbides at the surface. However, no free carbides were observed in the case of any of the steels.

#### Discussion of Results:

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The results of these experiments with Mr. Fisch's case-hardening compound indicate that the cases obtained compare very favourably with those obtained with commercial carburizing compounds.

The cases produced are as good as those obtained with similar grades such as Houghton's activated charcoal compound, and in some steels slightly deeper cases resulted.

The use of the isolating paste in the selective case-hardening and heat-treatment gave very satisfactory results. - Page 5 -

Conclusion:

The results of the work done on Mr. Elsch's materials may be stated to substantiate his claims. The economics of manufacturing and distribution

of these products have not been studied.

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