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710/307

WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/307

Resistance of an Aluminum Alloy (R301-T)

to Perforation by Fragment-Simulating Projectiles

BY
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DATE 13 December 1944

WATERTOWN ARSENAL
WATERTOWN, MASS.

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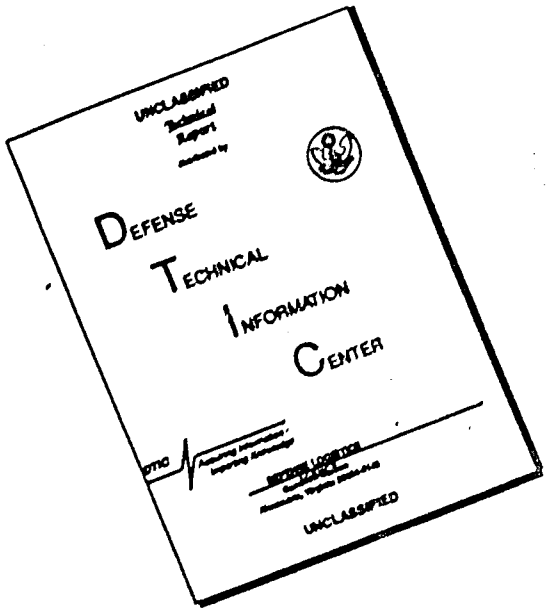

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WATERTOWN ARSENAL LABORATORY

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25th Partial Report on Problem B-8.2

13 December 1944

Resistance of an Aluminum Alloy (R301-T) to Perforation by Fragment-Simulating Projectiles

1. In accordance with a request from the Office, Chief of Ordnance[1], tests have recently been concluded on samples of R301-T aluminum alloy furnished by the Reynolds Metals Company.

2. The resistance of the 1/8" samples to perforation by the cal..45 steel-jacketed projectile and by the fragment-simulating projectile G-2 was consistent with the results of earlier tests conducted on material of the same type[3]. The resistance of all samples to perforation by all of the fragment-simulating projectiles employed was greatly inferior to that of equivalent weights of Hadfield manganese steel.

3. Samples of R301-T alloy of nominal thicknesses .125", .156" and .188" were measured and weighed and clamped rigidly to wooden ballistic frames which allow a generous area in each plate to remain unsupported from the rear. Into these areas were directed fair impacts of cal..45 steel-jacketed ball projectiles and fragment-simulating projectiles G-2 (cal..22 - 17 grains), G1-A (cal..30 - 150 grains) and G-1-S (cal..30 - 34 grains)[4]. The results of these tests appear in Table I.

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1. O.O. 470.1/41526 - Wtn 470.1/55 dated 16 September 1944
2. WAL 762/253
3. WAL 710/636
4. WAL 762/247

4. Under impact of the cal..45 steel-jacketed ball projectile the resistance of the 1/8" sample was comparable with that of similar material previously tested here[5], but considerably less than that of Hadfield manganese steel of equivalent weight-per-unit-area. The resistance of the .156" and .188" to perforation by the same projectile was correspondingly low.

5. The resistance of all samples to perforation by cal..22 fragment-simulating projectile G-2 was lower than that of Hadfield steel equivalent in weight to the lightest sample. Under impact of cal..30 fragment-simulators G-1-A and G-1-S, the resistance of these materials continued to be low.

6. Although the comparative resistance of the subject material to perforation by fragment-simulating projectiles employed in these tests is lower than that of Hadfield manganese steels, actual fragmentation tests, which should be considered to be more representative of actual service attack, have shown that the subject material is perhaps a better resistor of actual fragments than is an equivalent weight of Hadfield manganese steel. The discrepancy between the tests conducted at this arsenal and actual fragmentation tests is undoubtedly attributable to the fact that the fragment-simulators, as used here, represent fragments attacking a target in the most efficient manner possible, whereas efficient attack of a target by a fragment of a high explosive shell is exceptional. Tests are being currently conducted at this arsenal to alter the manner of attack of the fragment-simulators so that they may be used to reproduce the typical inefficiency of an actual fragment.

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APPROVED:

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5. Reference 3

TABLE I

Summary of Results of Ballistic Tests

Conducted at Watertown Arsenal on Samples of R301-T

Aluminum Alloy from Reynolds Metals Company

Material	Actual Thickness	Grams/Sq.Ft.	Equiv. Steel Thick.	Ballistic Limit			
				Cal..45	G-1-A[2]	G-1-S[3]	G-2[4]
R301-T	.125"	825	.045"	766	—	—	—
R301-T	.129"	851	.046"	—	440	815	798
R301-T	.154"	1016	.055"	882	—	—	—
R301-T	.152"	1002	.054"	—	473	980	873
R301-T	.188"	1240	.067"	1057	—	—	—
R301-T	.189"	1247	.067"	—	617	1135	1108
FOR COMPARISON:							
Hadfield Manganese Steel	.045"	—	—	950	—	—	1675

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