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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/668

Resistance of Austempered Mn-Mo Steel to
Perforation by Cal. .45 Steel-Jacketed
Ball Projectiles

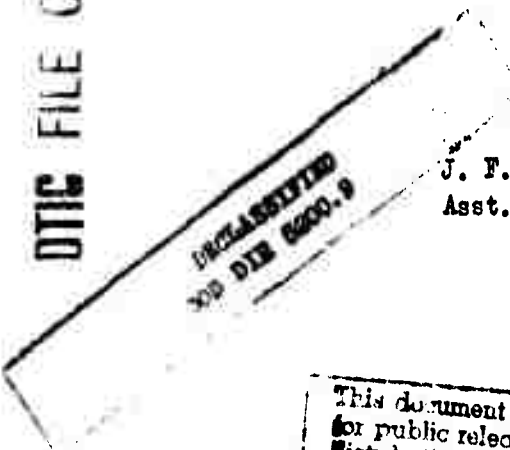
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BY

J. F. SULLIVAN
Asst. Engineer

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DATE 18 September 1944

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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT NO. WAL 710/668

Seventeenth Partial Report on Problem B-8.2

18 September 1944

Resistance of Austempered Mn-Mo Steel to

Perforation by Cal. .45 Steel-Jacketed

Ball Projectiles

1. As part of a program of development of improved body armor component materials, requested by the Office, Chief of Ordnance¹, samples of a manganese-molybdenum steel austempered in a salt bath at different temperatures have recently been tested at this arsenal.

2. Although a slight superiority in resistance to perforation by cal. .45 steel-jacketed ball projectiles is apparently attained by the sample austempered with agitation at 500°F when compared with samples austempered without agitation at 450°F, 500°F, 600°F and 700°F, the general level of resistance is far below that of an equivalent weight of Hadfield manganese steel and is appreciably inferior to that of some other types of ferritic steels previously examined.

3. Samples of each heat treatment were clamped rigidly to wooden ballistic frames and impacted fairly in unsupported areas by cal. .45 steel-jacketed ball projectiles. The results appear in Table I.

4. The resistance of sample HF-10 (as measured by its ballistic limit with cal. .45 steel-jacketed ball projectile - 632 f/s) which had been austempered with agitation at 500°F appears to be greater than that of any of the other samples (HF-6, 553 f/s; HF-7, 560 f/s; HF-8, 489 f/s; HF-9, 536 f/s) which had been austempered without agitation at 450°F, 500°F, 600°F and 700°F, respectively. An equivalent weight of Hadfield manganese steel, however, will characteristically have a ballistic limit of 930 feet-per-second with the same projectile and a ferritic steel of equivalent weight recently examined here had a ballistic limit of 830 feet-per-second.

1. O.O. 422.3/71(c) - Wtn 470.5/7443(c), dated 28 September 1943.

2. Watertown Arsenal Laboratory Memorandum Report No. WAL 710/672, "Comparative Resistance of Light-Gauge (.045") X4130 Steel and 8630 Steel, As-Rolled and After Heat Treatment, to Perforation by Flak-Simulating Projectiles", 18 September 1944.

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5. Thus, it does not appear that the subject steel in the austempered condition offers much promise in this gauge as prospective body armor component material.

J. F. Sullivan

J. F. SULLIVAN
Asst. Engineer

APPROVED:

E. L. Reed
for

N. A. MATTHEWS
Major, Ordnance Dept.
Chief, Armor Section

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TABLE I

Summary of Results of Tests Conducted at Watertown Arsenal

on Samples of Austempered Mn-Mo Steel

CHEMICAL ANALYSIS

C	Mn	Si	S	P	Mo
.25	1.61	.22	.017	.020	.50

Sample No.	Actual Gauge	Hardness (Rockwell C ¹)	Austempering Temperature (In Salt Bath)	Ballistic Limit (F/S)	
				Cal.	.45 ¹
HP-6	.040"	46	450°F	553	
HP-7	.042"	44	500°F	580	
HP-8	.043"	42	600°F	489	
HP-9	.042"	38	700°F	536	
HP-10	.043"	45	500°F (with agitation)	632	
For comparison:					
Average Hadfield Manganese Steel					930
NE-8630 Steel ²					880

¹Cal.

Average Hadfield Manganese Steel

NE-8630 Steel²

¹Cal. .45 steel-jacketed ball projectile - 230 grains.

²VAL 710/672. NE-8630 steel heat treated at Watertown Arsenal.

TITLE: Resistance of Austempered Mn-Mo Steel to Perforation by Cal 45 Steel-Jacketed Ball Projectiles

AUTHOR(S): Sullivan, J. F.

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ABSTRACT:

Resistance tests were made of austempered Mn-Mo steel to perforation by 0.45 cal. steel-jacketed ball projectiles. Samples of a manganese-molybdenum steel were austempered in salt bath with agitation at 500°F and their resistance to perforation was compared with samples austempered without agitation at 450, 500, 600 and 700°F. Although a slight superiority in resistance to perforation by cal. 0.45 steel-jacketed ball projectiles is apparently obtained by the samples austempered with agitation at 500°F when compared with the samples austempered without agitation, the general level of resistance is far below that of an equivalent weight of Hadfield manganese steel, and is inferior to some other types of ferritic steels previously examined. It does not appear that the steel tested offers much promise in this regard as prospective body armor.

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