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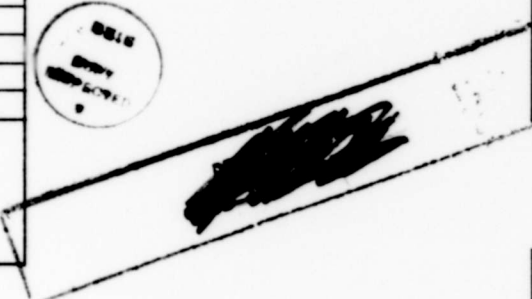
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LABORATORY

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**WATERTOWN ARSENAL
LABORATORY**

MEMORANDUM REPORT

NO. WAL 710/284

Resistance of Various Laminates Supplied by
U. S. Rubber Co. to Perforation by
Cal. .45 Steel-Jacketed Ball Projectiles

BY

J. F. SULLIVAN
Asst. Engineer

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WATER TOWN ARSENAL LABORATORY

MEMORANDUM REPORT NO. WAL 710/284

Second Partial Report on Problem B-8.13

16 October 1944

Resistance of Various Laminates Supplied by
U. S. Rubber Co. to Perforation by
Cal. .45 Steel-Jacketed Ball Projectiles

1. In response to a request of the Office, Chief of Ordnance¹, tests have recently been conducted at this arsenal on five (5) samples of nylon-rubber (2), fiberglass-resin (2) and nylon-resin (1) laminates developed by the U. S. Rubber Co.
2. The resistance of each of these laminates to perforation by cal. .45 steel-jacketed ball projectiles was so low that tests with other fragment-simulating projectile were foregone. The nylon-rubber laminates tested, while apparently very well fabricated, failed to afford the amount of protection desired, whereas the fiberglass-resin and nylon-resin laminates neither appeared to be properly fabricated nor did they furnish the desired protection.
3. Samples (14" x 14") were mounted in a slotted wooden ballistic frame and subjected to impact by cal. .45 steel-jacketed ball projectiles. The results appear in Table I.
4. Since the nylon-rubber laminates were apparently very well fabricated the resistance which those samples afforded probably represents the ultimate which may be attained from such a combination. Their fundamental weakness probably lies in the fact that such construction allows each layer of nylon to be attacked individually.
5. Since the fiberglass-resin laminates exhibited so much less resistance to perforation than "Doron" which is similarly constituted it may be assumed that the method or technique of fabricating them was faulty. The nylon-resin laminate also appeared to be poorly made.

1. O.O. 100.112/15010(c) - Wtn 400.112/3167(c).

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6. Although a fiberglas-resin combination has not been tried, it is seriously doubted that such a combination will afford sufficiently increased resistance to warrant its consideration as body-armor component since it will undoubtedly retain the weakness inherent in the nylon-rubber combination - the exposure of the cloth constituents to individual attack.

J. F. Sullivan
J. F. SULLIVAN
Asst. Engineer

APPROVED:

E. L. Reed. *RAM 10/23/44*
E. L. REED
Research Metallurgist
Acting Chief, Armor Section

TABLE I

Summary of Tests for Resistance to Perforation Conducted
at Watertown Arsenal on Laminates Developed by U. S. Rubber Co.

<u>Sample No.</u>	<u>Type</u>	<u>Weight (grams)</u>	<u>Weight/sq. ft. (grams)</u>	<u>Thick-ness</u>	<u>Equivalent Steel Gauge</u>	<u>Ballistic Limit Cal. .45*</u>
1	Nylon-Rubber	1553	1141	15/32"	.062"	606 ± 15
2	Nylon-Rubber	1129	830	11/32"	.045"	569 ± 22
3	Fiberglas-Resin	918	675	3/16"	.036"	425 ± 25
4	Fiberglas-Resin	993	803	7/32"	.043"	445 ± 50
5	Nylon-Resin	983	723	11/32"	.039"	367 ± 67
<u>For Comparison:</u>						
Doren		--	--	--	.040"	1050
Hadfield Manganese Steel		--	--	--	.040"	300

*Cal. .45 steel-jacketed ball projectile (230 grains).

TITLE: Resistance of Various Laminates Supplied by U.S. Rubber Co. to Perforation by
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ABSTRACT:

Resistance tests were made on five samples of laminates of nylon-rubber, fiber-glass - resin, and nylon - resin to perforation by cal. 0.45 steel jacketed ball projectiles. Results of the tests show that the resistance of each of the laminates to perforation by 0.45 cal. steel jacketed projectiles was so low that tests with other fragment-simulating projectiles were not made. The nylon-rubber laminates tested, while apparently well fabricated, failed to afford the amount of protection desired, whereas the fiber-glass - resin, and nylon-resin laminates neither appeared to be properly fabricated nor did they furnish the desired protection. The nylon-rubber laminates probably present the ultimate which may be attained from such a combination.

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