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WATERTOWN ARSENAL  
LABORATORY

MEMORANDUM REPORT

NO. WAL 710/638

Resistance of a Light-Gauge (.042" to .046") Austenitic Steel at  
Various Degrees of Hardness to Perforation by  
Fragment-Simulating Projectiles

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BY

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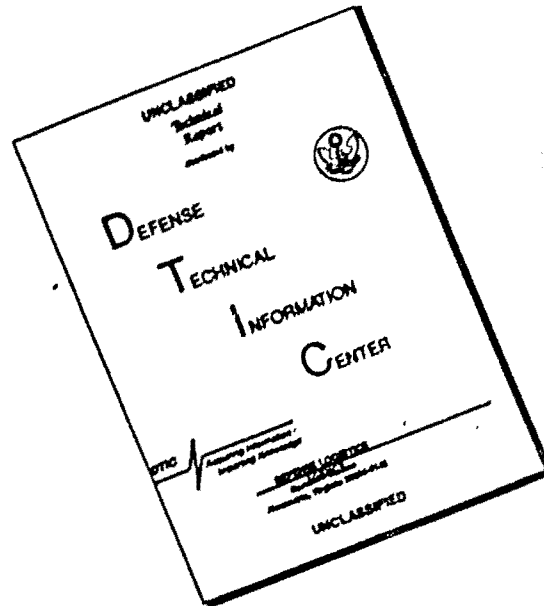
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RESTRICTEDWATERTOWN ARSENAL LABORATORYMEMORANDUM REPORT NO. WAL 710/638Twelfth Partial Report on Problem B-8.2

10 June 1944

Resistance of a Light-Gauge (.042" to .046") Austenitic Steel at  
Various Degrees of Hardness to Perforation by  
Fragment-Simulating Projectiles

1. In accordance with a request of the Office, Chief of Ordnance<sup>1</sup>, a program of development of improved body armor components ~~is being~~ *was* conducted at this arsenal. As part of this program tests have recently been concluded on samples of an austenitic steel, in various conditions of hardness, supplied by Jessop Steel Company.

2. The resistance of the "as-annealed" sample to perforation by cal. .45 (steel-jacketed) projectiles was superior to that of the hardened samples. The resistance of the 1/4 Hard sample to perforation by the cal. .22 fragment-simulator<sup>2</sup> appears to be superior to that of the others although the gauge variation between the samples renders precise evaluation difficult. The resistance of all samples of this steel is considerably inferior to that of an equivalent weight of Hadfield manganese steel.

3. Samples in each condition of hardness were rigidly clamped to wooden ballistic frames which allow areas 8"x8" to remain unsupported from the rear. Into the faces of these areas there were then directed impacts of cal. .45 ball projectiles (steel-jacketed) and of cal. .22 fragment-simulating projectiles. The results of these firings are set out in Table I. The hardness determinations recorded are those of the supplier.

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1. O.O. 422.3/71(c) - Wtn 470.5/7443(c), dated 28 September 1943.
  2. WAL Memorandum Report No. 762/253, Development of a Projectile, to Be Used in Testing Body Armor, to Simulate Fragments of a 20 mm. H.E. Projectile, dated 7 January 1944.

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4. Under impact of steel-jacketed cal. .45 ball projectiles the resistance of the "as-annealed" sample (728 feet-per-second) was superior to that of the hardened samples (689, 685 and 625 feet-per-second) but considerably inferior to that of an equivalent weight of Hadfield manganese steel (920 feet-per-second).

5. Under impact of the cal. .32 fragment-simulating projectile, G-2, the resistance of the 1/4 Hard sample (1283 feet-per-second) is greater than that of the other samples (1237, 1171 and 1155 feet-per-second) and although its thickness (.045") is somewhat greater than that of the "as-annealed" sample (.042") its superiority is greater than can be attributable entirely to the gauge differential. The resistance of none of these samples compares with that of an equivalent thickness (.042") of Hadfield manganese steel (1630 feet-per-second).

6. Thus, the resistance of this austenitic steel in this gauge is not such as to warrant further consideration of it as a body armor component. However, since its resistance in this gauge is comparable to that of ferritic steels, and since some ferritic steels approach and even surpass Hadfield manganese steel in the heavier gauges, further development of this steel in gauges applicable to flak-curtain components (.060" to .125") seems warranted since the demand for a non-magnetic steel may exist in the higher thickness ranges.

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Table I

Summary of Ballistic Tests Conducted at Watertown Arsenal on  
Samples of an Austenitic Steel Submitted by Jesson Steel Co.

<u>Sample</u>	<u>Gauge</u>	<u>Hardness</u>	<u>Ballistic Limit (F/S)</u>	
			<u>Cal. .45<sup>1</sup></u>	<u>G-.22</u>
As Annealed	.042"	255 BHN	728	1171
	.042"	255 BHN		
1/4 Hard	.045"	270 BHN	689	1283
	.045"	270 BHN		
1/2 Hard	.042"	282 BHN	625	1155
	.044"	282 BHN		
Full Hard	.045"	301 BHN	685	1237
	.046"	295 BHN		
For Comparison:				
Hadfield manganese steel	.042"	88 Rb	920	1630

<sup>1</sup>Cal. .45 (steel-jacketed) ball projectile - 230 grains.

<sup>2</sup>Cal. .22 fragment-simulating projectile - 17 grains.