TECHNICAL MEMORANDUM 1322

A METHOD FOR BALLISTICALLY TESTING XM94 PRIMERS

LOUIS SILBERMAN
DONAL ELLINGTON

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JANUARY 1964

PICATINNY ARSENAL
DOVER, NEW JERSEY

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BY

LOUIS SILBERMAN
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JANUARY 1964

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DOVER, NEW JERSEY

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ABSTRACT

A method for ballistically testing primers in conjunction with propellant containers used for ejection fuzes was devised. A significant difference in velocities is noted between the use of XM94 and XM94E1 Primers.

INTRODUCTION

The present specification acceptance test for output for the XM94 and XM94E1 primer is based on depression of a lead disc. This test has not been adequate to insure satisfactory performance in all items using these primers. It has often been necessary to resort to testing of a complete end item for which the propellant-ignition combination is an integral part in order to determine the source of ballistic difficiencies. This report covers studies with a special .45-caliber gun (modification of a Minneapolis-Honeywell design) which demonstrated a simple and economical technique for measuring functional adequacy of these primers in a system similar to that employed in the end item. The test appears very sensitive to primer quality. The weapon chamber can be modified to fire several different primer-propellant container combinations (Figure 1A, 1B, 1C, 2A, 2B, 2C). Propellant containers as shown in Figure 1A were used with XM94 and XM94E1 primers for this report. The output of the primer-propellant container is determined by measuring muzzle velocity of the .45-caliber bullet.

It should be noted that in conjunction with this program, a card gap test is also being developed for testing the output of primers, and will be covered by a separate report.

STUDY

A test was devised for the .45-caliber gun using one production lot of propellant containers and four different lots of primers of the following composition:

1. XM94 loaded to minimum of specification,45 mg of NOL and 53 mg and dextrinated lead azide.

2. XM94 loaded to maximum of specification,50 mg of NOL and 57 mg of dextrinated lead azide.

3. XM94E1 loaded to minimum of specification, 45 mg of NOL and 63 mg of 1333 lead azide.

4. XM94E1 loaded to maximum of specification,50 mg of NOL and 67 mg of 1333 lead azide.

The first series of tests were fired (Table 1) over a one-day period using the four different lots of primers in conjunction with the propellant containers. The second series (Table 2) consisted of three different lots using the same lot of propellant containers. As shown in Table 1 comparing XM94 and XM94E1 minimum and maximum respectively, the following results are noted:

From Table 1

XM94 minimum = 354 ft/sec, XM94E1 minimum 511 ft/sec

XM94 maximum = 401 ft/sec, XM94E1 maximum 515 ft/sec

From Table 2

XM94 maximum 397 ft/sec, XM94E1 minimum 501 ft/sec,
XM94E1 maximum 514 ft/sec

There is a significant difference between the velocities obtained with the XM94 and XM94E1. However, with the XM94E1 there does not appear to be any significant difference in velocity between minimum and maximum loaded. With the XM94 there is a measurable difference in this respect.

The ballistic results show that the XM94E1 not only gives significantly higher results, but the results are more uniform (Table 1 and 2). Also, the variation of the average velocity of each day's firing of the same primer lot is not significant (Table 1 and 2).

CONCLUSION

Feasibility of a simplified technique for functionally testing primers and propellant containers independent of the end item has been demonstrated. This method should be useful as a development tool, and also for acceptance testing for primer and propellant containers.

Action to be Taken

Arrangements will be made to check out production lots of primers and propellants container assemblies to obtain data to base specification limits.

APPENDICES

APPENDIX A

TABLES

TABLE 1

BALLISTIC RESULTS OF FIRING OF XM94 AND XM94E1 PRIMERS

WITH PROPELLANT CONTAINER ASSEMBLIES

[redacted])

XM94 Minimum, ft/sec	XM94 Maximum, ft/sec	XM94E1 Minimum, ft/sec	XM94E1 Maximum, ft/sec
342	431	532	578
348	441	497	511
340	298	474	507
388	444	528	529
327	415	521	502
300	380	508	468
380	345	517	519
337	440	515	516
300	406	536	534
384	421	516	542
369	388	527	538
377	449	465	502
351	386	520	540
372	360	551	534
403	431	510	507
333	416	520	532
360	352	472	493
355	382	504	454
355	449	500	477
	394	515	
354 = Average	401 = Average	511 = Average	515 = Average
28 = Standard Deviation	41 = Standard Deviation	22 = Standard Deviation	29 = Standard Deviation

TABLE 2

BALLISTIC RESULTS OF FIRING OF XM94 AND XM94E1 PRIMERS WITH PROPELLANT CONTAINER ASSEMBLIES

(FIGURE I)

XM94 Maximum, ft/sec	XM94E1 Minimum, ft/sec		XM94E1 Maximum, ft/sec	
403	487	485	497	482
380	489	512	522	514
338	501	526	529	502
414	546	512	501	532
371	516	512	527	517
386	503	515	537	530
407	502	482	511	528
381	514	499	510	512
353	511	468	496	504
453	476	476	516	477
439	504	506	521	525
376	510	462	524	534
401	526	513	502	535
394	518	503	483	518
409	481	524	497	524
449	494	501	498	518
412	476	529	513	535
375	515	518	508	536
406	493	527	522	508
400		498	521	498
379				
415	503 = Average 19 = Standard Deviation		514 = Average 16 = Standard Deviation	
397 = Average 28 = Standard Deviation				

APPENDIX B

FIGURES

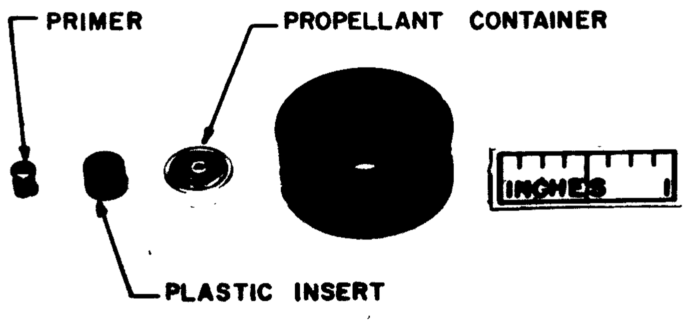


Figure 1A

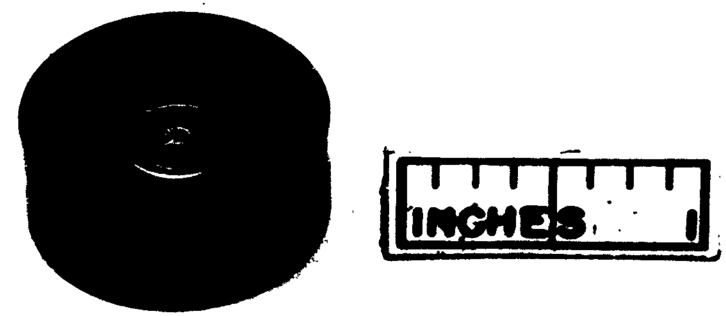


Figure 1B

Fixture for Firing Primer and
Small Round Propellant Container

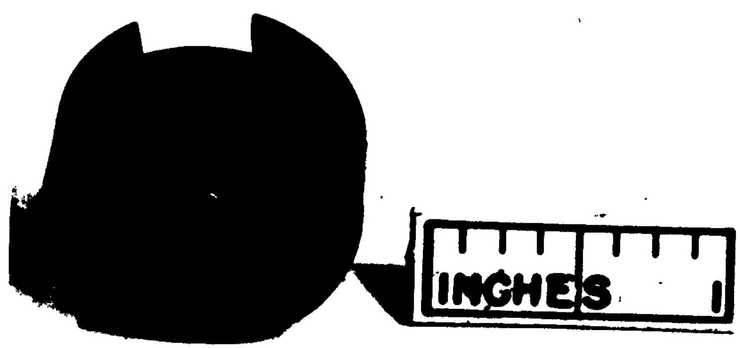


Figure 1C

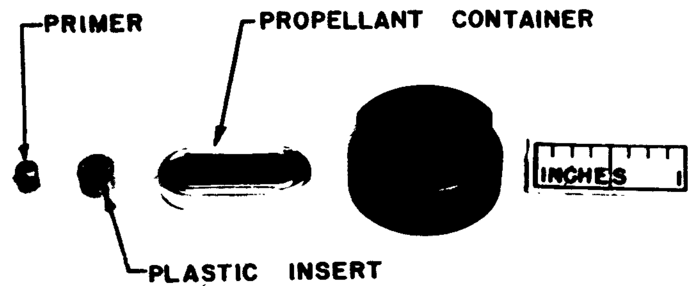


Figure 2A

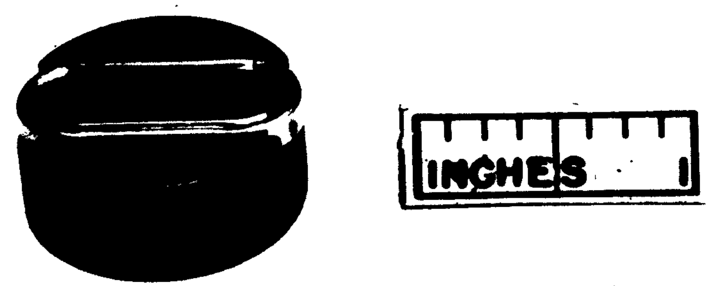


Figure 2B

Fixture for Firing Primer and
Oval Shaped Propellant Container

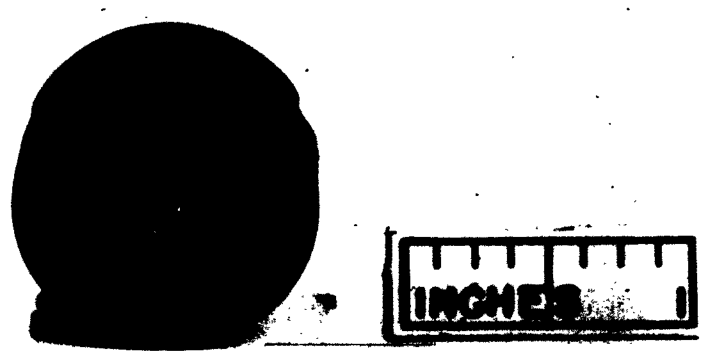


Figure 2C

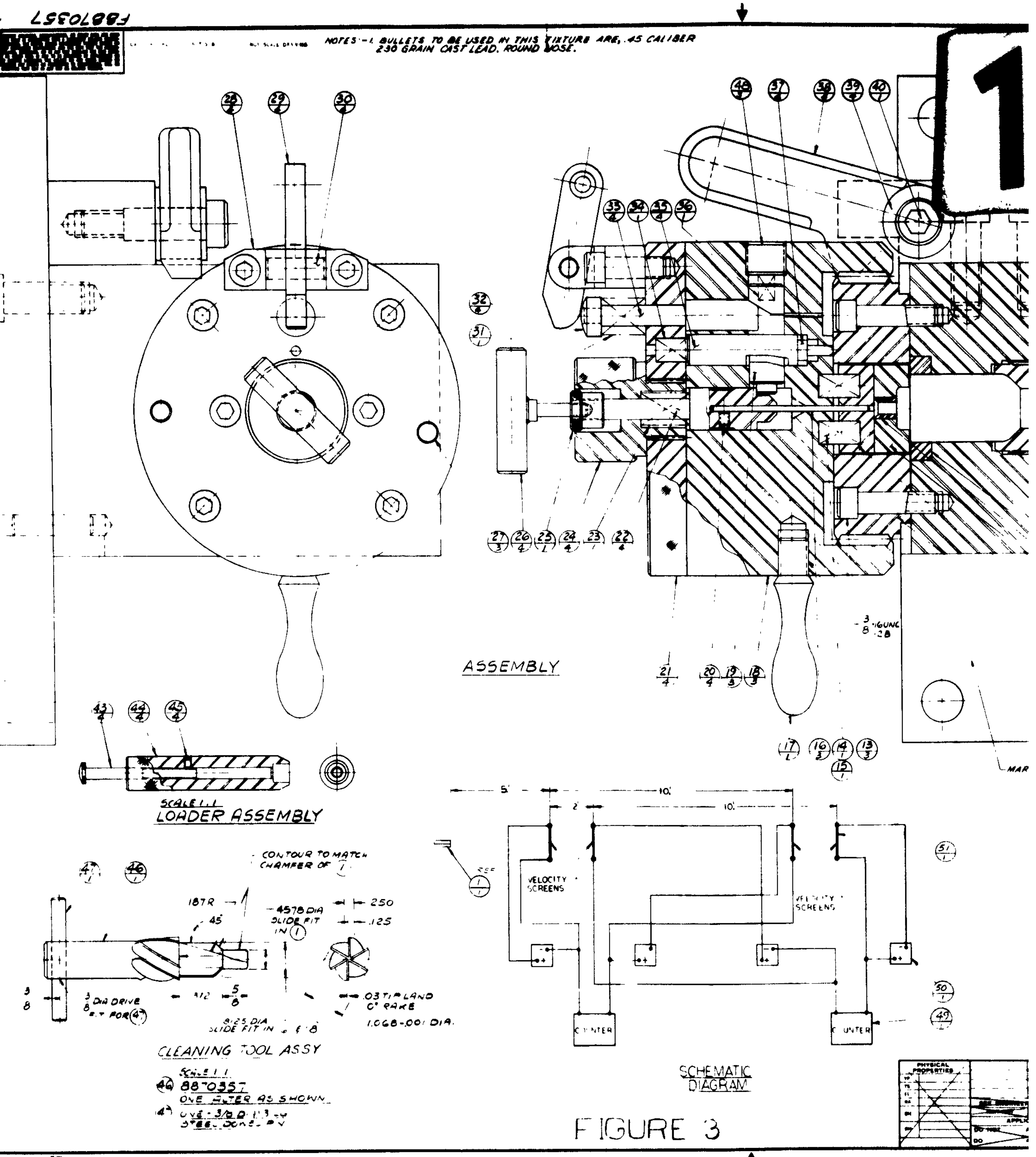
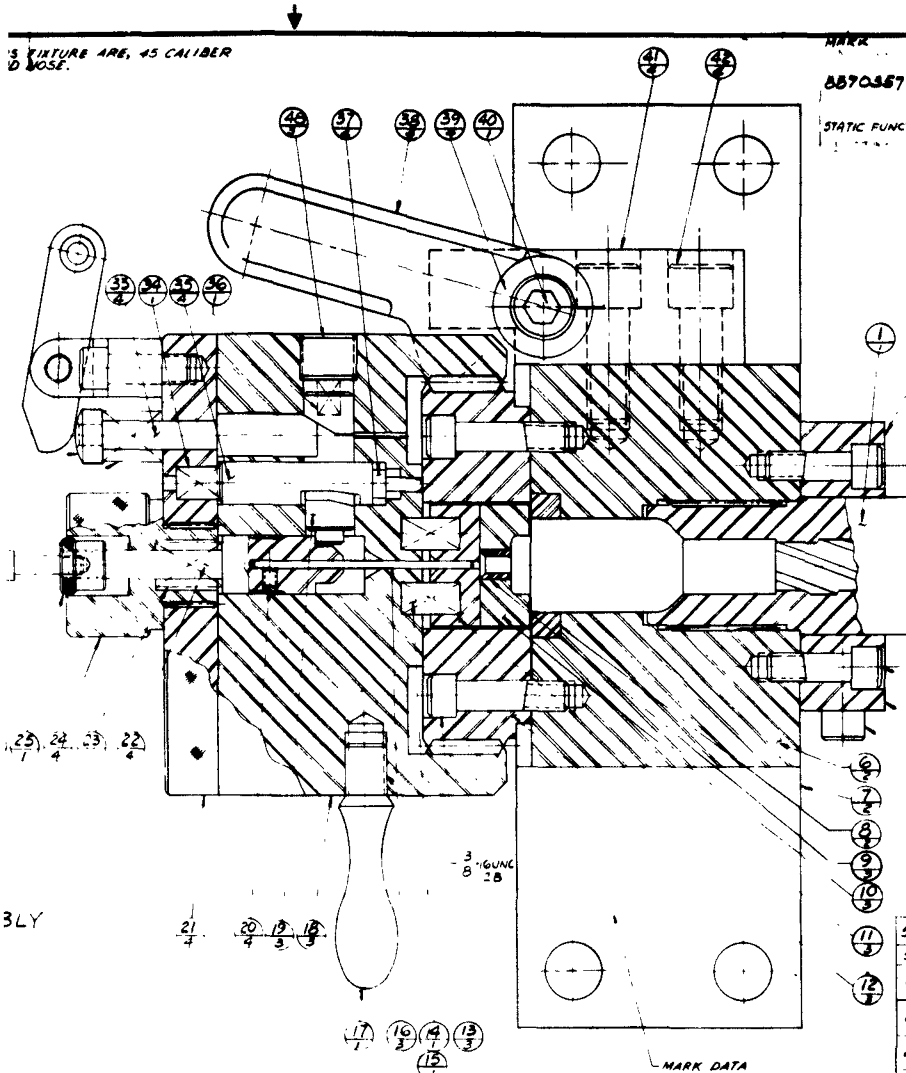
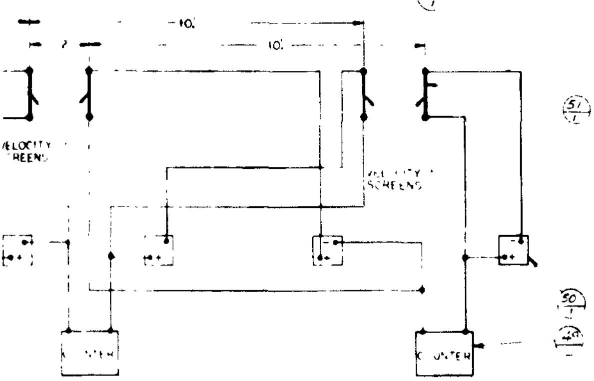

NOTES - 1. BULLETS TO BE USED IN THIS FIXTURE ARE, .45 CALIBER 230 GRAIN CAST LEAD, ROUND NOSE.
ASSEMBLY
SCALE 1:1
LOADER ASSEMBLY
CONTOUR TO MATCH CHAMFER OF 1
.187R
45
.4578 DIA SLIDE FIT IN 1
.250
.125
.03 TIP LAND 0° RAKE
1.068-.001 DIA.
CLEANING TOOL ASSY
SCALE 1:1
46 88-0357
ONE FILTER AS SHOWN
VELOCITY SCREENS
COUNTER
SCHEMATIC DIAGRAM

FIGURE 3

F-8870357





SCHEMATIC DIAGRAM

FIGURE 3

REVISIONS		
1	B	✓
2	✓	
3	✓	
4	✓	

Part No.	Description	As Req.	
51	VELOCITY SCREEN, AVTRON MFG CO INC CLEVELAND OHIO, OR APPROVED EQUAL	AS REQ	
50	BATTERY, 6V DC	4	
49	COUNTER MODEL NO 5230 BERKLEY DIV. BECKMAN INSTRUMENTS INC RICHMOND, CALIF. OR APPROVED EQUAL	2	
46	END MILL CAT. NO. NO.638 CLEVELAND TWIST DRILL CO CLEVELAND 14, OHIO, OR APPROVED EQUAL	1	
40	SHOULDER SCR 3/8 x 1 LG ALLEN MFG CO HARTFORD 2, CONN OR APPROVED EQUAL	1	
36	SPRING, CAT. NO. C180-032-0500 ASSOCIATED SPRING CORP BRISTOL, CONN OR APPROVED EQUAL	1	
34	SPRING, CAT NO C240-038-0560 ASSOCIATED SPRING CORP BRISTOL, CONN. OR APPROVED EQUAL	1	
31	SPRING CAT NO C360-038-0750 ASSOCIATED SPRING CORP. BRISTOL, CONN OR APPROVED EQUAL	1	
25	ALLENUT 1/4-28UNF ALLEN MFG CO HARTFORD, CONN OR APPROVED EQUAL	1	
23	SPRING, CAT NO C360-038-0880 ASSOCIATED SPRING CORP BRISTOL, CONN OR APPROVED EQUAL	1	
17	HANDLE CAT NO H 375 - ALTER AS SHOWN JERGENS CLEVELAND, OHIO OR APPROVED EQUAL	1	
15	SHOULDER SCREW CAT NO 4319 PIC DESIGN CORP EAST ROCKAWAY, L.I. NY OR APPROVED EQUAL	2	
14	SPRING CAT NO C240-038-0690 ASSOCIATED SPRING CORP BRISTOL, CONN. OR APPROVED EQUAL	2	
1	BARREL (45-458 x 14 BR BARREL) NO PO. 317009 OF DOUGLAS CO, 5504 BIG TYLER ROAD CHARLSTON, W.VA. ALTER AS SHOWN OR APPROV EQ.	1	
	OPERATING INSTRUCTIONS		A8870683

MEDICAL & AUXILIARY PARTS

AS NOTED — GEN 63 — PIN

ORIGINAL DATE OF DRAWING 4 MAR 63

CONTAINER ASSY TEST FIXTURE

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ABSTRACT DATA

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Picatinny Arsenal, Dover, New Jersey

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1. Primers - ballistically testing

I. Louis Silberman
II. Donal Ellington

UNITERMS

XM94
XM94E1
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Propellant Containers
.45-Caliber Gun
Ejection Fuzes
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D. Ellington

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