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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/708

Resistance of Several Samples of Aluminum Alloy (24ST)

to Perforation by Fragment-Simulating Projectiles

BY

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DATE 27 December 1944

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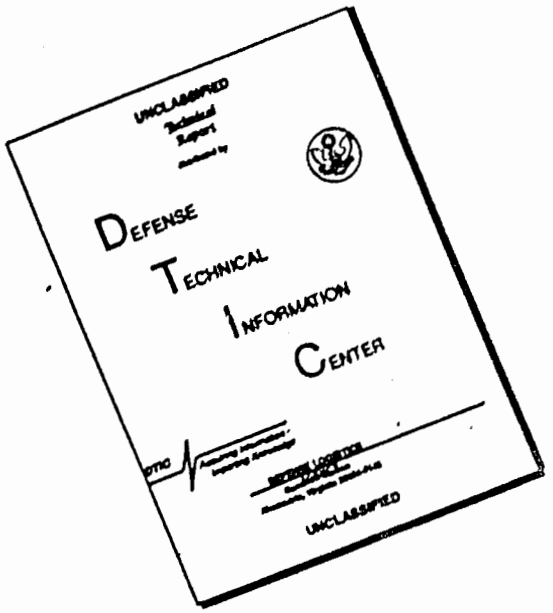

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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT NO. WAL 710/708

27th Partial Report on Problem B-8.2

27 December 1944

Resistance of Several Samples of Aluminum Alloy (24ST) to Perforation by Fragment-Simulating Projectiles

1. In response to a request of the Office, Chief of Ordnance[1], tests have recently been conducted at this arsenal on several samples of 24ST aluminum alloy to determine the resistance of this material to perforation by fragment-simulating projectiles developed at this arsenal[2,3]. Ballistic limits were also determined with cal..45 steel-jacketed ball projectiles.

2. Although the resistance of this material to perforation by the projectiles used at this arsenal was inferior to that of Hadfield manganese steel of 82% the weight-per-unit-area, it is considered that the results of tests of materials under actual fragmentation of 20mm. high explosive shell (as conducted at the Ordnance Research Center, Aberdeen Proving Ground) may be more indicative of the material's resistance to service attack and should be preferred as a basis of evaluation of the relative resistance characteristics of various materials to any ballistic limit test so far devised.

3. Samples of this material were gauged and weighed and clamped rigidly to wooden ballistic frames and impacted fairly with cal..45 steel-jacketed ball projectiles and fragment-simulators, G-1-A, G-1-S and G-2. The results of these tests are included in Table I.

4. The resistance of typical .045" Hadfield manganese steel to perforation by these projectiles is superior to that of any of the samples tested although its weight is but 82% of that of any of them. Under actual fragmentation of 20mm. high-explosive shell, however, equivalent weights of the subject material afford greater resistance than Hadfield manganese steel. In view of this discrepancy it is felt that the subject tests be interpreted as merely indicative of the resistance of the tested

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1. O.O. 426/2179 - Wtn 400.112/3174. 24 August 1944.
2. WAL 762/247
3. WAL 762/253

materials to perforation by the specific projectiles and not be considered as indicative of the resistance of these materials to service attack from fragments of high-explosive shell.

5. Material for use as components of body armor assemblies should be selected on the basis of actual fragmentation tests. Thereafter the projectiles used on the subject tests may be employed as a means of evaluating the quality of successive lots of any one material and effectively insure quality control.

J. F. SULLIVAN
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APPROVED:

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TABLE I

Summary of Tests Conducted at Watertown Arsenal on Samples of 24ST Aluminum Furnished by Aberdeen Proving Ground

$\frac{16}{454} \times \text{Grams} \square = \text{oz/sq. ft.}$

Sample No.	Actual Gauge	Grams/ Sq. Ft.	Equiv. Steel Gauge	Ballistic Limits .45[1]	G-2[2]	G-1-A[3]	G-1-S[4]
1A	.155"	1015	.055"	—	998	512	1078
1B	.157"	1032	.056"	—	1050	537	1128
1C	.154"	1017	.055"	891	—	—	—
1D	.155"	1015	.055"	900	—	—	—
2A	.158"	1040	.056"	—	1035	505	1080
2B	.156"	1035	.056"	—	1015	520	1075
2C	.153"	995	.054"	843	—	—	—
2D	.156"	1031	.056"	862	—	—	—
3A	.158"	1037	.056"	—	1010	538	1072
3B	.155"	1020	.055"	—	1053	530	1070
3C	.156"	1034	.056"	896	—	—	—
3D	.154"	1015	.055"	882	—	—	—
4A	.156"	1033	.056"	—	1015	468	1075
4B	.155"	1023	.055"	—	968	480	1035
4C	.153"	1001	.054"	907	—	—	—
4D	.155"	1015	.055"	902	—	—	—
5A	.158"	1035	.056"	—	1023	530	1077
5B	.157"	1037	.056"	—	1035	535	1035
5C	.155"	1017	.055"	939	—	—	—
5D	.156"	1031	.056"	937	—	—	—
FOR COMPARISON:							
Hadfield manganese steel	.045"	—	—	950	1675	—	—

1. Cal. .45 steel-jacketed projectile - 230 grains
2. Cal. .22 fragment-simulating projectile - 17 grains
3. Cal. .30 " " " -150 grains
4. Cal. .30 " " " - 34 grains

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ABSTRACT:

Tests were made on several samples of 24 ST aluminum alloy to determine the resistance to perforation by fragment simulating projectiles. Ballistic limits were also determined with cal. .45 steel-jacketed ball projectiles. The samples were gauged, weighed and clamped rigidly to wooden ballistic frames and impacted with cal. .45 G-1-A, G-1-S, and G-2 projectiles. The resistance of typical .045" Hadfield manganese steel to perforation by these projectiles is superior to that of any of the samples tested although its weight is but 82%. Under actual fragmentation of 20-mm high-explosive shell, however, equivalent weights of the subject material afford greater resistance than Hadfield manganese steel. In view of this discrepancy it is felt that the subject tests be interpreted as merely indicative of the tested materials to perforation by the specific projectiles.

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