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SEP 1 1 1956
Case No. 433.00
Ref. Sym: 1612 (370)
Project No. TM-436
File: H-490, 3-2

MR. L. A. DUNN - 1284 TCG-NNT-1

Re: Drop Test of H-490 With Sponge Rubber and Polyurethane Cushioning

INVENTORIED AUG 6 1956 3427-1

Summary of Results

12 inch package drop tests were performed on the H-490 container to compare the shade isolation characteristics of three configurations of polyurethane and sponge rubber pads. The three pad configurations tested and the respective maximum faired accelerations measured on the contained units are as follows: Container A, medium Stafoam with three plugs of firm sponge rubber, 17g; Container B, medium Stafoam with four plugs of medium sponge rubber, 16g; Container C, No. 9030 Stafoam with three plugs of firm sponge rubber, 20g.

Neither the contained dummy XW-25 nor the container were damaged by the tests.

INVENTORIED BY ORG. 2743

RECEIVED SEP 13 1956 R & D FILES

Object of Test

The test was performed to compare the shock mitigating properties of three different cushioning configurations of polyurethane and sponge rubber in the H-490.

INVENTORIED SEP 14 '65 3428-3

Reason for Test

The test was requested in a Request for Materials Laboratory Investigation from L. A. Dunn, 1284, to P. H. Adams, 1612, dated July 30, 1956.

INVENTORIED MAR 2 1959 3643

CDL No. ACCOUNTABILITY CARD FILE No. H-490 3-2

Summary of Past Tests

Drop tests were performed on the H-490 prototype No. 5 container (similar to the container used in this test) which contained medium polyurethane Cushioning material. The test, entitled "Ramp and Drop Test of the H-490 Prototypes 4 and 5," Ref. Sym. 1612 (286), was reported on January 30, 1956 in a memorandum to L. A. Dunn, 1284, from R. L. Ault, 1612.

The maximum measured faired vertical acceleration on the dummy XW-25 warhead during the 12" drops was 3.7g; maximum faired longitudinal acceleration was -20g. Accelerations are with respect to the warhead axes. Accelerations were read in accordance with SCS-10.

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No mechanical or electrical damage resulted to either the dummy XW-25 warhead or the container from the 12 inch drops.

Another test, "Ramp Test of H-490 with Polyurethane Cushioning (X9030)", Ref. Sym. 1612 (365), was reported in a memorandum from G. M. Willson, 1612, to L. A. Dunn, 1284, dated August 21, 1956

Ramp tests were run at 7.0 and 9½ m.p.h.

Two types of shields were tested on the dummy XW-25; a plywood shield and a plywood-and-steel type shield.

Using the plywood shield, maximum measured faired accelerations (with respect to the warhead axes) on the dummy XW-25 warhead were: Vertical, -31g; longitudinal, -3.1g.

Using the plywood-and-steel type shield maximum measured faired accelerations (with respect to the warhead axes) on the dummy XW-25 warhead were: vertical, -22g; longitudinal, -3.8g.

The container legs were bent by the 9½ m.p.h. impact.

No damage resulted to the dummy XW-25.

The plywood-and-steel type shield was more effective than the plywood shield in reducing shock to the contained dummy XW-25 warhead.

A test, "Material Cushioning Properties for XH-490," Ref. Sym. 1612 (350), was submitted in a memorandum to L. A. Dunn, 1284, from R. L. Ault, 1612, dated July 25, 1956.

The XH-490 using four different mounting systems for the dummy XW-25 warhead contained, was subjected to ramp and drop tests.

Maximum measured faired longitudinal accelerations (with respect to the warhead axes) on the dummy XW-25 warhead during the drops ranged from 15g to 39g.

No damage occurred to the dummy XW-25 warhead or to the container during the drops.

During the 7.0 and 9½ m.p.h. ramp tests, maximum measured faired accelerations (with respect to the warhead axes) on the dummy XW-25 warhead ranged as follows: vertical, 15g to 74g; longitudinal, 2.6 to 142g. No comparisons of the cushioning materials could be made from the 9½ m.p.h. vamp test, as the dummy XW-25 was hitting the container sides.

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The polyurethane appeared to have the best cushioning properties for the drop tests.

Setup for Test

Figure 1 shows the H-490 drop test setup.

Figure 2 shows the dummy XW-25 warhead with plywood-and-metal shields fastened in place on both ends.

Figure 3 shows accelerometers mounted on the dummy XW-25.

Figures 4, 5 and 6 show the different types of cushions tested.

Figure 7 shows a partially assembled container A.

Components tested are listed in Table I.

Test equipment used by Division 1612 for the drop test was:

Wm. Miller Oscillograph Mod. J, Serial No. 99.
Wm. Miller Amplifiers, type C-3, Mod. CA-12, Serial No. 3.

Instrumentation included:

Statham Accelerometers as listed in Table II and shown in Figures 1 and 3.

Procedure

Accelerometers No. 2 and 3 were attached to the dummy XW-25 Warhead (Figure 3) to record the longitudinal and vertical accelerations respectively. Accelerometer No. 1 was attached to the outside of the container (Figure 1) to record vertical acceleration. (All accelerations are with respect to the dummy XW-25 warhead axes.)

The dummy XW-25 warhead was fitted with plywood-and-metal type shields (Figure 2) on both ends for all drop tests.

The three types of cushioning material were placed in containers as follows:

Container A - Medium Stafoam with 3 plugs of firm sponge rubber.
Container B - Medium Stafoam with 4 plugs of medium sponge rubber.
Container C - #9030 Stafoam, with 3 plugs of firm sponge rubber.

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After instrumentation, the dummy XM-25 warhead was cushioned successively with the three types of material (Containers A, B and C; Figures 4, 5 and 6 respectively) and 12 inch drop tests were performed on each container.

Results

Maximum measured accelerations and rise and pulse times, read in accordance with SCS-10, are given in Table III.

Typical oscillograph records are shown in Figures 8, 9 and 10.

No damage was done to either the dummy XM-25 warhead or the H-490 container by the 12-inch drop tests.

Conclusions

The shock mitigation properties of the three different type cushions did not vary appreciably in wave form or magnitude.

G. M. WILSON - 1612-1

P. H. ADAMS - 1612

GW:1612-1:tm

DISTRIBUTION:
1/7A L. A. Dunn - 1284
2/7A W. L. Gardner - 1610
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6/7A R. K. Smeltzer - 7222-2
7/7A R. K. Smeltzer - 7222-3

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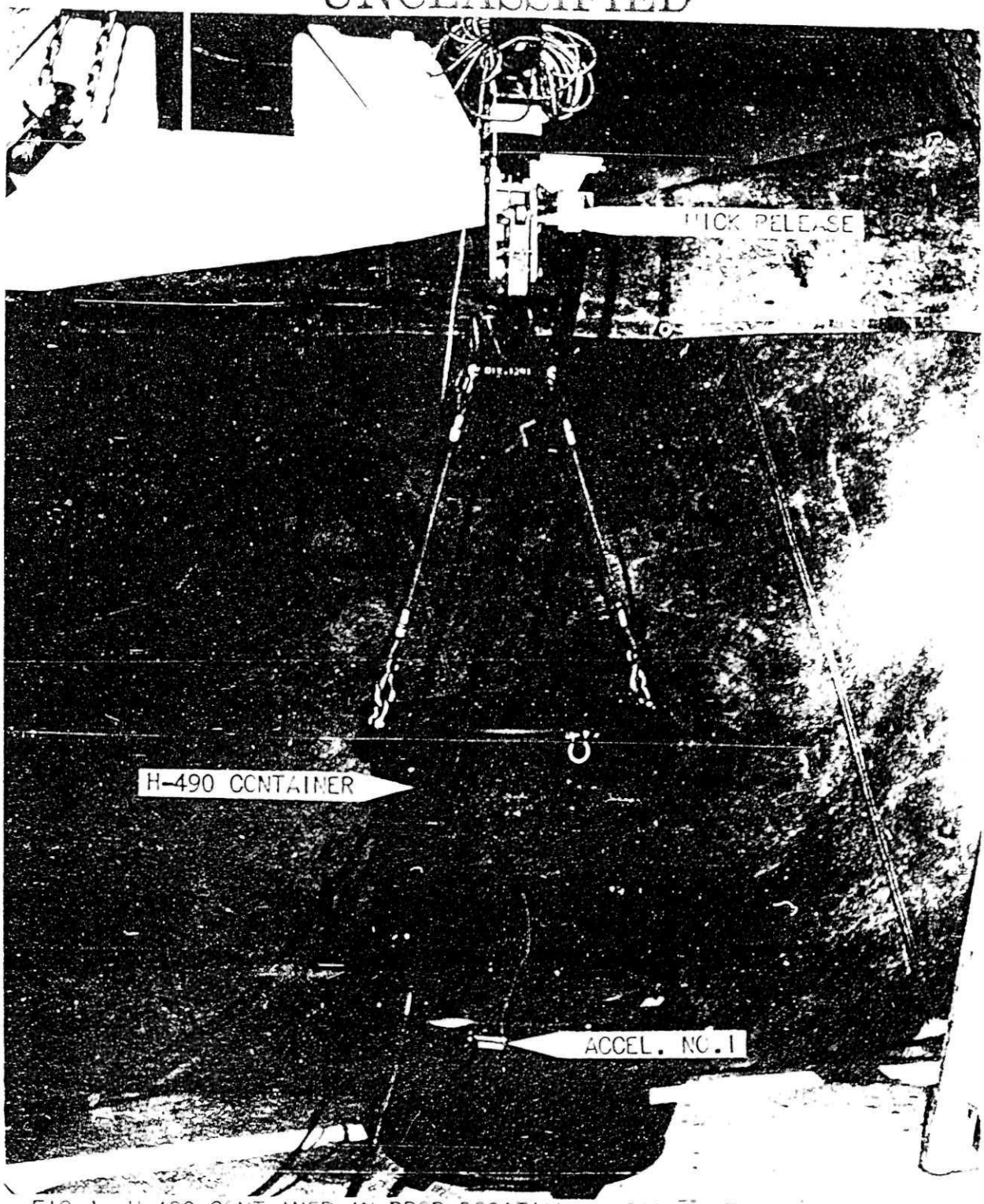

FIG. 1 H-490 CONTAINER IN DROP POSITION---DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

D#77826

REF. SYM. 1612(370)
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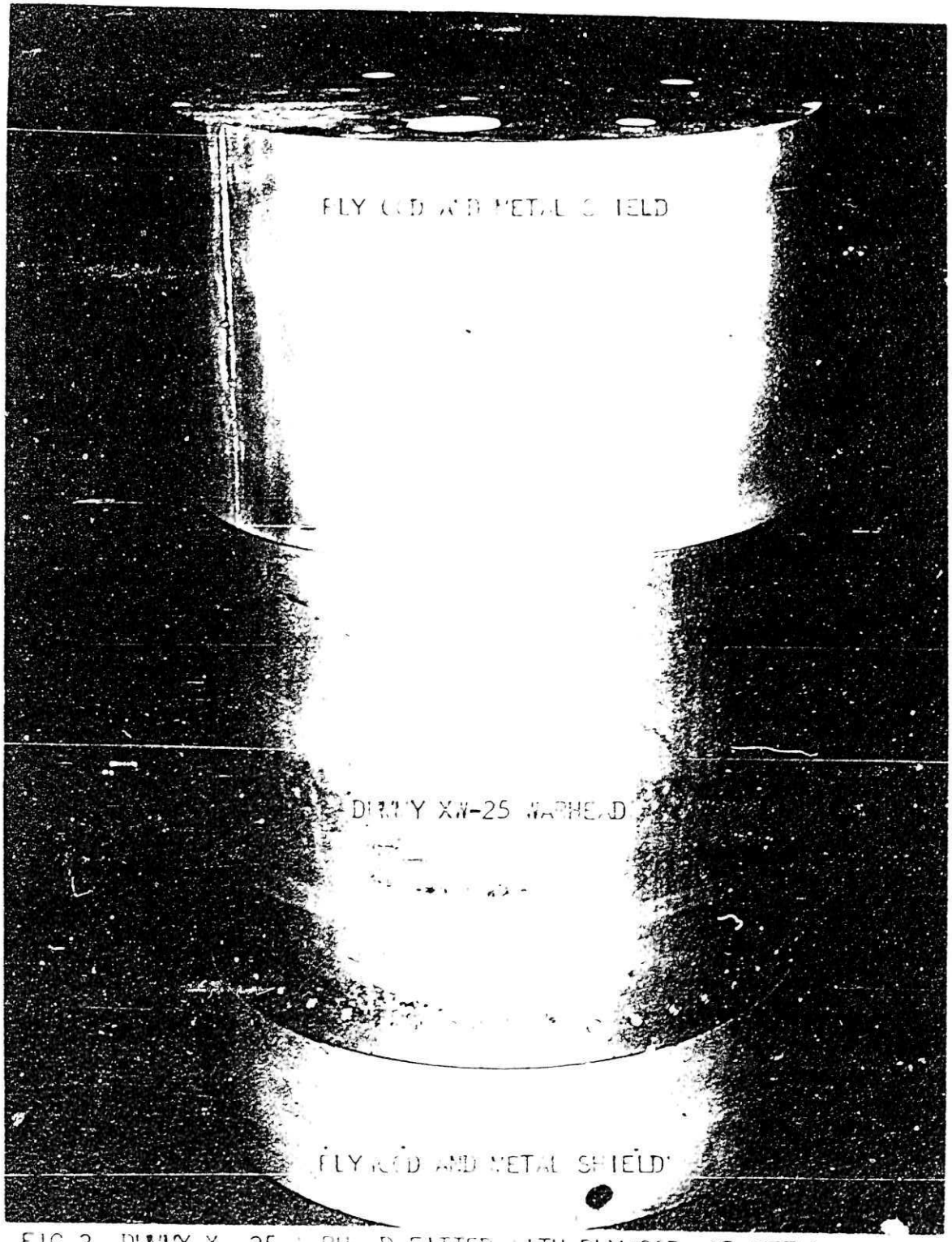

FIG.2 DUMMY XW-25 WARHEAD FITTED WITH FLYWOOD AND METAL SHIELDS---DROP TEST OF F-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

D# 77823

REF. SYM. 1612(370)
DW. 436

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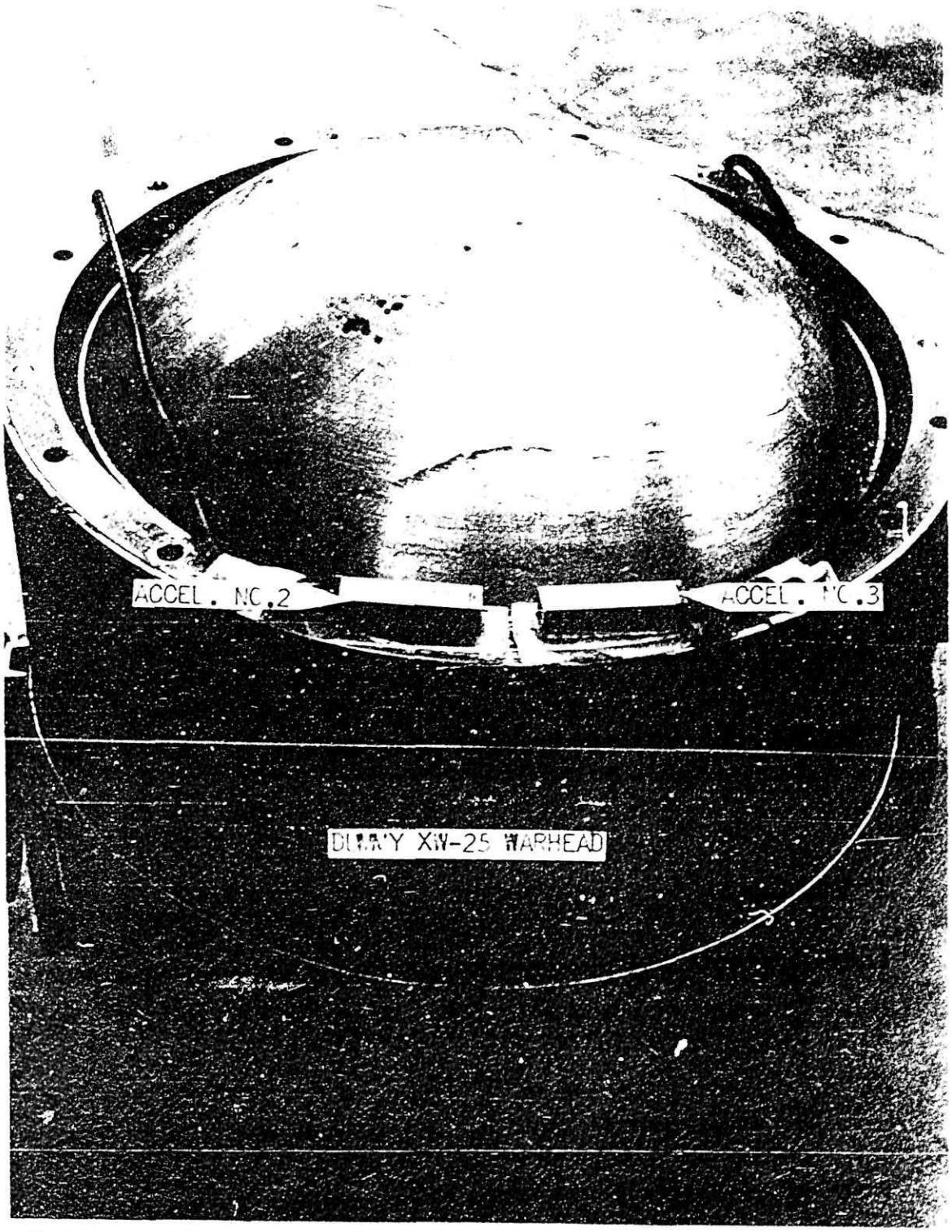

FIG.3 INSTRUMENTATION ON THE DUMMY XW-25 WARHEAD---DPCP TEST OF W-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

D#77827

REF. SYM. 1612(370)
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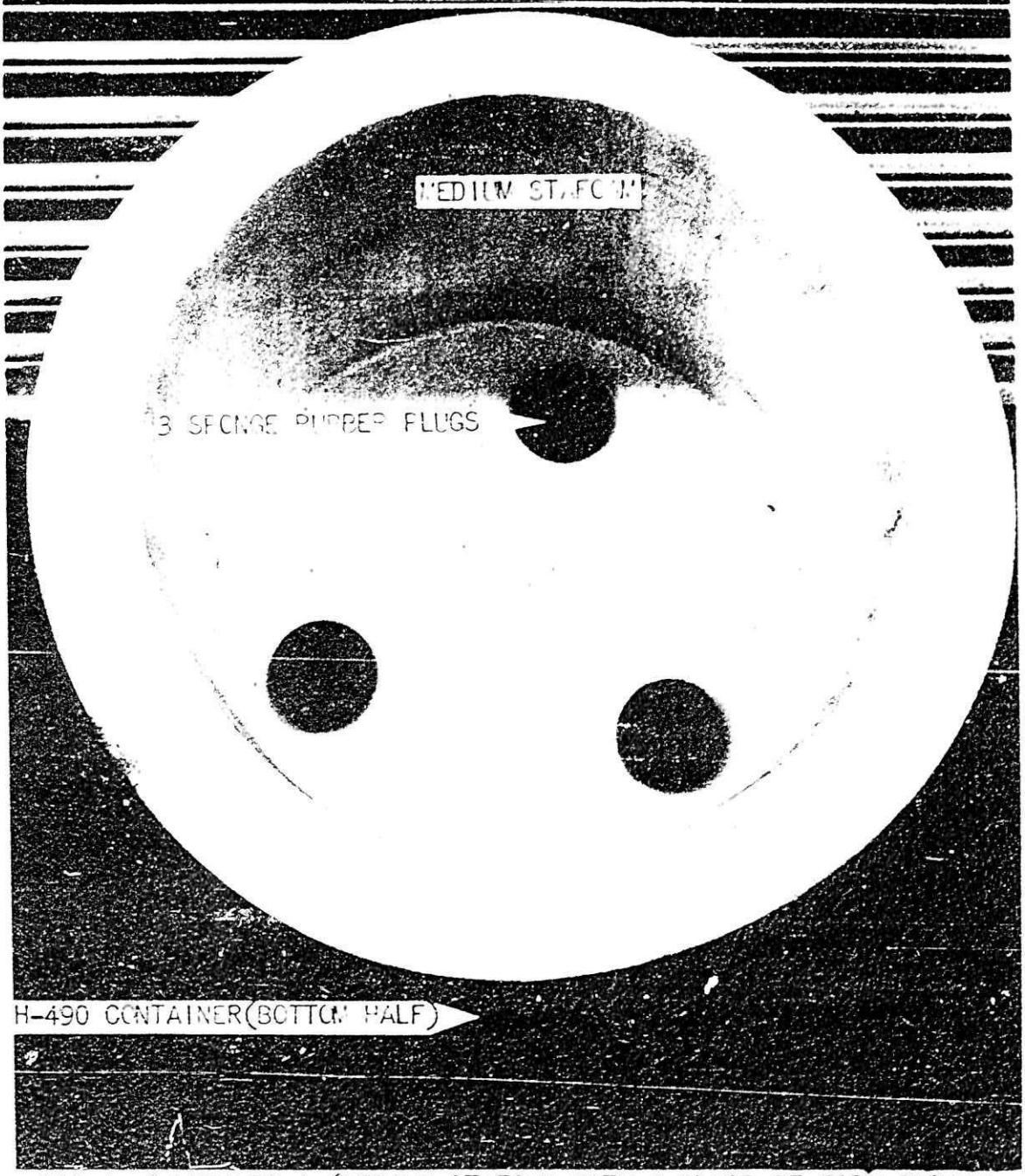

FIG.4 CONTAINER-A (MEDIUM STAFOAM WITH 3 PLUGS OF FIRM SPONGE RUBBER)---DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

D# 17828

REF. SYM. 1612(370)
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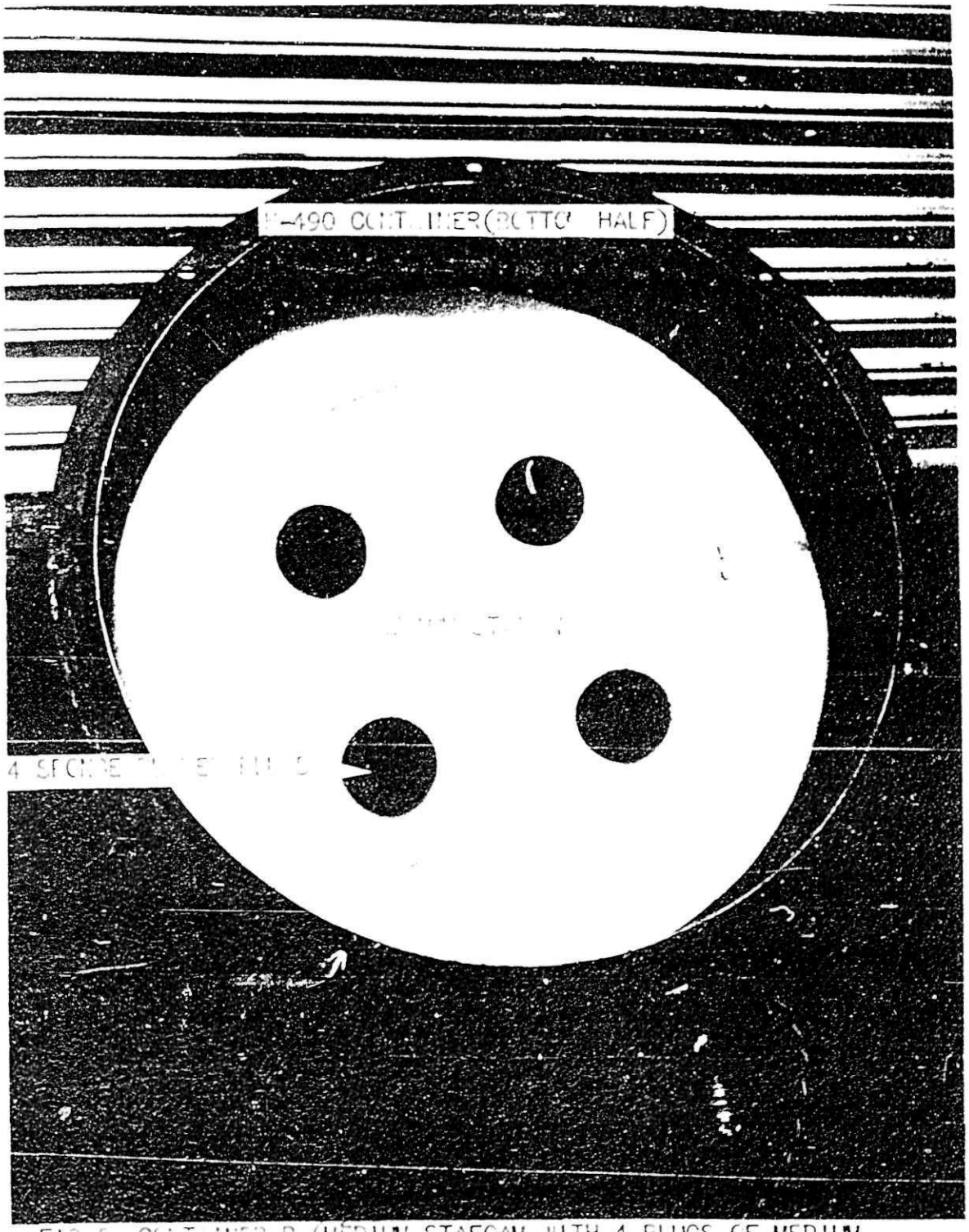

FIG. 5 CONTAINER-B (MEDIUM STAFCAN WITH 4 PLUGS OF MEDIUM SPONGE RUBBER)---DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

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REF. SYM. 1612(370)
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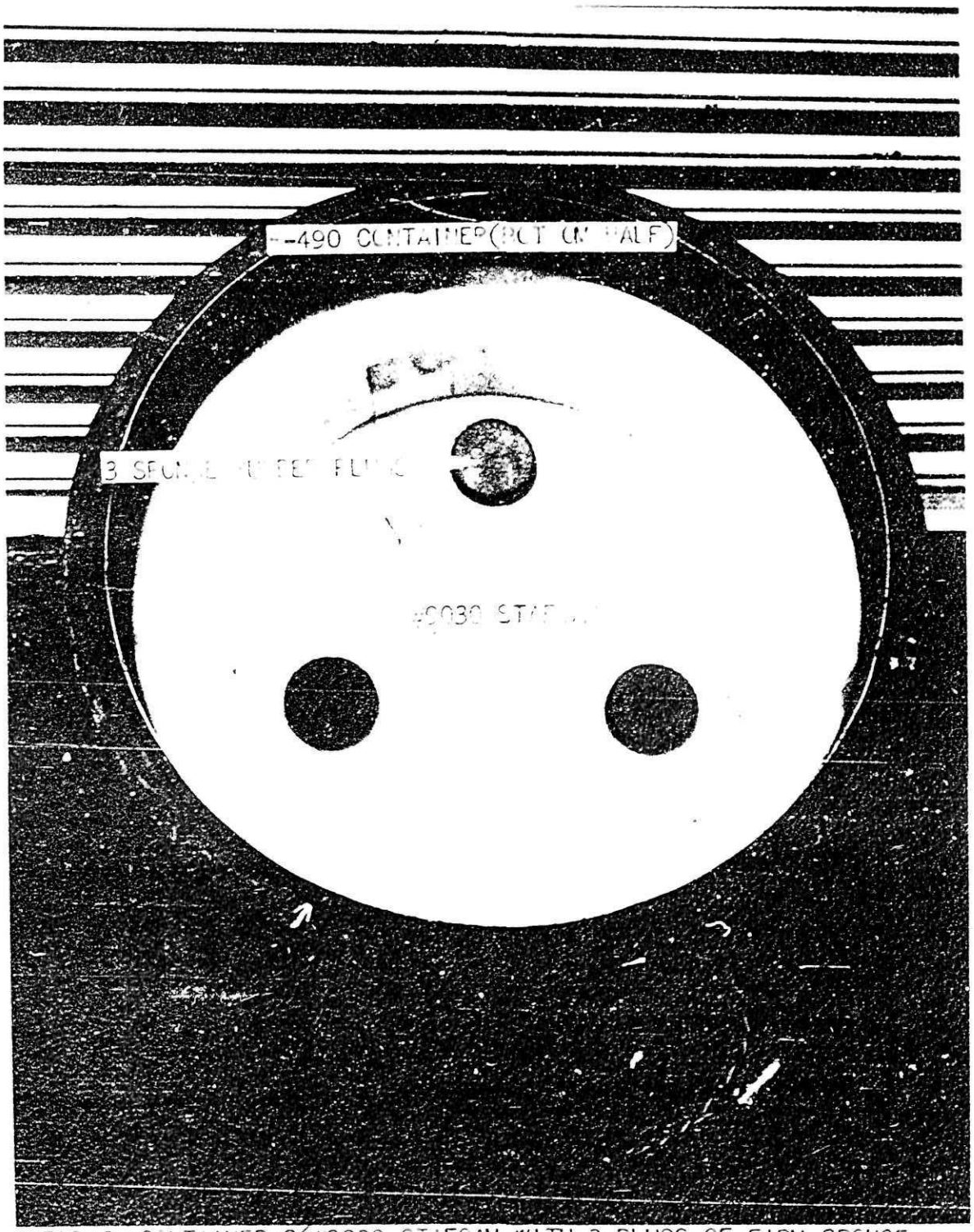

FIG.6 CONTAINER-C(#9030 STAFCAN WITH 3 PLUGS OF FIRM SPONGE RUBBER)---DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

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FIG.7 CONTAINER-A PARTIALLY ASSEMBLED--DROP TEST OF W-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

REF. SYM. 1612(370)
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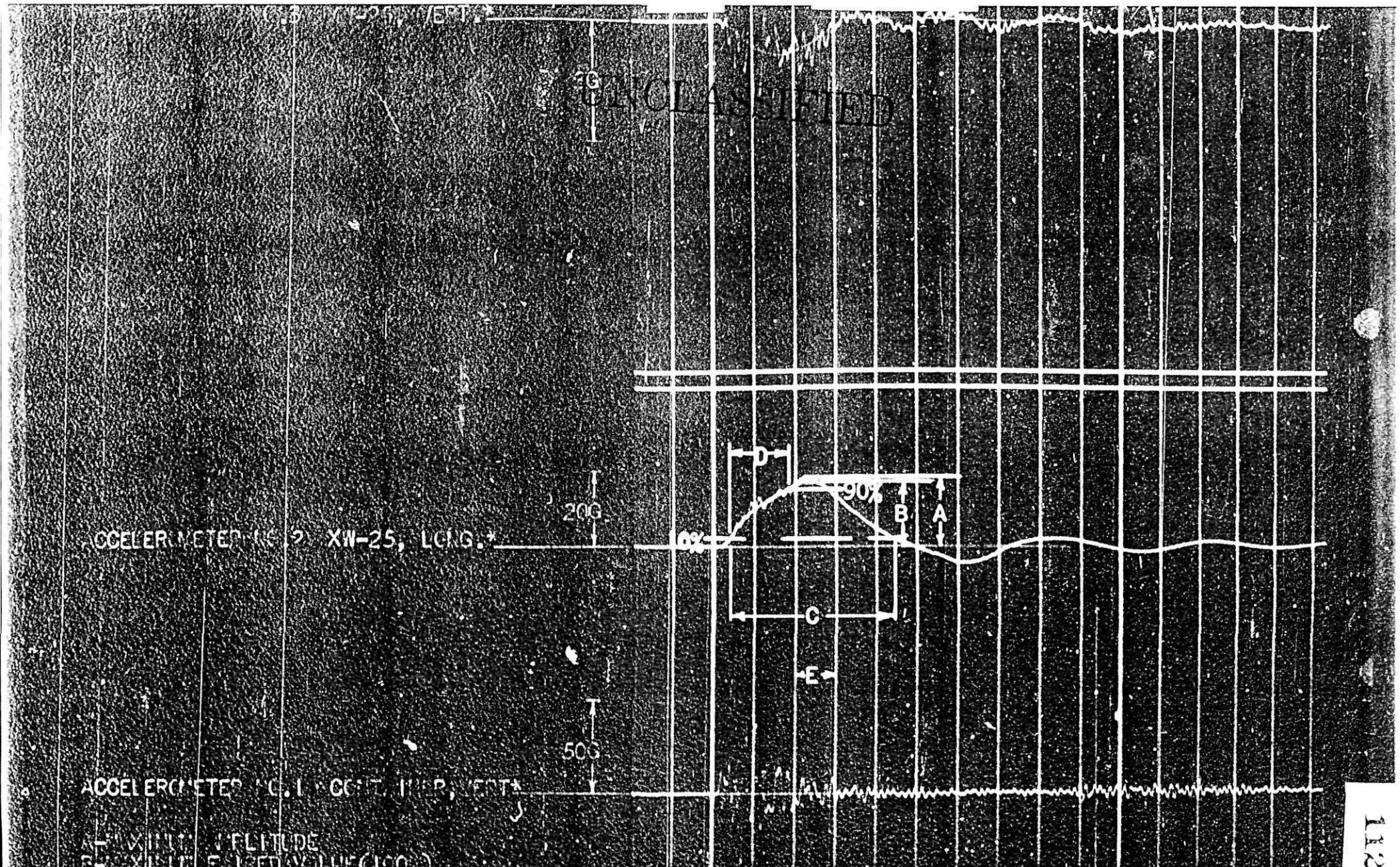

A-MAXIMUM AMPLITUDE
B-MAXIMUM FIRED VALUE(100%)
C-PULSE DURATION
D-RISE TIME
E-0.01SEC.

* ALL ACCELERATIONS WITH RESPECT TO XW-25 WARHEAD AXES

FIG. 8 REPRESENTATIVE OSCILLOGRAPH RECORD FOR 12 INCH DROP TEST(CONTAINER A)--DROP TEST OF H-[illegible]0 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

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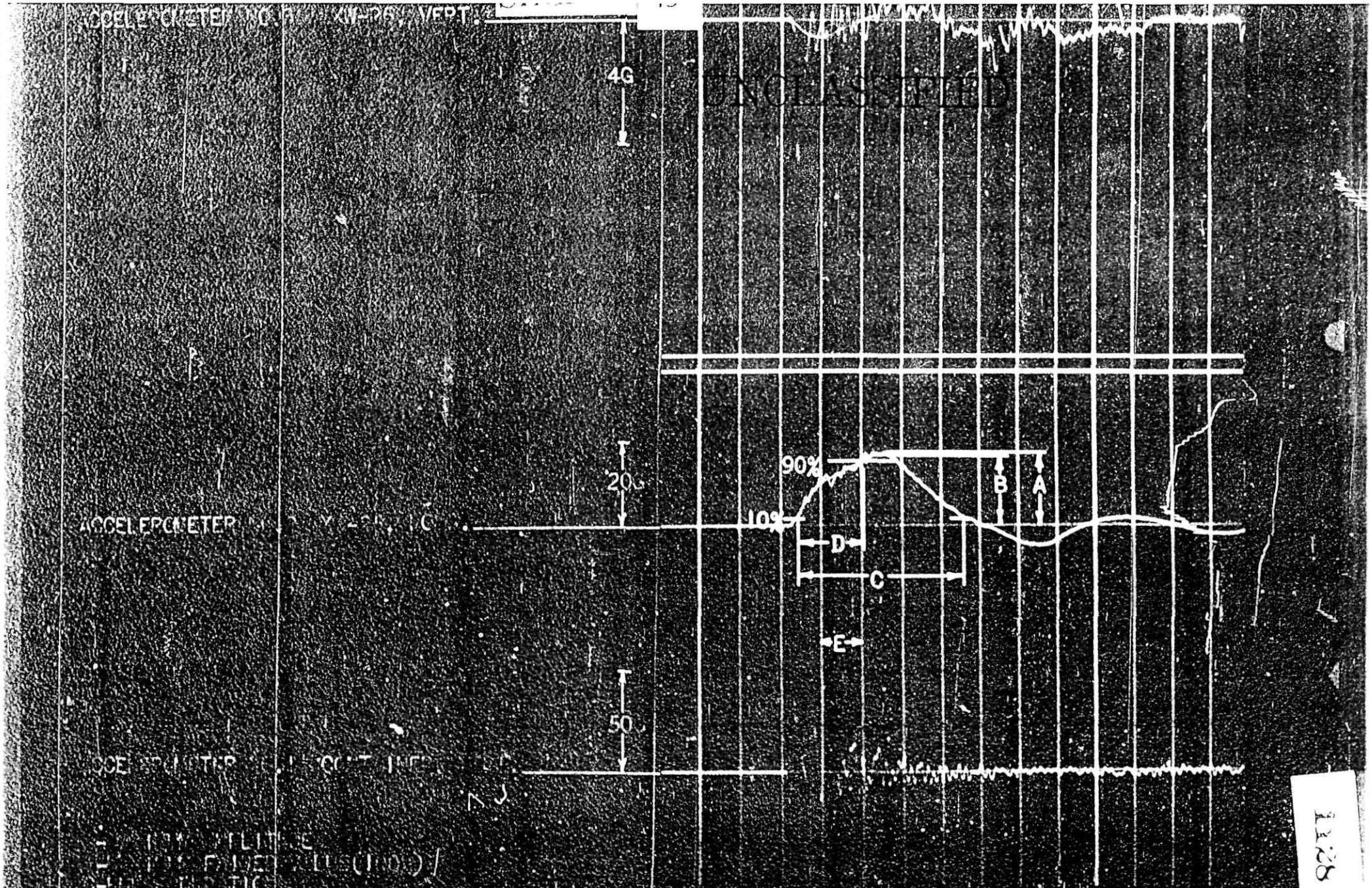

FIG. 9 REPRESENTATIVE OSCILLOGRAPH RECORD FOR 12 INCH DROP TEST (CONTAINER B)--DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

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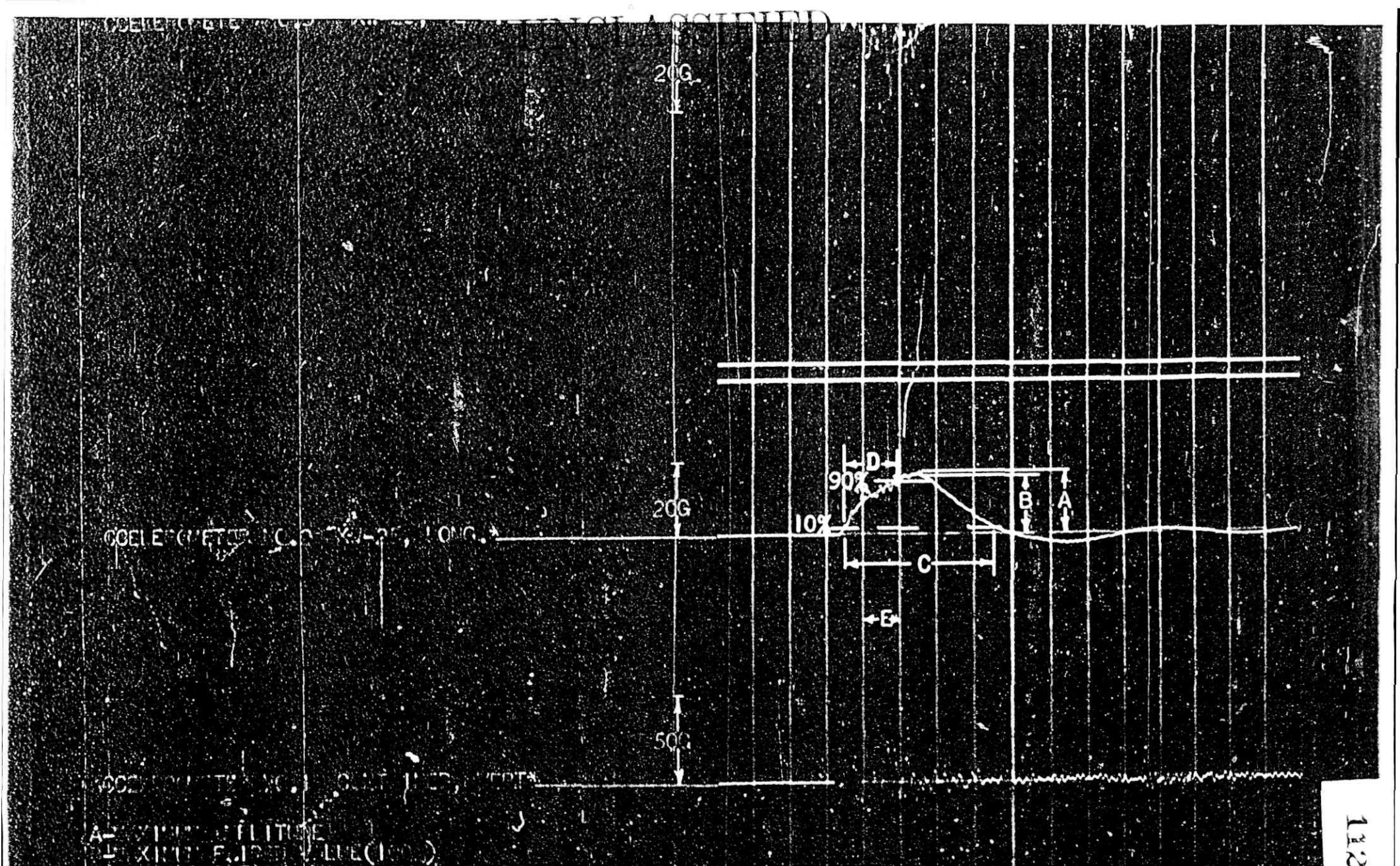

A-[illegible] AMPLITUDE
B-[illegible] VALUE([illegible])
C-PULSE DURATION
D-RISE TIME
E-0.01 SEC.

* ALL ACCELERATIONS WITH RESPECT TO XW-25 WARHEAD AXES

FIG.10 REPRESENTATIVE OSCILLOGRAPH RECORD FOR 12 INCH DROP TEST (CONTAINER C)--DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

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Ref. Sym. 1612 (370)
Proj. No. TM-436

TABLE I

COMPONENTS TESTED

DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

COMPONENT	DRAWING NO.	SERIAL NO.
Sphere, Concrete	None	None
MC-672 Case, HE Sphere	310 236	AA-1005-H5
Cover & Mount, X-Unit	126,662	None
H-490 Container	DS(1284) 56206	None
Packing, Polyurethane (X-9030)	None	None
Packing, Med. Stafoam	None	None
Firm Sponge Rubber Plugs	None	None
Med. Sponge Rubber Plugs	None	None
Insert, Metal Drum, Bottom	SK(1284)60485	None
Insert, Metal Drum, Top	SK(1284)60486	None

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TABLE II

Ref. Sym. 1612 (370)
Proj. No. TM-436

ACCELEROMETERS USED FOR THE DROP TEST OF H-490
WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

ACCEL NO.	LOCATION*	SERIAL NO.	RANGE	STATHAM MOD NO	NAT. FREQ. (cps)
1	Container, Vertical	2076	±50g	FA-50-300	550
2	Dummy XW-25 Warhead-Long.	682	±50g	FA-50-300	560
3	Dummy XW-25 Warhead-Vert.	1377	±50g	FA-50-300	500

* All accelerations are given with respect to the dummy XW-25 Warhead Axes.

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Ref. Sym. 1612 (370)
Proj. No. TM-436

TABLE III

ACCELERATIONS AND TIMES - DROP TEST OF H-490 WITH SPONGE RUBBER AND POLYURETHANE CUSHIONING

Container	CUSHIONING MATERIAL CONTAINED	ACCEL. NO.	LOCATION*	ACCELERATION, G* MAX. FAIRED	MAX AMP.	TIME (SECS.) RISE	PULSE
		1	Container, Vert.		43		
A	Med. Stafoam; 3 plugs	2	Dummy XW-25, Long.	-17	-19	.014	.040
	firm sponge rubber	3	Dummy XW-25, Vert.	.9	2.0	.009	.029
B	Med. Stafoam; 4 plugs	1	Container, Vert.		52		
	Med Sponge rubber	2	Dummy XW-25, Long.	-16	-17	.016	.041
		3	Dummy XW-25, Vert.	0.6	4.6	.005	.017
	#9030 Stafoam; 3	1	Container, Vert.		46		
C	plugs firm Sponge	2	Dummy XW-25, Long.	-20	-20	.016	.041
	Rubber	3	Dummy XW-25, Vert.	7.4	20	.007	.023

* All accelerations are given with respect to the dummy XW-25 warhead axes.

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