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REPORT ON

TEST OF CARTRIDGE, 105-MM, APDS, T382 (U)

Second Report on Project No. FA-I/59-21

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By authority of DTIC AD 313 080
Date 4 Aug 81

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R. H. ALLEN

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OCTOBER 1959



Aberdeen Proving Ground
Maryland

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**DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND**

AUTHORITY: ORDA-6151

RHallen/nkj

TEST OF CARTRIDGE, 105-MM, APDS, T382 (U)

Second Report on Project FA-I/59-21

Dates of Test: June and July 1959

ABSTRACT (S)

3

A total of 75 Shot, APDS, 105-mm, T382, with ~~three~~ different subdesigns, were supplied for an evaluation of their armor-penetration and 1000-yd accuracy characteristics. The variations of the subdesigns were principally in methods of manufacture and of component materials used.

The failure of the first six shot to yield a protective ballistic limit, coupled with breakup of the subprojectile during the early stages of flight, led to additional firing to determine the cause of this unsatisfactory performance. Fifteen additional shot were fired, at various propellant charges. Five of these were assembled with an annealed hemispherical nose cap; satisfactory performance was noted on four of these five rounds.

The evidence available from this program indicates failures originate from several different sources. The principal cause of malfunction is believed to be the rotating band material which has proven to be substantially tougher, or more dense, than the material used on the UK shot. The physical properties of the hemispherical nose cap, sintered tungsten nose pad, forward subprojectile sheath and sabot body also differ from the UK materials in varying degrees. It is concluded that these items, in combination with the engraving force differential caused by the tougher rotating band, are the primary source of projectile breakup.

It is recommended that samples submitted for future testing incorporate more exact physical and structural replicas of the satisfactory UK model of the subject APDS shot.

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CONTENTS (U)

	<u>PAGE</u>
INTRODUCTION.	3
DESCRIPTION OF MATERIEL	3
DETAILS OF TEST.	4
Procedure.	4
Results	4
Remarks and Observations	7
CONCLUSIONS	9
RECOMMENDATIONS	9
APPENDIX A: CORRESPONDENCE	A-1
APPENDIX B: FIRING RECORD	B-1
APPENDIX C: PHOTOGRAPHS	C-1
APPENDIX D: STAR-GAUGE REPORTS	D-1
APPENDIX E: EXPERIMENTAL AMMUNITION DATA CARD	E-1
APPENDIX F: DISTRIBUTION	F-1

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1. (S) INTRODUCTION

Following a weapons system evaluation in which the United Kingdom's 105-mm TK-X15E8 Gun (20-Pdr) was selected for use in the XM60 tank, tests were conducted to determine the feasibility of manufacturing a translated design using American components. From the results of these tests, it was determined that a translation could be accomplished. The first series of American manufactured shot was produced in April 1959.

The current firing contains shot of a United States production lot assembled with U.S. components. The object of the test is to evaluate the performance of the U.S. shot.

2. (S) DESCRIPTION OF MATERIEL

2.1 Shot, APDS, 105-mm, T382, Numbers 1 to 50, Lot FA-E-441-1

Shots 1 to 25 were stamped with the letter A and designated for accuracy and metal-parts security at high and low temperature. The assembly of the metal parts for this group was the same as used in the assembly of Lot FA-E-440. All the hemispherical cups on the subprojectile were Type 416 stainless steel annealed to Rp90. Shots 26 to 50 were stamped with the letter P and designated for the plate phase.

Shots 26 to 38: The subprojectile were assembled under 39 tons of pressure. Shots 39 to 50: The component parts of the subprojectile were not pressed together under pressure, but were made with a higher degree of finish on the mating parts to eliminate press form fitting.

The obturators on shots 1 to 50 were compounded to U.S. specifications and the approximate weight of each was 2.2 ounces with a durometer reading of 90.

The sabots on shots 1 to 15 were given a minimum surface treatment, while the sabots on shots 16 to 50 were painted with salt-spray resistance enamel and baked for 150 hours. They were then machined to reduced dimensions to allow paint build-up of approximately 0.004 inch on the threads.

The front sheath had a black anodized instead of enameled finish to give it a harder surface.

2.2 Case, Cartridge, 105-mm, Lot FA-E-442

This case was the first U.S. manufactured case and was made with a primer recess for the U.S. primers.

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2.3 Primer, Electric, XM80 (Modified)

This primer was assembled with 860 ± 20 grains of Benite strands. The T42E1 electric igniter was used in lieu of the XM59 electric igniter. Lot PA-E-29473.

2.4 Shot, APDS, 105-mm, T382, Lot FA-E-441-2.

The shot (25 in number) were assembled from hand-picked subassemblies. The hemispherical cup on the subprojectile was made from Type 416 stainless steel which was annealed to RB70.

3. (S) DETAILS OF TEST

3.1 Procedure

Prior to assembly of the components, all of shot were reduced in rotating-band diameter by various amounts, as noted in paragraph 3.2, Results.

All shot for the accuracy phase at high and low temperature were assembled with the propellant charge developed in a previous granulation test.

The firing of shot for defeat of armor was conducted in accordance with the test program request (Appendix A). The yaw card used for recording sabot discard was suspended on two upright poles placed parallel to the line of fire.

The last ten rounds in the test consisted of two shot lots which were alternated for round-by-round comparison between the lots.

Smear photographs were obtained on these rounds in two locations.

3.2 Results

The first group of shot fired consisted of six shot (Lot FA-E-441-1) which yielded the following results against 4.7-inch RH Armor at 60° obliquity.

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Table I. Results of First Group

Test Round Number	Propelling Charge		Corrected Muzzle Velocity, fps	Chamber Pressure, psi/100	Plate Damage
	lb	oz			
1	11	10	4361	347	P
2	11	14	4471	383	P
3	12	10.5	Lost	439	C
4	12	8	4727	433	C
5	12	4	4566	397	a
6	12	4	Lost	410	P

^aSubprojectile without sheath struck left plate butt.

P - Partial. C - Complete.

The rotating bands of these shot were machined to 4.264-inch diameter.

As the velocity of test round 1 was below the previously established protective ballistic limit, a partial penetration of the plate was expected.

Test round 2 gave evidence of breakup of the subprojectile on the yaw card which was set 10 feet forward of the plate. Test round 3 gave a complete penetration.

Test round 4 penetrated the plate without any evidence of erratic flight. Test round 5 struck the left plate butt holder although the point of aim was to the right center of the plate.

The diameter of the hole made by the core on the yaw card approximated the diameter of the core.

Examination of the tube showed the rifling to be slightly gouged and scored in the forward half. This was believed caused by in-bore failure of the sabot.

Test round 6 gave evidence of breakup on the yaw card, which indicated that the forward sheath had separated from the core and rear sheath. Two fragments of the forward sheath were found approximately 200 feet from the muzzle. This condition indicated the failure occurred in flight. The point of breakage of the sheath showed numerous small cracks in the area which forms the point of contact with the three petals. Numerous small holes were also observed in the yaw card.

The test was suspended to permit an examination of the tube for damage incurred by the breakup of the shot during shot travel. Several gouges and lands cut by the passage of metal were noticed forward of the origin of rifling. It was felt that the damage would not affect projectile launching, and firing was resumed.

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The second group of rounds consisted of four of the shot fired at service charge and one with the charge reduced 2.5 ounces. These shot also had rotating bands of 4.264-inch diameter.

Test rounds 7 and 8 yielded a complete penetration.

It was noted that this penetration of round 7 was superior to the others as there was no evidence of hinged spalls; the exit area on the plate was "clean."

Test rounds 9, 10 and 11 failed to penetrate the plate. Yaw card evidence showed that in each case breakup of the shot occurred during the early stages of shot flight prior to impact upon the plate. On test round 11 the drop in chamber pressure from an average of 44,400 to 34,600 psi supports the belief that breakup of the obturator and sabot coupled with the escape of gas into the sabot cavity caused the breakup of the shot.

The test was then suspended pending evaluation of current results and the arrival of new shot. The new shot, Lot FA-E-441-2 were similar to the shot previously fired except for the hemispherical cup on the carbide core. The cup was made from Type 416 stainless steel which had been annealed. The purpose was to permit better seating of the cup on the core during assembly. The rotating bands were finished to 4.260-inch diameter at Frankford Arsenal.

The five shot were fired alternately with the same shot lot previously fired, as shown in the summary. The rotating bands of these shot were reduced to 4.245-inch diameter. The first two rounds (test rounds 12 and 13) were fired with the standard charge of 12 pounds 10.5 ounces. All other rounds were fired with a charge of 12 pounds 4 ounces. Both shot yielded complete penetration with the shot "showing" no distortion on the yaw card.

Test rounds 14 and 15 yielded complete penetrations, with round 14 showing no evidence of breakup. Round 15 may have had slight yaw, as evidenced by the yaw card.

Test round 16 failed to yield a complete penetration. It was suspected from an examination of the smear photographs that some degree of deformation occurred on the forward sheath of the subprojectile. Erosion was also noted on the rotating band stop. The depth of penetration of this shot was 4.5 inches, which produced a 2-inch bulge on the rear of the plate.

Test round 17 gave a complete penetration on the plate. Heavy engraving was noted on the carrier at the two camera positions near the gun.

Test round 18 broke up completely either on setback or on emergence from the tube. Small fragments of the recovered forward sheath show that the center, between the tip and the threaded portion, was crushed, presumably by the petals on setback.

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Test round 19 produced a complete penetration on the plate which created a bulge first and then "knocked" off the cap of the bulge. The size of the exit hole was the smallest observed in the firing. Test rounds 20 and 21 both yielded partial penetrations, but showed satisfactory flight characteristics prior to impact on the yaw card. Round 20 deviated from the expected trajectory, impacting 4 feet above the point of aim. Approximately three degrees of subprojectile yaw were observed on the yaw card. No yaw was observed from round 21. The bulge on the rear of the plate had a crack around the right side of the bulge 7.75 inches in length. The width of the crack was approximately 0.031 inch in width, maximum.

With the firing of test round 21, the test program request was considered completed, and the test of the translated design shot at high and low temperature was cancelled by the representative of Frankford Arsenal. Except for the one failure noted above (round 18), all rounds apparently launched and performed satisfactorily. The smear camera records obtained in front of the plate showed all subprojectiles to be apparently in true flight. The trajectory of round 20 was above the camera field of view and was not recorded.

3.3 Remarks and Observations

It was noted that the new cartridge cases, Lot FA-E-442 performed satisfactorily. No difficulties were experienced either in loading the case into the chamber or extracting it after the firing. No extrusion of metal was observed either at the mouth or rear. The face of the base remained flat when examined for bulging in the primer recess area following firing.

A summary of round-by-round data is given as Table II.

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Table II. (S) Summary of Round-by-Round Data

Tube Round Number	Test Round Number	Projectile Lot FA-E	Rotating Band Diameter, in.	Corrected Muzzle Velocity, fps	Plate Damage	Propellant Charge		
						lb	-	oz
77	1	441-1	4.264	4361	P	11		10
78	2	441-1	4.264	4471	P	11		14
79	3	441-1	4.264	4805 ^a	C	12		10.5
80	4	441-1	4.264	4727	C	12		8
81	5	441-1	4.264	4566	b	12		4
82	6	441-1	4.264	4566 ^a	P	12		4
83	7	441-1	4.264	4806	C	12		10.5
84	8	441-1	4.264	4768	C	12		10.5
85	9	441-1	4.264	4798	P	12		10.5
86	10	441-1	4.264	Lost	P	12		10.5
87	11	441-1	4.264	4357	P	11		8
88	12	441-1	4.245	4801	C	12		10.5
89	13	441-2	4.260	4802	C	12		10.5
90	14	441-1	4.245	4574	C	12		4
91	15	441-2	4.260	4600 ^a	C	12		4
92	16	441-1	4.245	4569 ^a	P	12		4
93	17	441-2	4.260	4576 ^a	C	12		4
94	18	441-1	4.245	4571 ^a	P	12		4
95	19	441-2	4.260	4578 ^a	C	12		4
96	20	441-1	4.245	4569 ^a	P	12		4
97	21	441-2	4.260	4585 ^a	P	12		4

^aEstimated, as coils were hit by sabots and velocities lost.

b

P - Partial

C - Complete

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4. (S) CONCLUSIONS

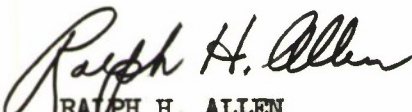
It is concluded that:

- a. The APDS, 105-mm, T382 shot as currently manufactured will not give consistently satisfactory performance because of metal-parts failures.
- b. None of the rounds submitted for test thus far could be considered an exact translation of the UK design shot in either physical properties or over-all performance.

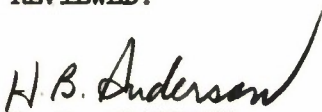
5. (S) RECOMMENDATIONS

It is recommended that additional rounds be submitted for accuracy and plate tests in comparison with UK control rounds. These rounds should incorporate physical and design features equivalent to those of the UK shot.

SUBMITTED:


RALPH H. ALLEN
Test Director

REVIEWED:


H. B. ANDERSON
Chief
Artillery Ammunition Branch


H. A. BECHTOL
Chief
Artillery Division

APPROVED:


H. A. NOBLE
Assistant Deputy Director
for Engineering Testing
Development and Proof Services

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APPENDICES

	<u>PAGE</u>
A, CORRESPONDENCE.	A-1
B, FIRING RECORD.	B-1
C, PHOTOGRAPHS.	C-1
D, STAR-GAUGE REPORTS.	D-1
E, AMMUNITION DATA CARD	E-1
F, DISTRIBUTION.	F-1

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APPENDIX A
Correspondence

ORDNANCE CORPS
FRANKFORD ARSENAL
PHILADELPHIA 37.
PENNSYLVANIA

Mr. Psyk/smf/3177

22 May 1959

774K 53-59-1118

IN REPLY
REFER TO ORDBA-6151

SUBJECT: Cartridge, APDS-T, 105mm T382 (U)

TO: Commanding General
Aberdeen Proving Ground
Aberdeen, Maryland
ATTN: ORDBG-D&PS, Mr. H. Anderson

Inclosed is Test Program Request FA-IEP-59-6114-1-2 covering testing of subject cartridge. It is requested that this Arsenal be notified in advance of the test in order that a representative may be present.

FOR THE COMMANDER:

C. W. Brown

1 Incl
1. TPR-FA-IEP-59-6114-1-2
(in dupe)

C. W. BROWN
Assistant

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JTPsyk/smf/3177
1 May 1959

Test Program Request
FA-IEP-59-6114-1-2
Frankford Arsenal, Phila., Pa.

*Doc 114-1-2-1-2
59-6114-1-2*

1. Material for Test:

(a) Fifty (50) each cartridge, APDS-T, 105mm, T382 (U.S. metal parts, propellant, primers and cartridge cases).

(b) Twenty (20) each U.K. cartridge APDS-T, 105mm, T382. (These are to be used as control rounds if available.)

(c) U.K. X15E8 gun tube, one half (1/2) to three quarters (3/4) worn.

2. Project Authority:

DSC Log Project No. 517-FY-58 (Ord) A6-86-58-1.

3. Arsenal Expenditure Order:

XO 84525-02

4. Object of Development or Experiment:

To evaluate performance of rounds produced during U.S. production engineering of the translated U.K. design.

5. Historical Sketch:

Refer to TPR #FA-IEP-59-6114-1-1.

6. Improvement or Changes since last Proving Ground Test:

This is the first test to determine plate capabilities and high and low temperature metal parts security of U.S. manufactured U.S. translated U.K. design rounds. These rounds are identical with round Nos. 1 to 25 fired under TPR-FA-IEP-59-6114-1-1.

7. Object of this Test:

To determine ambient penetration characteristics and metal parts security at extreme temperature.

8. Precautions in Handling and Testing:

Normal safety precautions should be employed in the handling and testing of this ammunition.

9. Recommended Test Program:

This program will be fired in two (2) phases. Phase I is to determine plate penetration capabilities of the design and Phase II is to determine metal parts security at extreme temperatures.

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Phase I - Plate Penetration

- (a) All rounds are to be fired against 4.7 inches of homogeneous armor plate set at an angle of 60 degree obliquity.
- (b) Establish a PBL for the control and test rounds.
- (c) Record chamber pressure and muzzle velocities.
- (d) Take photograph of the plate to reveal the nature of the shot break-up.
- (e) Set up yaw card in front of armor plate to ascertain sabot discard prior to striking armor plate.

Phase II - Metal Parts Security

- (a) Ten (10) each test rounds fired + 125°F temperatures.
- (b) Ten (10) " " " " - 40°F temperatures.
- (c) Fired 1000 yard target.
- (d) Record muzzle velocity and chamber pressure for each round.
- (e) Record photographically the first sixty-five (65) feet of projectile travel for all test rounds.
- (f) Horizontal and vertical distances between target impacts will be recorded for P.E. to assess accuracy.
- (g) Supplemental information such as meteriological data, test irregularities, etc. is to be recorded as determined significant by the Proof Director.

10. Examination of Rounds Prior to Testing:

- (a) Record projectile weights, and diameters of centering bands, rotating bands and obturators.
- (b) Check breakaway torque of bases of projectiles, if less than 1000 inch-lbs., reseal to a torque of 1000 + 100 inch-lbs., and again record diameter of centering band.

11. References:

- (a) Project Order 80304230-1-19-51751-01-0 dated 20 June 1958.
- (b) AIFO #87170100-99-45250-21.

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12. Coordination:

Office, Chief of Ordnance

Ordnance Ammunition Command

Picatinny Arsenal

Aberdeen Proving Ground

Frankford Arsenal

A-4

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APPENDIX B
Firing Record

DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND, MARYLAND
FIRING RECORD

Test of Cartridge, 105-mm,
APDS, T382 (U)

Firing Record No.: P-64351
Dates of Test: 25, 26 June and
6 July 1959
Authority: Letter dated 22 May 1959,
ORDBA With THR FA-IEP-59-
6114-1-2

Work Order No. 331-919-02

nej

ITEMS UNDER TEST (S)

Shot, APDS, 105-mm, T382, Numbers 1 to 50, Lot FA-E-441-1
Shot, APDS, 105-mm, T382, Lot FA-E-441-2.

SUPPORTING FACILITIES AND MATERIALS (S)

Ammunition

Primer, Electric, XM80 (Modified), 860 $\pm$ 20 grains Benite strands, with
T42E1 electric igniter, Lot FA-E-29473.

Case, Cartridge, 105-mm, RLB-83/SA, S1/1800, F1/13870/E, 4/1958 (resized).
Case, Cartridge, 105-mm, Lot FA-E-442.

Propellant, MP, M17, 0.048-inch web, Lot 62814.

Weapon

Gun, 105-mm, TK-XL5E6 (20-Pdr TK MX), British 2833, and Tube, 105-mm, TK-
XL5E8, E/2895, mounted on Carriage, 155-mm, M1, No. 150, and Recoil
Mechanism, 155-mm, M7, No. 2882, with APG Sleigh No. 77.

For Camera Coverage:

35-mm, smear type camera with film speed of 115 feet per second.

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Firing Record No. P-64351

2

Velocity Coil Measurements

25 June 1959

Muzzle to 1st Coil	89.89 feet
Between Coils	49.74 feet
2nd Coil to center of plate	157.00 feet
Velocity measured at	114.76 feet

26 June 1959

Muzzle to 1st Coil	89.30 feet
Between Coils	49.50 feet
2nd Coil to center of plate	157.70 feet
Velocity measured at	114.05 feet

6 July 1959

Muzzle to 1st Coil	94.52 feet
Between Coils	50.13 feet
2nd Coil to center of plate	151.00 feet
Velocity measured at	119.59 feet

M3 Pressure Gage Data

All rounds assembled with two M3 Gages.

Type of gage:	Medium Caliber (M3) Copper Cup.
Position of Gage:	In base of case.
Crusher cylinder:	Metal of 1956, Annealed 1956, Lot 9C-56.
Initial compression:	0

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Firing Record No. P-64351

3

ROUND-BY-ROUND DATA (S)

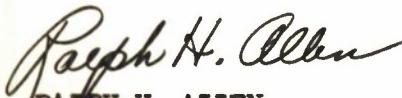
Round No. Tube Test	Projectile		Rotat- ing Band Diam, in.	Prop Charge, lb-oz	Velocity,		Chamber		Plate Damage,	Size of Entry, in.	Depth, in.	Size of Exit, in.	Ht of Bulge, in.	Breakup of Subproj Observed on Yaw Card (287 ft)
	Lot	Wt, lb			Instr	Corrd Est kuz	psi/100	Corrd						
Date fired: 25 June 1959														
77	441-1	12.77	26	4.264	4356	4361	351	347	P	4x12	4.5		1.25	No
78	441-1	12.73	30	4.264	4469	4471	386	383	P	3.75x9.25	3.75		1.0	No
79	441-1	12.72	31	4.264	Lost	---	442	439	C	3x9.5		3.25x4	---	No
80	441-1	12.69	33	4.264	4728	4727	436	433	C	3x10.5		3.5 x4	---	No
81	441-1	12.74	34	4.264	4563	4566	400	397	*a	2.875 x 4	6.0		---	Yes
82	441-1	12.76	35	4.264	Lost	---	414	410	P	4.5 x 9	4.0		2.0	Yes
Date fired: 26 June 1959														
83	441-1	12.78	1	4.264	4801	4806	454	449	C	3 x 10		3 x 4	---	No
84	441-1	12.69	2	4.264	4769	4768	446	443	C	3 x 11		2.75 x4	---	No
85	441-1	12.79	3	4.264	4792	4798	445	440	P	4 x 10	3.0		2.0	Yes
86	441-1	12.77	39	4.264	Lost	---	448	444	P	4 x 9.25	4.0		1.75	Yes
87	441-1	12.70	40	4.264	4357	4357	348	346	P	2.75x12	4.0		1.50	Yes
Date fired: 6 July 1959														
88	441-1	12.67	27	4.245	4803	4801	415	412	C	3.5 x 10		4 x 5.75	---	No
89	441-2	12.71	121	4.260	4801	4802	428	425	C	4 x 11		3.5x3.75	---	No
90	441-1	12.69	28	4.245	4574	4574	392	390	C	4x11.25		3.5x3.75	---	No
91	441-2	12.72	122	4.260	Lost	---	4600	415	C	4 x 9		3.25x4.75	---	No
92	441-1	12.73	29	4.245	4566	4569	390	387	P	4 x 11	4.5		2.0	No
93	441-2	12.68	123	4.260	Lost	---	4576	393	C	3.5x10.5		3 x 3.25	---	No
94	441-1	12.71	36	4.245	Lost	---	4571	391	P	5.75 x 9	2.0		---	Yes
95	441-2	12.73	124	4.260	Lost	---	4578	394	C	4 x 11		2.25x2.75	---	No
96	441-1	12.69	37	4.245	N.T. ^b	---	4569	390	P	3.5x11	4.75		2.25	No
97	441-2	12.73	125	4.260	N.T.	---	4585	398	P	4.5x11	4.5c		2.50	No

* a Subprojectile without sheath impacted on plate butt.
 Velocities not taken on Test Rounds 20 and 21.
 Bulge cracked on right side, length of crack 7.75 inches.
 Velocities corrected to standard projectile weight of 12 lb, 8 oz.
 Pressure corrected for presence of 2 - 13 gages.

P = Partial C = Complete

This firing record forms a part of the Second Report on Project Number
FA-I-59/21.

SUBMITTED:


RALPH H. ALLEN
Test Director

REVIEWED:

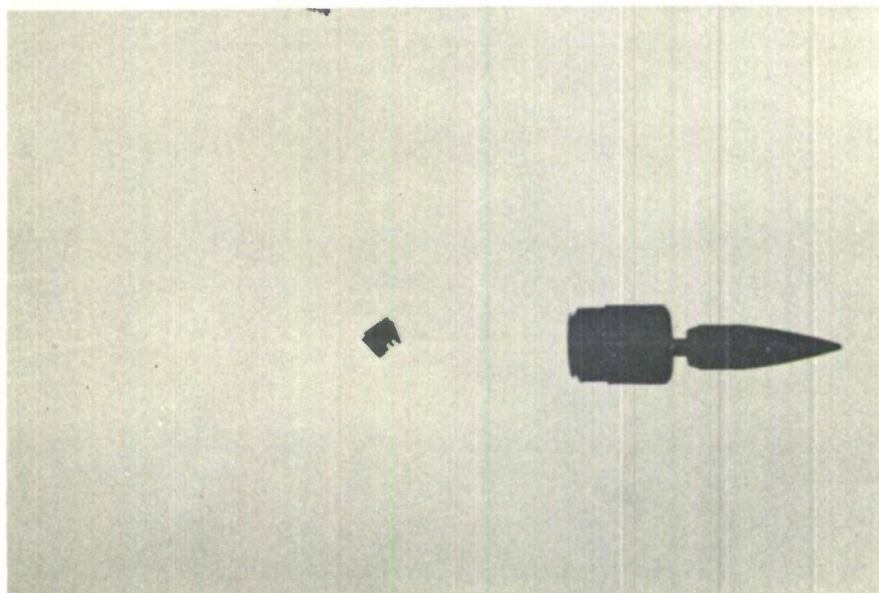
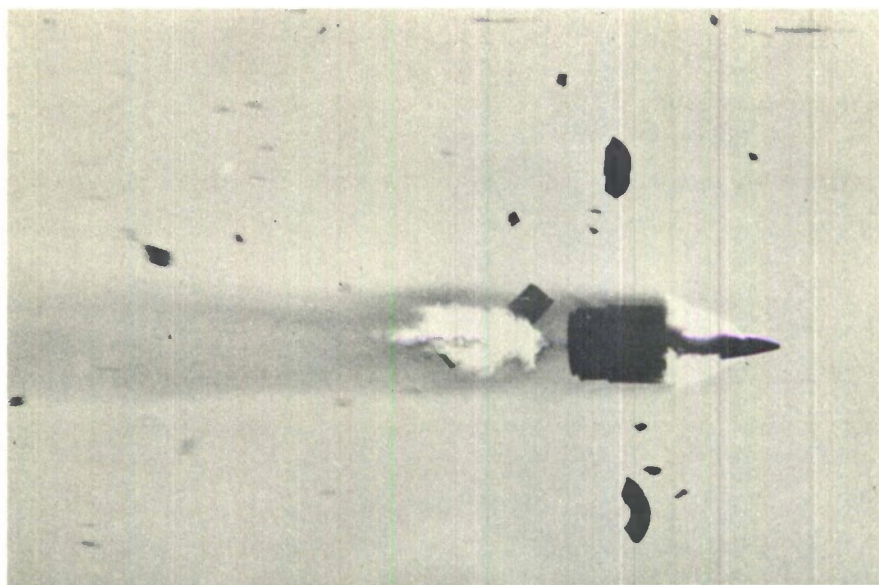

H. B. ANDERSON
Chief
Artillery Ammunition Branch

APPROVED:


H. A. BECHTOL
Chief
Artillery Division

~~SECRET~~

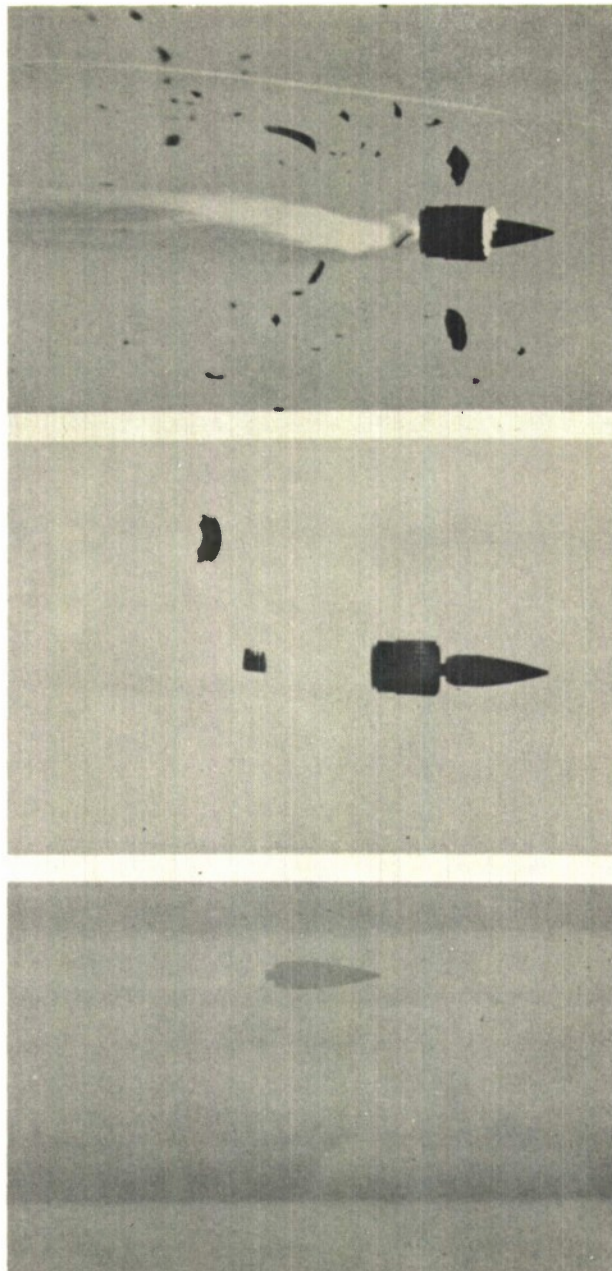
APPENDIX C



59T2829: Two smear photographs of Test Round 12, taken in flight.
TOP TO BOTTOM: 15 and 30 feet from Muzzle. Shot Lot FA-E-441-1.
Propellent Charge 12 lb, 10.5 oz.

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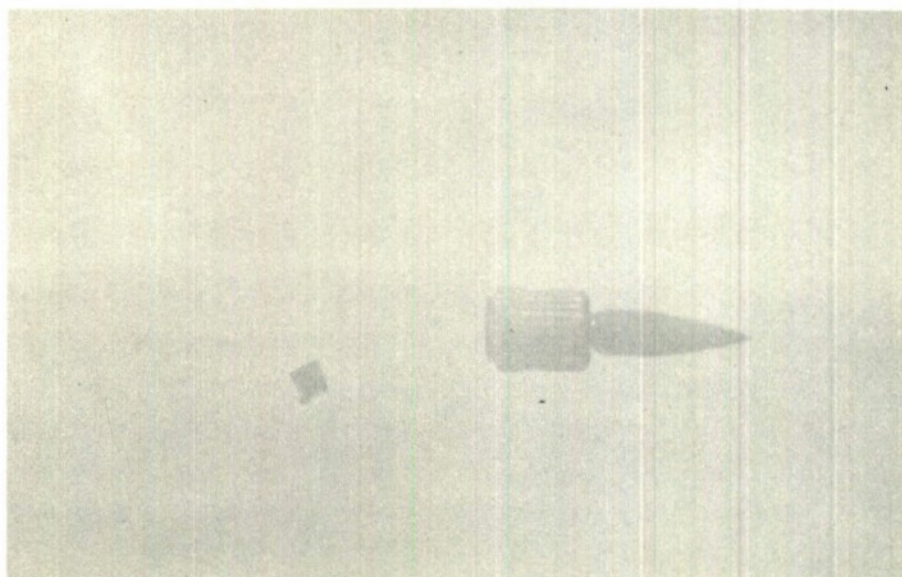
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59T2830: Three smear photographs of Test Round 13 taken in flight.
TOP TO BOTTOM: 15, 30 and 287 feet from Muzzle. Shot, Lot FA-E-441-2.
Propellent Charge 12 lb, 10.5 oz.

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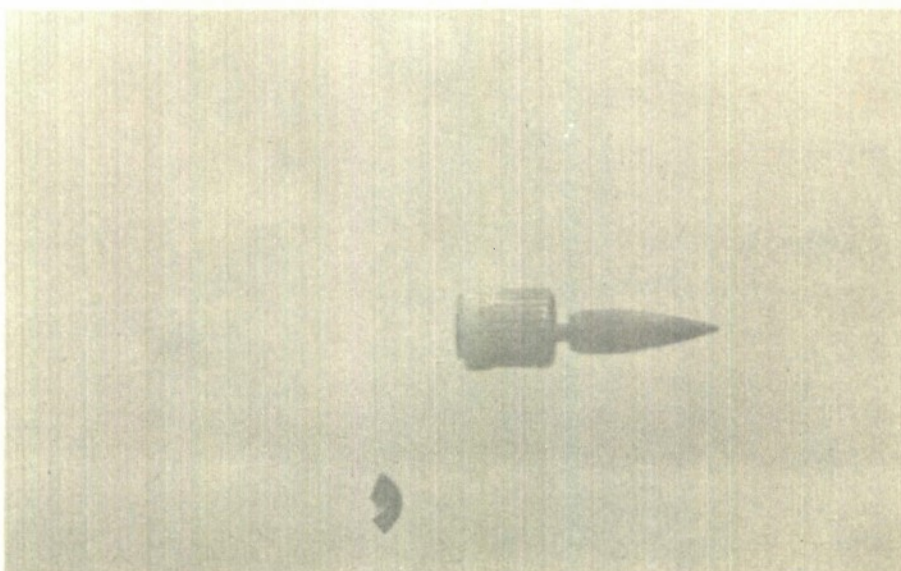
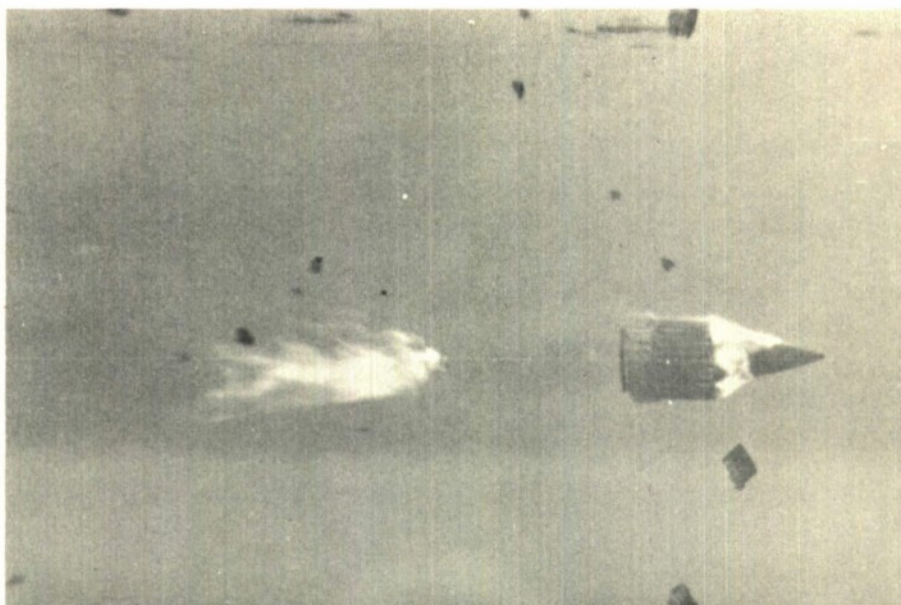
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59T2831: Two smear photographs of Test Round 14 taken in flight.
TOP TO BOTTOM: 15 and 30 feet from Muzzle. Shot, Lot FA-E-441-1.
Propellant Charge 12 lb, 4 oz.

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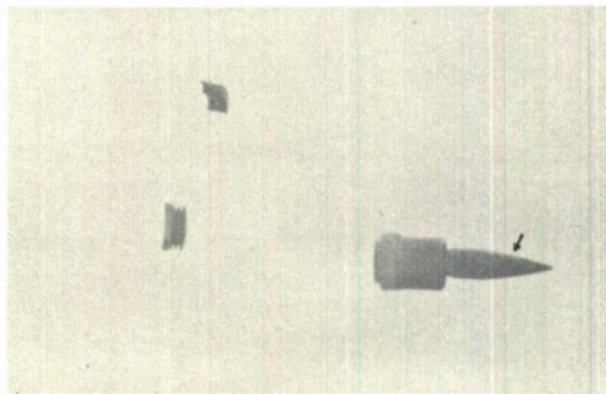
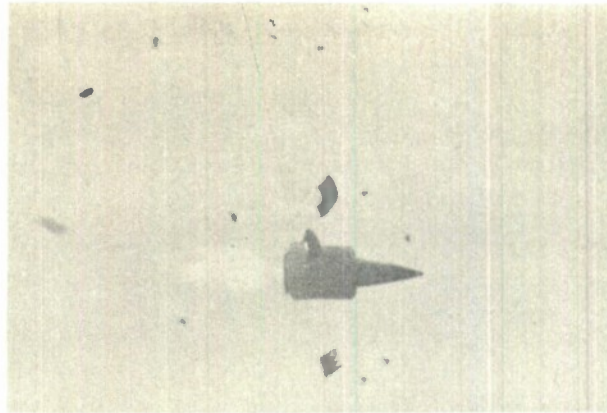
~~SECRET~~



59T2832: Two smear photographs of Test Round 15 taken in flight.
TOP TO BOTTOM: 15 and 30 feet from Muzzle. Shot, Lot FA-E-441-2.
Propellant Charge 12 lb, 4 oz.

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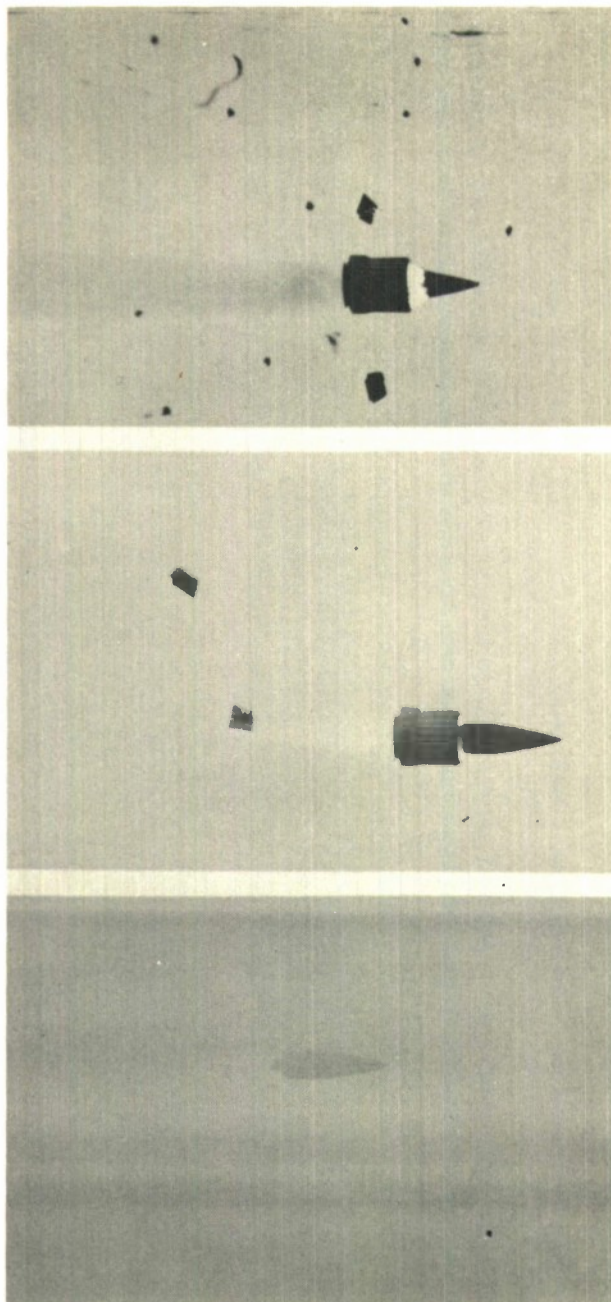
~~SECRET~~



59T2833: Three smear photographs of Test Round 16 taken in flight. TOP TO BOTTOM: 15, 30 and 287 feet from Muzzle. Shot, Lot FA-E-441-1. Propellant Charge 12 lb, 4 oz. Arrow indicated area of deformation of Subprojectile.

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59T2834: Three smear photographs of Test Round 17 taken in flight.
TOP TO BOTTOM: 15, 30 and 287 feet from Muzzle. Shot, Lot FA-E-441-2.
Propellant Charge 12 lb, 4 oz.

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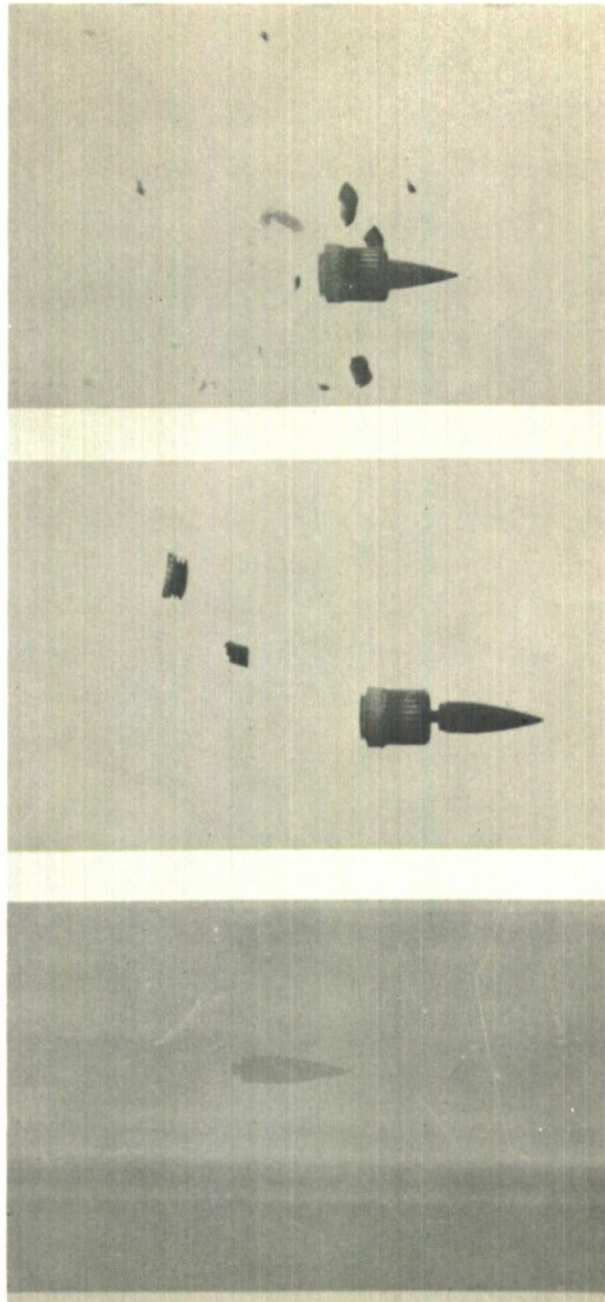
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59T2835: Three smear photographs of Test Round 18 taken in flight, showing breakup of shot. TOP TO BOTTOM: 15, 30 and 287 feet from Muzzle. Shot, Lot FA-E-441-1. Propellant Charge 12 lb, 4 oz.

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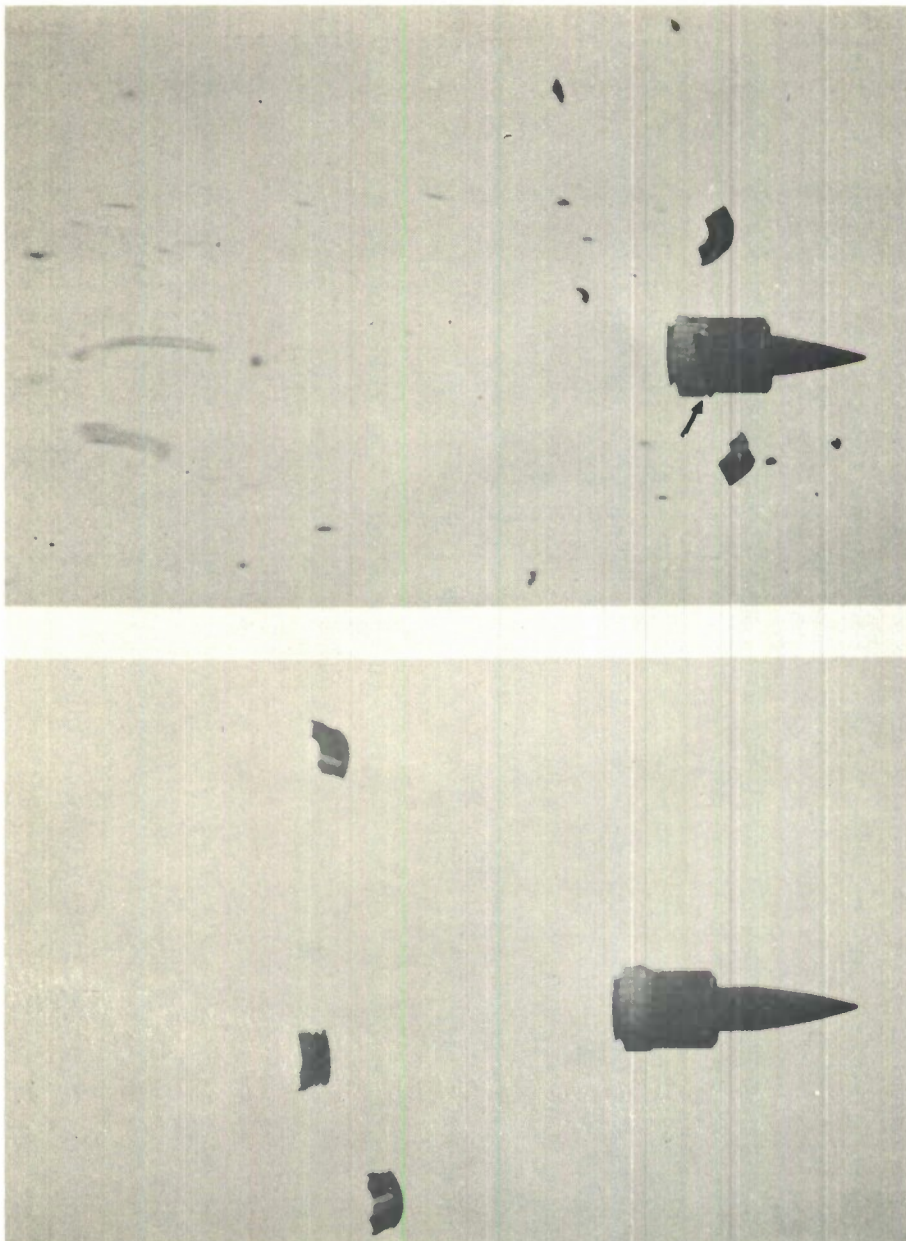
~~SECRET~~



59T2836: Three smear photographs of Test Round 19 taken in flight.
TOP TO BOTTOM: 15, 30 and 287 feet from Muzzle. Shot, Lot FA-E-441-2.
Propellent Charge 12 lb, 4 oz.

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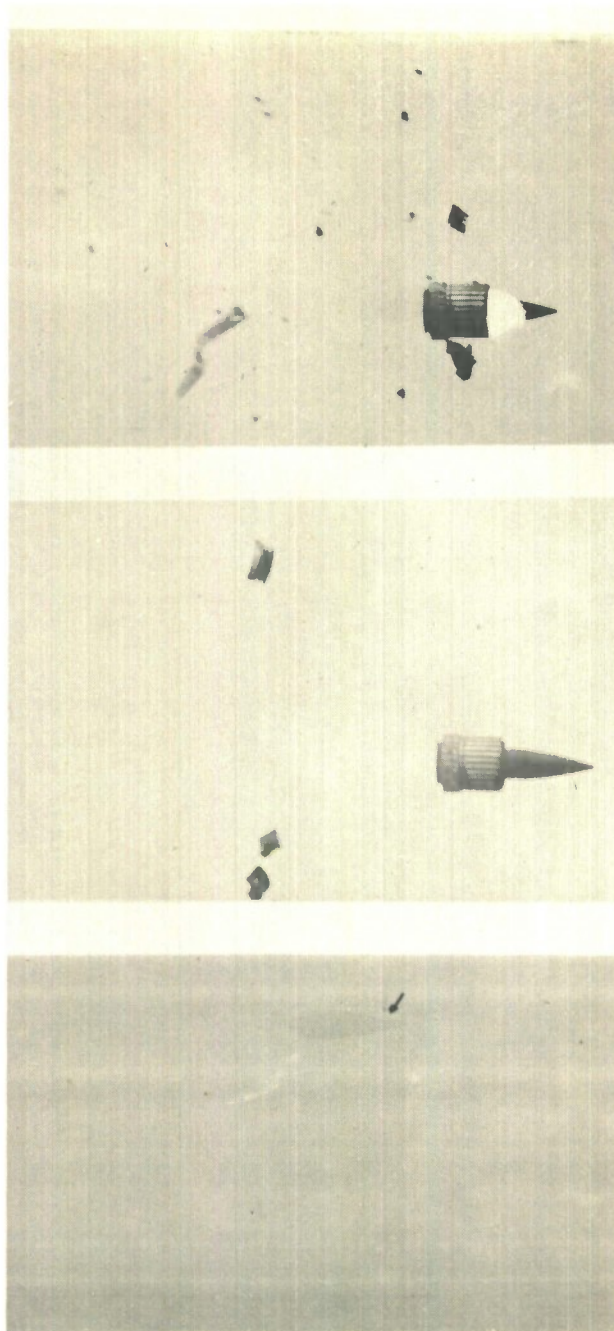
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59T2837: Two smear photographs of Test Round 20 taken in flight.
TOP TO BOTTOM: 15, 30 feet from Muzzle. Shot, Lot FA-E-441-1. Propellant Charge 12 lb, 4 oz. Arrow in top photograph indicates petal beside carrier.

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59T2838: Three smear photographs of Test Round 21 taken in flight. TOP TO BOTTOM: 15, 30 and 287 feet from Muzzle. Shot, Lot FA-E-441-2. Propellant Charge 12 lb, 4 oz. Arrow in bottom photograph indicates deformation on forward sheath of subprojectile.

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Downgraded as per authority by
DCM 37002 dtd 15 Feb 1959

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

BRITISH 105M/M TUBE		CASTING NUMBER ROF(c) 1958		MANUFACTURER PROOF OFFICER MR. ALLEN 40.331-919-0V FA-9/59/24		MODEL TKX 15E8 TKX 15E6		NUMBER OF ROUNDS 97		NUMBER F/1995 (Stamped on) 57040 (Muzzle Face)		FIRING STATUS (Check One) BEFORE AFTER		DATE OF GAUGING 8-July-58	
Distance (Inches) From			Gauge Meas. Indicated in 1/1000 of an Inch												
Muzzle Face	Rear Face of Breech	Rear Face of Tube	Basic Dia. 4.134" Lands		Basic Dia. 4.224" Grooves										
			Vert.	Hor.	Vert.	Hor.									
.25	219.80	210.30	.000	.000	+.002	+.003									
.55	219.50	210.10	0	0	2	3									
1.55	218.50	209.00	0	0	2	3									
3.55	216.50	207.00	0	0	2	3									
5.55	214.50	205.00	0	0	3	3									
10.55	209.50	200.00	0	0	3	3									
15.00	204.50	195.00	0	0	3	3									
20.55	199.50	190.00	0	0	3	3									
25.55	194.50	185.00	0	0	3	3									
30.55	189.50	180.00	0	0	3	3									
35.55	184.50	175.00	0	0	3	3									
40.55	179.50	170.00	0	0	3	3									
45.55	174.50	165.00	0	0	3	3									
50.55	169.50	160.00	0	0	2	3									
55.55	164.50	155.00	0	0	2	4									
60.55	159.50	150.00	0	0	2	4									
65.55	154.50	145.00	0	0	2	4									
70.55	149.50	140.00	0	0	2	4									
75.55	144.50	135.00	-	1	0	4									
80.55	139.50	130.00	1	-	1	4									
85.55	134.50	125.00	1	1	4	4									
90.55	129.50	120.00	1	1	4	4									
95.55	124.50	115.00	1	1	4	4									
100.55	119.50	110.00	1	1	4	4									
105.55	114.50	105.00	1	1	4	4									
110.55	109.50	100.00	1	1	4	4									
115.55	104.50	95.00	1	0	4	4									
120.55	99.50	90.00	0	0	4	4									
125.55	94.50	85.00	0	0	3	4									
130.55	89.50	80.00	0	0	2	3									
135.55	84.50	75.00	0	1	2	3									
140.55	79.50	70.00	+	1	2	3									
145.55	74.50	65.00	2	2	3	3									
150.55	69.50	60.00	3	3	3	3									
155.55	64.50	55.00	5	5	3	3									
160.55	59.50	50.00	9	9	3	3									
165.55	54.50	45.00	17	13	3	3									
170.55	49.50	40.00	17	18	5	4									
173.15	46.90	37.40	22	20	10	7									
175.55	44.50	35.00	22	23	15	10									
177.28	42.77	33.27	26	25	18	14									
180.55	39.50	30.00	31	30	22	20									
181.42	38.63	29.13	34	32	23	22									
182.55	37.50	28.00	35	33	25	24									
184.55	35.50	26.00	36	35	35	34									
185.05	35.00	25.50	44	41	32	33									
185.30	34.75	25.25	51	48	33	37									
185.45	34.60	25.10	+	.057	+	.055	+	.034	+	.037					
Pullover Meas.			Vert.	Hor.											
25.10			4.196	4.194											
25.25			4.187	4.185											
25.50			4.179	4.176											
26.00			4.171	4.170											

70% REMAINING UNCLASSIFIED

DECLASSIFIED

105M/M TUBE				CHAMBER						
DISTANCE (Inches) FROM				GAUGE MEASUREMENTS INDICATED IN 1/1000 OF AN INCH						
REAR FACE OF BRECH	MUZZLE FACE	REAR FACE OF TUBE	BASIC DIAMETER	ZERO	VERTICAL Y			HORIZONTAL X		
					GAUGE READING	ACTUAL DIAMETER	DIFFERENCE	GAUGE READING	ACTUAL DIAMETER	DIFFERENCE
33.55	186.50	24.05	4.416	4.400"	+0.021	4.421	+0.005	+0.021	4.421	+0.005
32.50	187.55	23.00	4.427		.031	4.431	.004	.031	4.431	.004
31.50	188.55	22.00	4.437		.040	4.440	.003	.040	4.440	.003
31.35	188.70	21.85	4.438		+0.042	4.442	.004	+0.042	4.442	.004
27.90	192.15	18.40	4.977	5.000"	-0.019	4.981	+0.004	-0.019	4.981	+0.004
27.50	192.55	18.00	4.985		.014	4.986	.001	.014	4.986	.001
25.50	194.55	16.00	5.025		+0.026	5.026	.001	+0.026	5.026	.001
23.50	196.55	14.00	5.065		.067	5.067	.002	.067	5.067	.002
21.50	198.55	12.00	5.105		.106	5.106	.001	.106	5.106	.001
19.50	200.55	10.00	5.145		.146	5.146	.001	.146	5.146	.001
17.50	202.55	8.00	5.185		.186	5.186	.001	.186	5.186	.001
15.50	204.55	6.00	5.225		.227	5.227	.002	.227	5.227	.002
13.50	206.55	4.00	5.265		.267	5.267	.002	.267	5.267	.002
11.50	208.55	2.00	5.305		.307	5.307	.002	.307	5.307	.002
10.50	209.55	1.00	5.325		.327	5.327	.002	.327	5.327	.002
10.00	210.05	.50	5.335		.339	5.339	.004	.339	5.339	.004
9.75	210.30	.25	5.340	.344	5.344	.004	.344	5.344	.004	
9.60	210.43	.10	5.343	+0.347	5.347	+0.004	+0.347	5.347	+0.004	
BORESCOPE REMARKS: TUBE NOT PLATED. LIGHT SMOOTH EROSION WITH MODERATE TO LIGHT HEAT CHECKING ENCIRCLING ORIGIN AND EXTENDING TO (APPROX) 65.00" FROM REAR FACE OF TUBE. LANDS LIGHTLY ROUNDED IN THIS AREA - LIGHT HEAT CHECKING ENCIRCLING BORE FROM 65.00" TO 96.00" - LIGHT SMOOTH EROSION ON FORWARD EDGES OF BORE EVACUATOR HOLES. SEVERAL LIGHT DAMAGES ON LANDS BETWEEN 12 & 4 O'CLOCK FROM 147.00" TO 160.00" FROM REAR FACE OF TUBE. NUMEROUS DAMAGES ON LANDS FROM 12 TO 6 O'CLOCK BEGINNING 170.00" FROM REAR FACE OF TUBE AND EXTENDING TO MUZZLE FACE. MOST OF THIS DAMAGE CONSISTS OF GOUSES IN LANDS WITH SOME FLATTENING AND TURNING UP OF EDGES ON SAME LANDS - BORE PHOTOGRAPHS WERE TAKEN AT ORIGIN AT 12.00 AND 6.00 O'CLOCK AND A (GENERAL VIEW). IMPRESSIONS MADE AT ORIGIN AT 12.00 AND 6.00 O'CLOCK										
SPECIAL MEASUREMENTS										
TOTAL LENGTH OF GUN				BASIC	ACTUAL			ROTATION OF TUBE AT BRECH		
TOTAL LENGTH OF TUBE				210.50"			MOVEMENT OF TUBE AT BRECH			
DEPTH OF BRECH RECESS				9.50"			NUMBER OF LANDS AND GROOVES			
							28			
							28			
UNCLASSIFIED										
STAMPED				STARGAUGED AND INSPECTED BY				REVIEWED BY		
RODMAN				TIME				COMPILATOR		
RECORDER				PLACE				GRAPHED BY		

ORDBG Form 2045-(R) 4 Apr 57 (Part 2)

Army--Aberdeen Proving Ground, Md--352-C--O

105 $\frac{w}{m}$ Tube British

~~SECRET~~

10.5" Tube = 57040 TRX 15E8 Chamber

Tube # 57040 TRX 15E8
Gun # E/2833 TRX 15E6
30 Tube 1959

DISTANCE (Inches) FROM				GAUGE MEASUREMENTS INDICATED IN 1/1000 OF AN INCH						
REAR FACE OF BREECH	MUZZLE FACE	REAR FACE OF TUBE	BASIC DIAMETER	ZERO	SECTION I			SECTION II		
					GAUGE READING	ACTUAL DIAMETER	DIFFERENCE	GAUGE READING	ACTUAL DIAMETER	DIFFERENCE
33.50				4.400"	+0.021	4.421		+0.021	4.421	
32.50					.031	4.431		.031	4.431	
31.50					+0.040	4.440		+0.040	4.440	
27.80				5.000"	-.018	4.982		-.018	4.982	
26.50					+0.007	5.007		+0.007	5.007	
25.50					.027	.027		.027	.027	
24.50					.047	.047		.047	.047	
23.50					.067	.067		.067	.067	
22.50					.087	.087		.087	.087	
21.50					.107	.107		.107	.107	
20.50					.127	.127		.127	.127	
19.50					.147	.147		.147	.147	
18.50					.167	.167		.167	.167	
17.50					.187	.187		.187	.187	
16.50					.207	.207		.207	.207	
15.50					.228	.228		.228	.228	
14.50					.248	.248		.248	.248	
13.50					.269	.269		.269	.269	
12.50					.289	.289		.289	.289	
11.50					.309	.309		.309	.309	
10.50					.329	.329		.329	.329	
10.00					.340	.340		.340	.340	
9.75					+0.346	5.346		+0.346	5.346	

Pullover Meas
25.10
25.25
25.50
26.00

VERT Horz
4.193 4.189
4.184 4.182
4.177 4.175
4.170 4.167

Photographs taken of damage to lands from 147.00" to 160.00", 170.00" to 178.00", 178.00" to 184.00", 184.00" to 190.00", 190.00" to 198.00", and 198.00" to 206.00" from rear face of tube, and of condition at origin, 6 & 12 o'clock and general view.

SPECIAL MEASUREMENTS			
TOTAL LENGTH OF GUN	BASIC	ACTUAL	ROTATION OF TUBE AT BREECH
TOTAL LENGTH OF TUBE			MOVEMENT OF TUBE AT BREECH
DEPTH OF BREECH RECESS		9.500	NUMBER OF LANDS AND GROOVES

Borecope Remarks: Tube not plated. Light smooth erosion with moderate to light heat checking encircling origin and extending to approximately 62.00" from rear face of tube. Lands lightly rounded in this area. Light smooth erosion on forward edges of bore evacuator holes. Several light damages on lands between 2 and 4 o'clock from 147.00" to 160.00" from rear face of tube. Numerous damages on lands from 12 to 6 o'clock beginning 170.00" from rear face of tube and extending to muzzle face. Most of this damage consists of gouges in lands, with some flattening and turning up of edges on some lands. Impressions made at origin at 6 and 12 o'clock.

STAMPED	STARGAUGED AND INSPECTED BY	REVIEWED BY
RODMAN	Boyd	P.B.
RECORDED	TIME	COMPILATOR
Roope	52.5	UNCLASSIFIED
McKay		

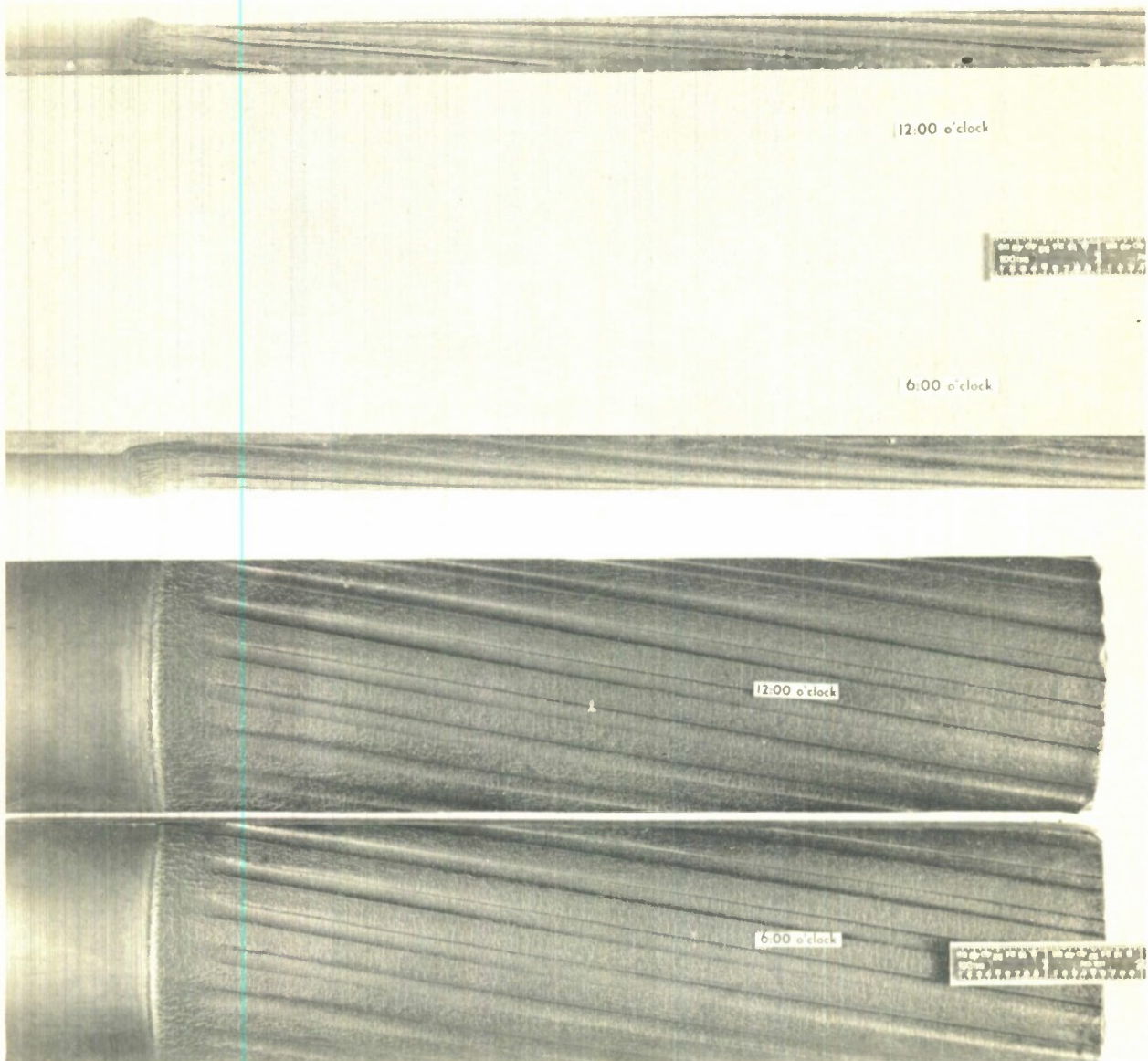
4575 FLYING 87 ROUNDS

FOR MR. ALLEN
NO. 331-919-02
DOW. FA-1/59/24

British 105 M/M Tube		NUMBER	MODEL	MANUFACTURER	CASTING NUMBER
British 105 M/M Tube		E/2895	TX 15E8		
DATE OF GAUGING 26 June 59		FIRING STATUS (Check One) BEFORE ☐ AFTER ☒		PROOF OFFICER Mr Allen	V.O. 331-919-01
Borescoped; Remarks. Light smooth erosion with moderate to light heat checking encircling origin and extending forward to (approx) 57.00" from rear face of tube. Very light smooth erosion on the forward edge of bore evacuator holes. Eight (8) light damaged areas on four (4) lands between 2:00 and 4:00 O'clock from 147.00" to 160.00" and twelve (12) light damaged areas on the lands between 12:00 and 6:00 O'clock 170.00" to 202.00" from rear face of tube. These damages consist of light gouges on lands, flattened and gouged lands and turned up edges on some of the lands. By Edwards Roops					

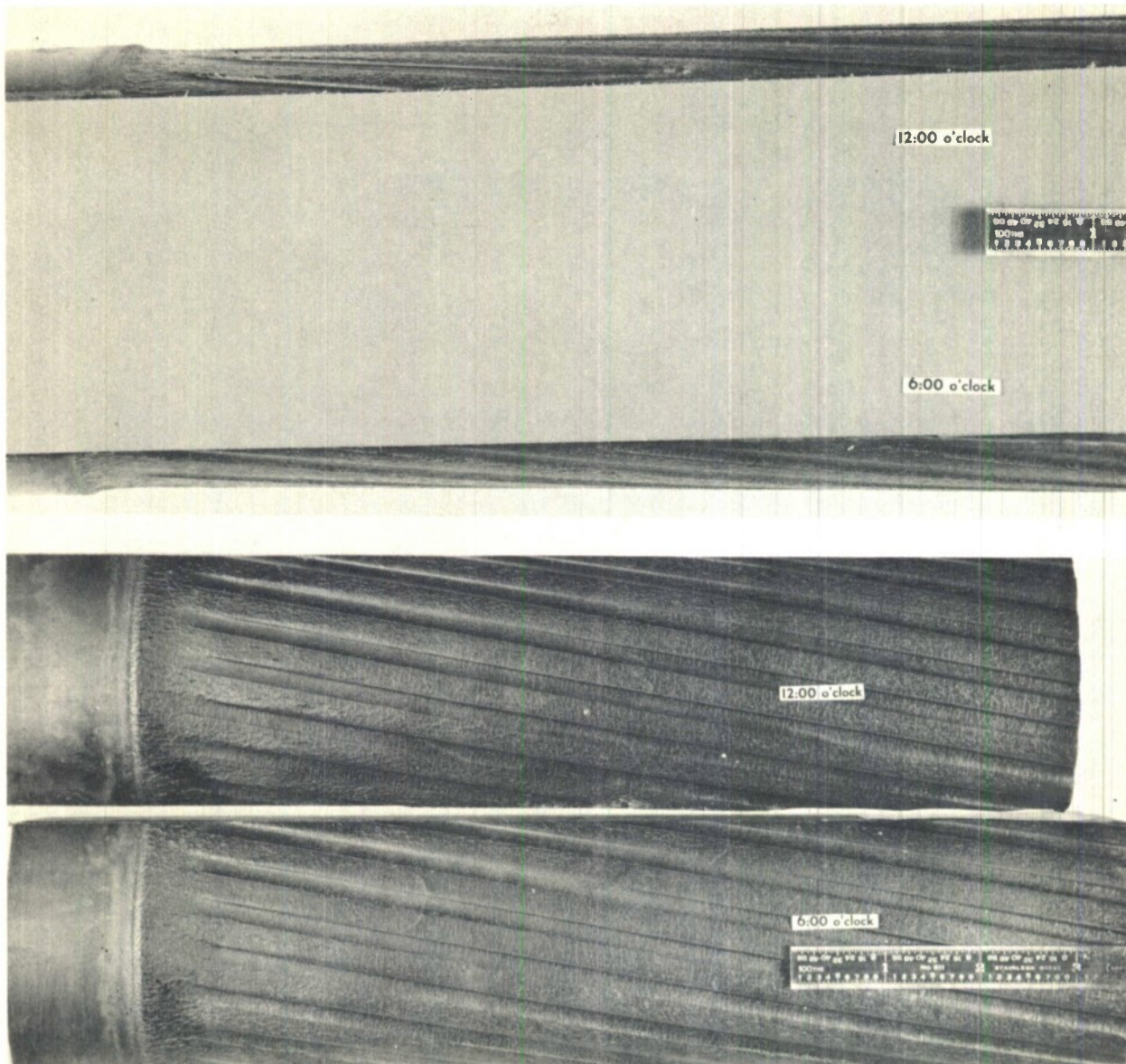
UNCLASSIFIED

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59T2432 Impressions Showing Condition of Rifling at Origin at 6 and 12:00 O'Clock, after Firing 87 Rounds.

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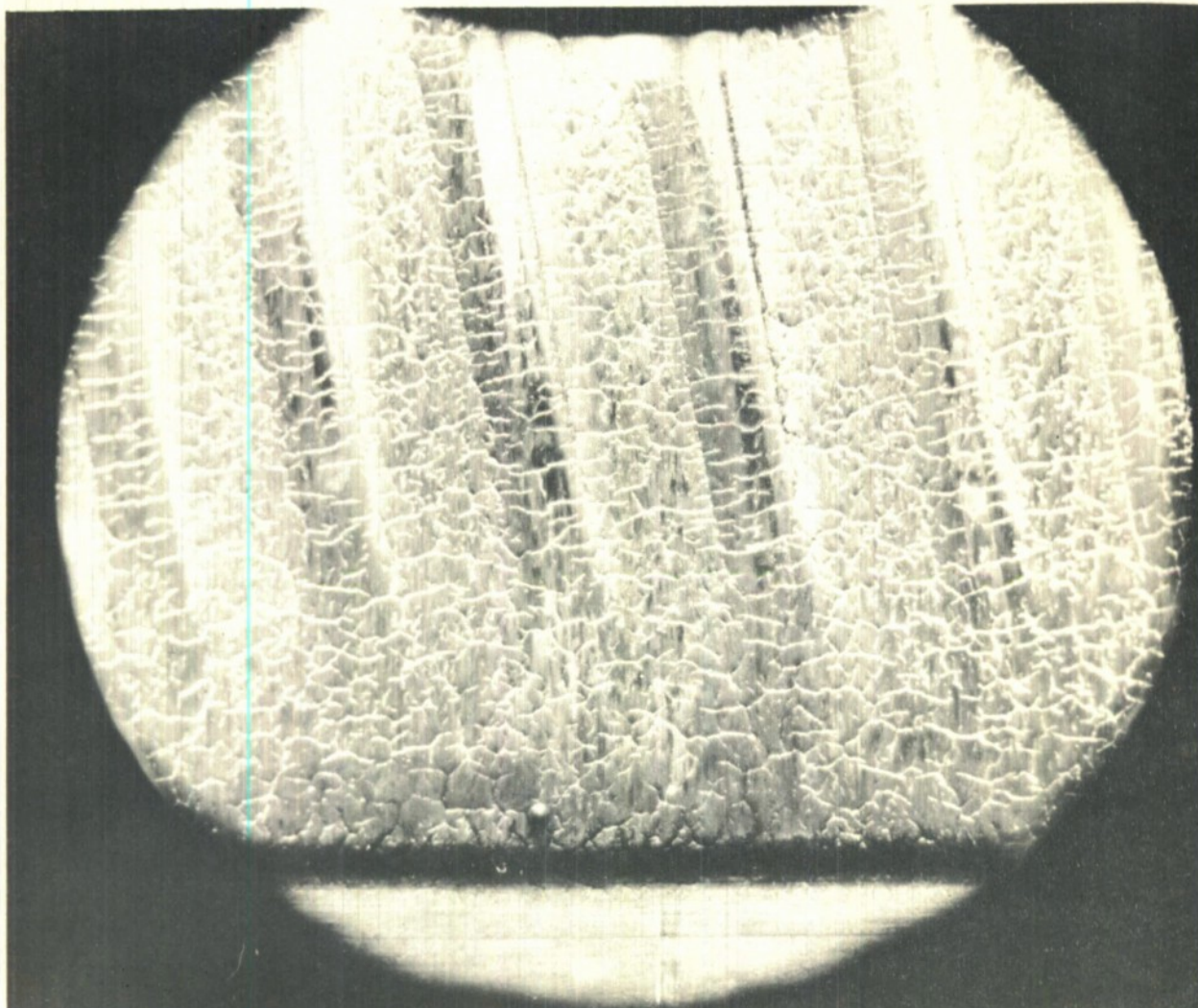


59T2433 Impressions Showing Condition of Rifling at Origin at 12:00 and 6:00 O'Clock, after Firing 97 Rounds.

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APPROXIMATE

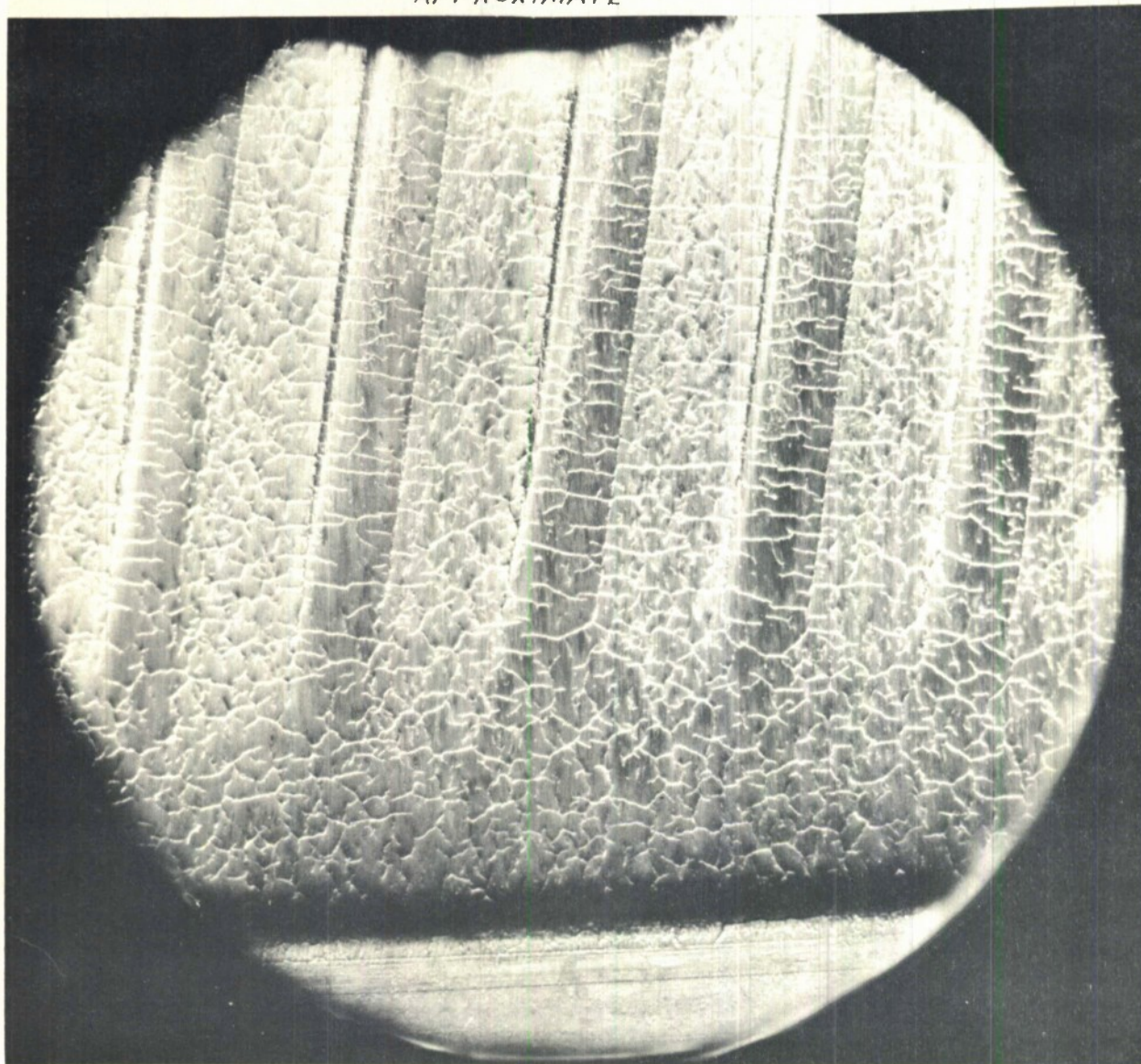
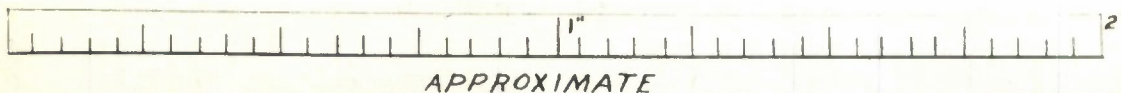


59T2319 Bore Photograph Showing Condition of Rifling at Origin at 6:00 O'Clock, after Firing 87 Rounds.

D-8

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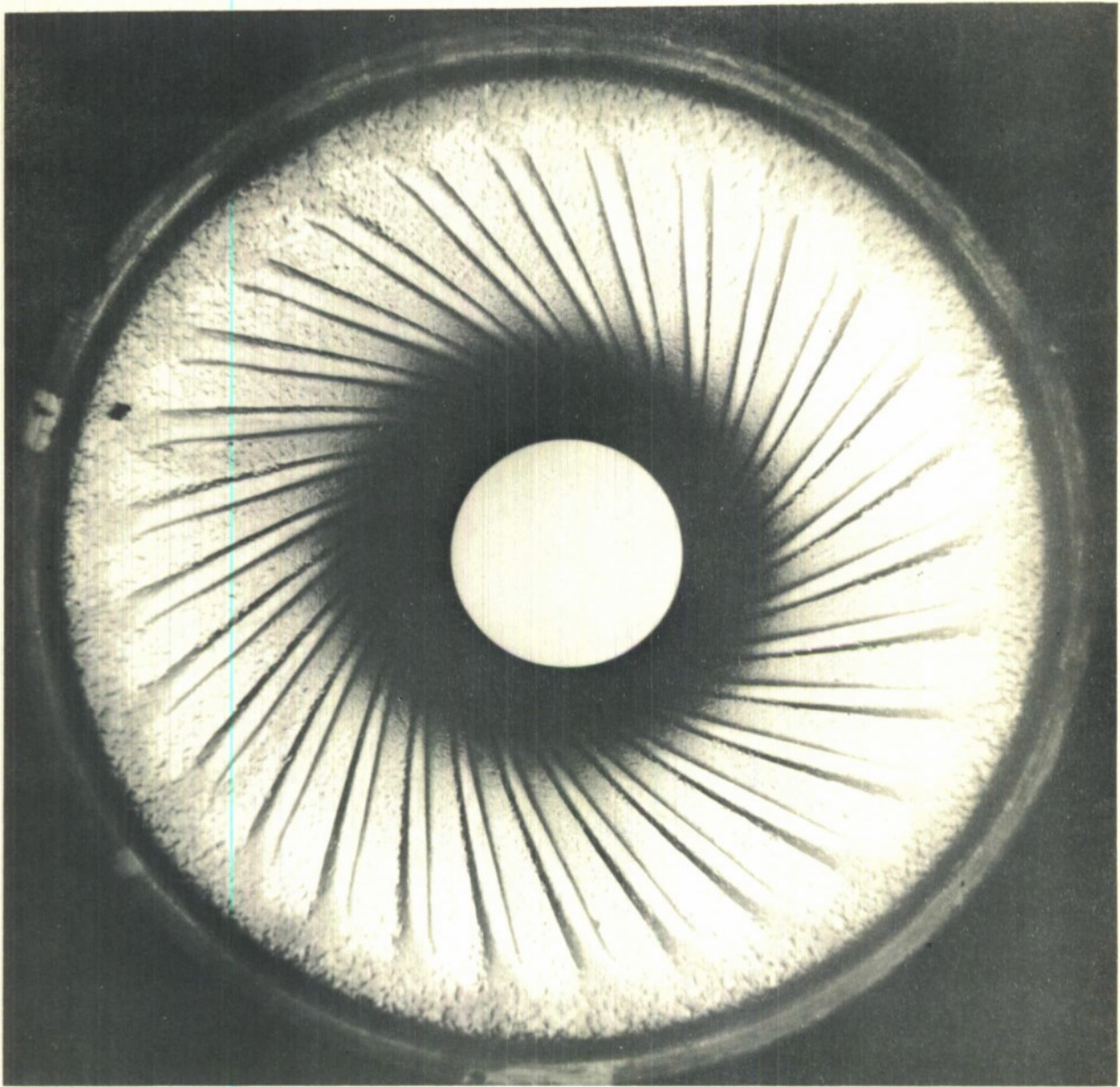


59T2320 Bore Photograph Showing Condition of Rifling at Origin at 12:00 O'Clock, after Firing 87 Rounds.

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12:00 O'clock



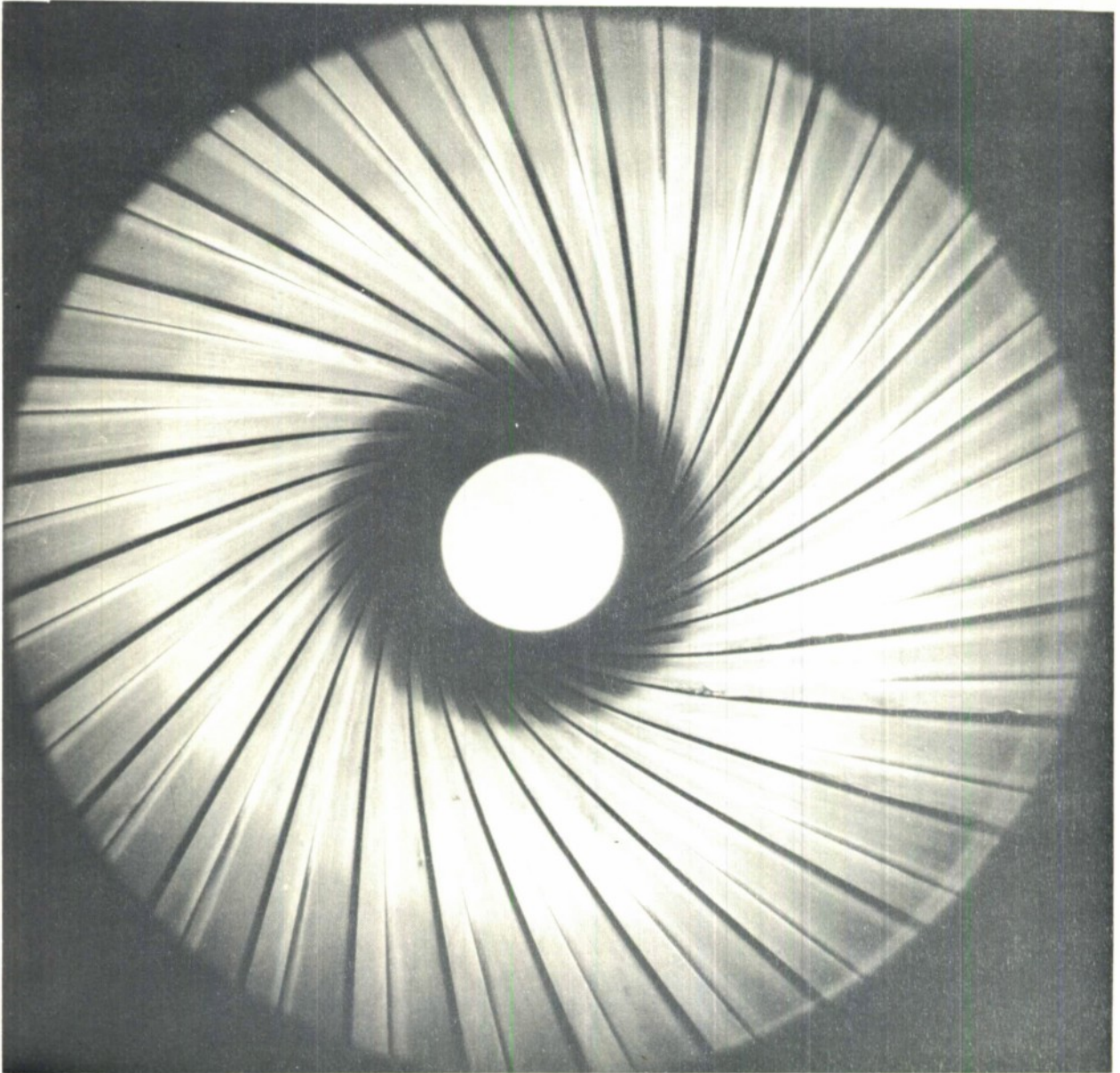
59T2321 Bore Photograph Showing Condition of Rifling at Origin, after Firing 87 Rounds.

D-10

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12:00 O'clock



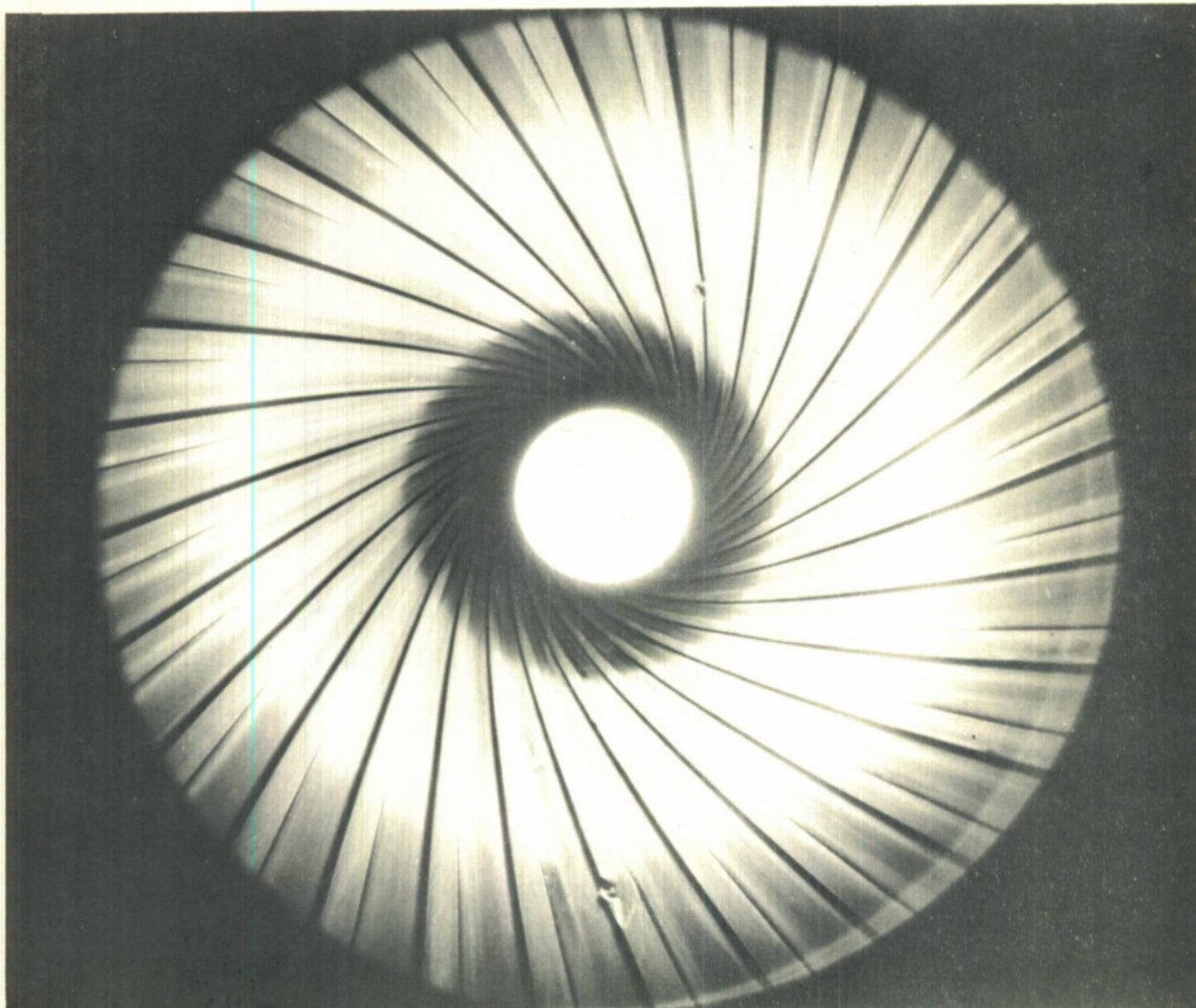
59T2322 Bore Photograph Showing Condition of Rifling from 147.00 in. to 160.00 in. from Rear Face of Tube, after Firing 87 Rounds.

D-11

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12:00 O'clock



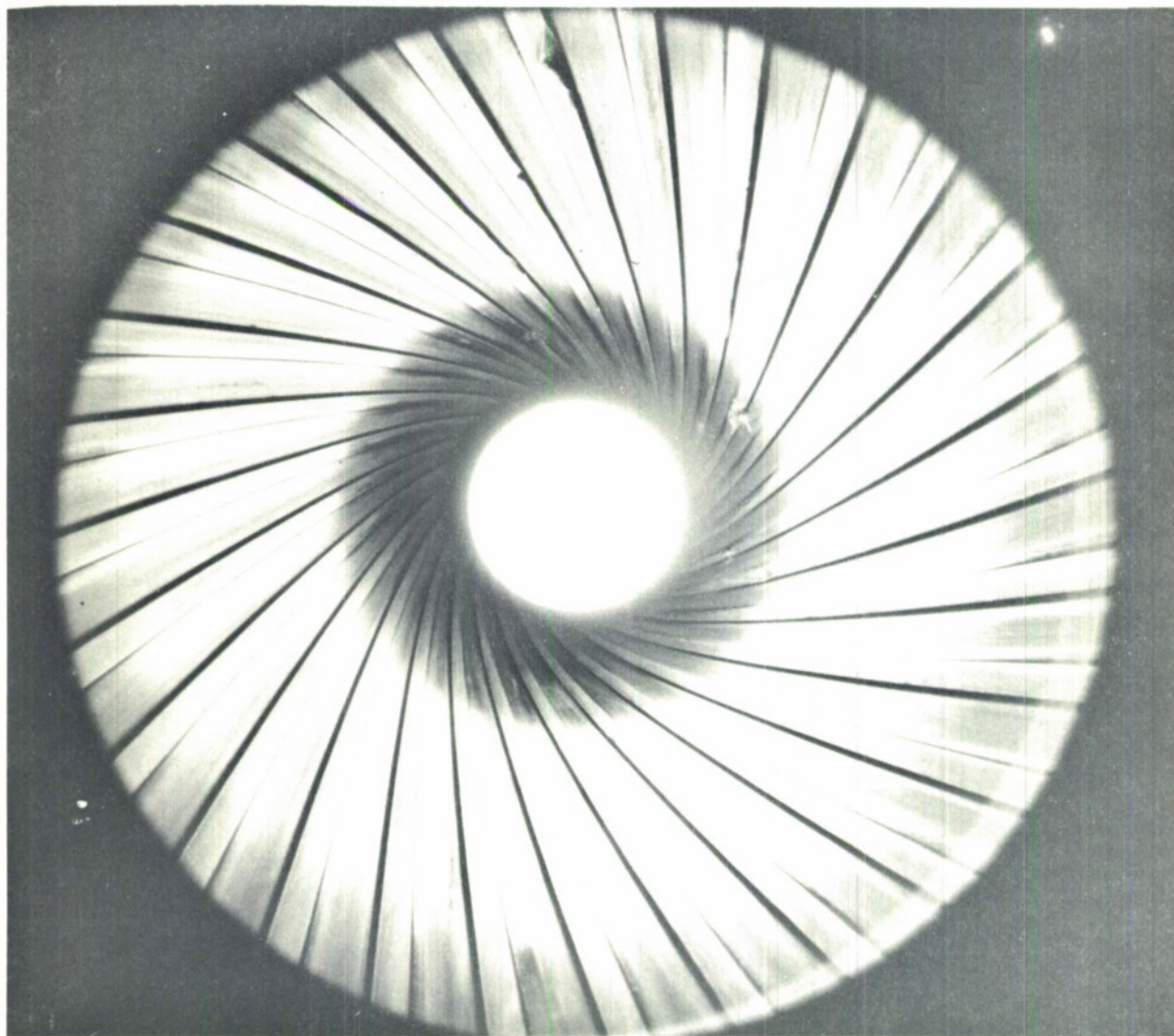
59T2323 Bore Photograph Showing Condition of Rifling from 170.00 in. to 178.00 in. from Rear Face of Tube, after Firing 87 Rounds.

D-12

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12:00 O'clock



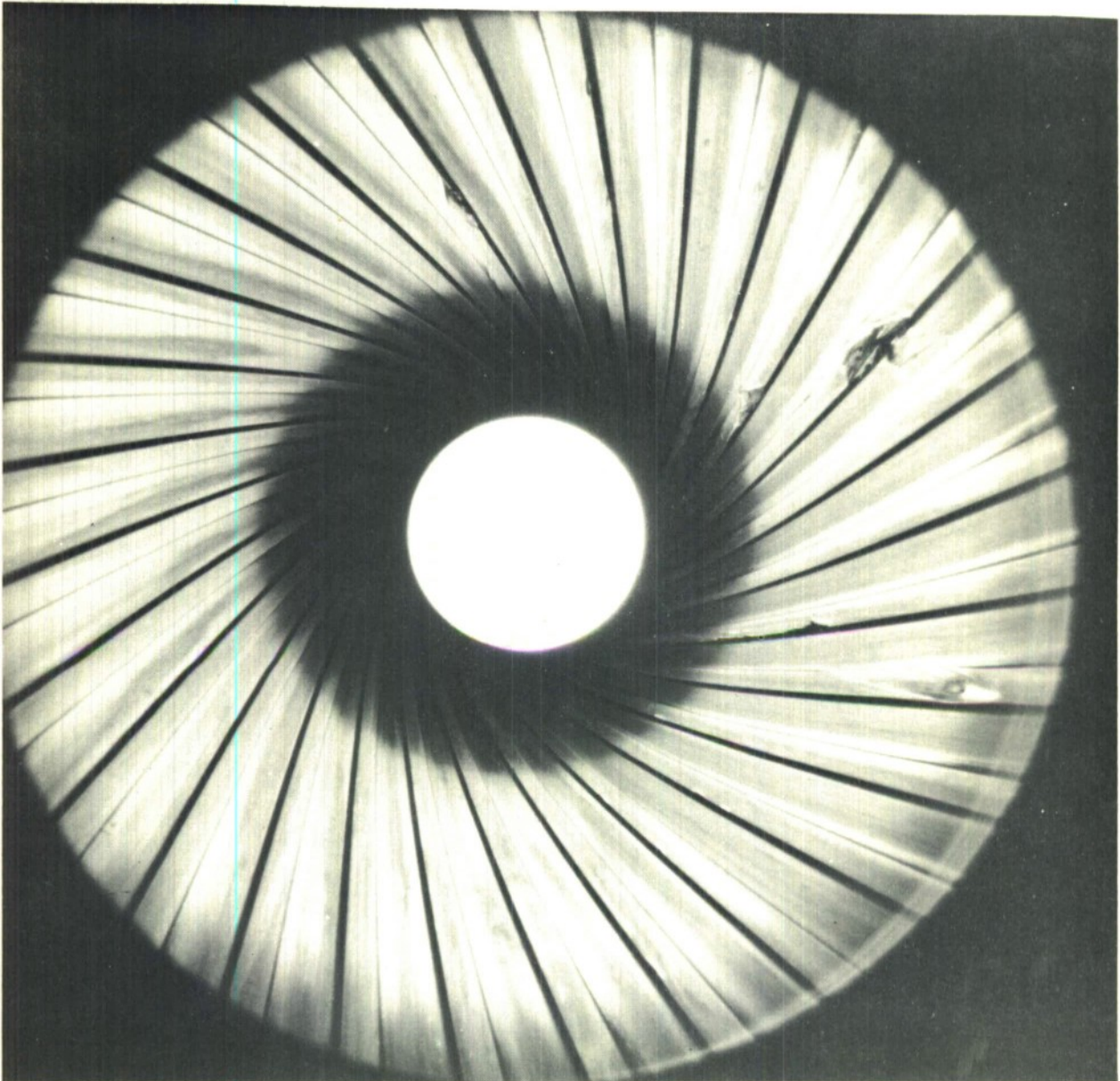
59T2324 Bore Photograph Showing Condition of Rifling from 178.00 in. to 184.00 in. from Rear Face of Tube, after Firing 87 Rounds.

D-13

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12:00 O'clock



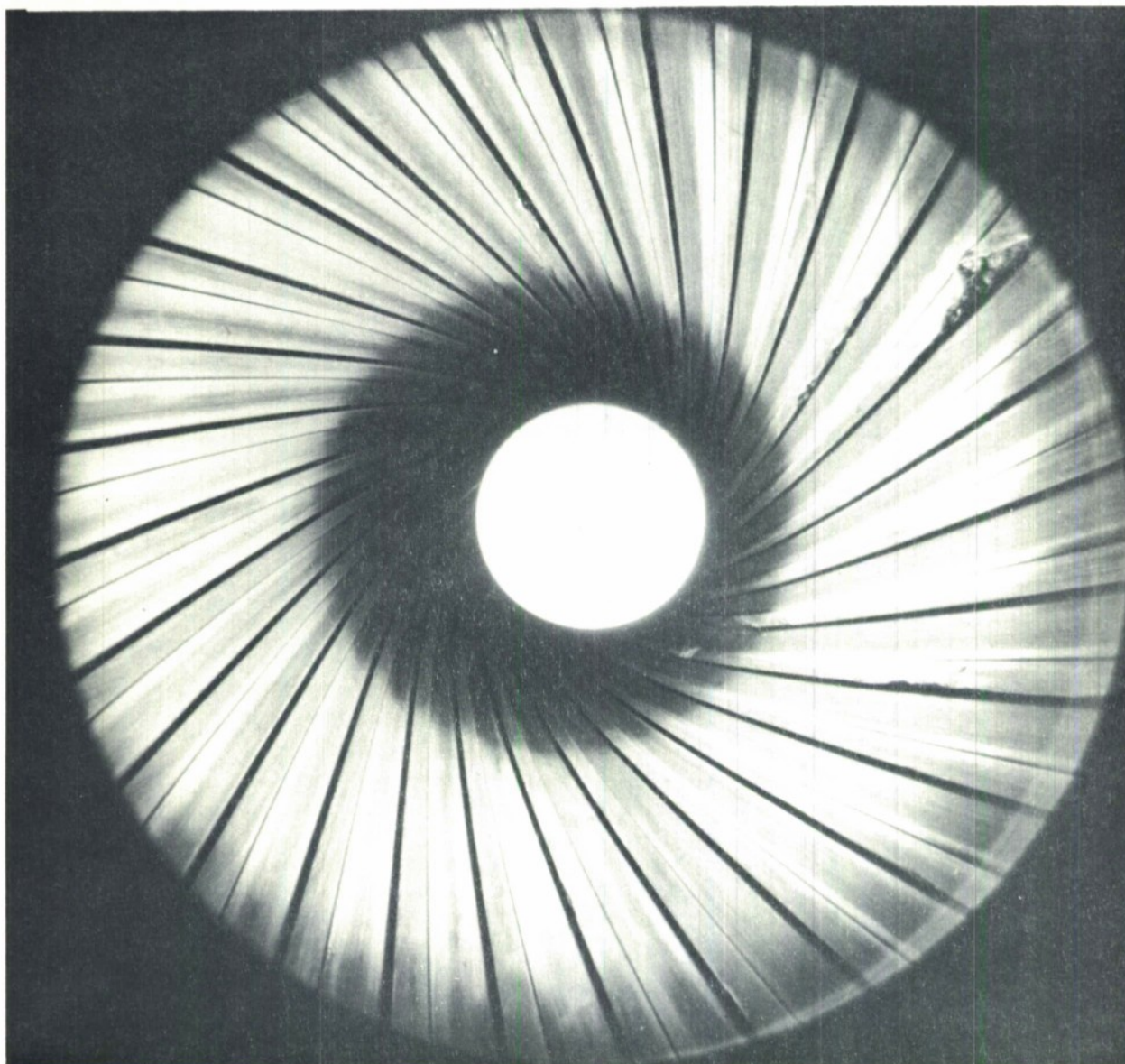
59T2325 Bore Photograph Showing Condition of Rifling from 184.00 in. to 190.00 in. from Rear Face of Tube, after Firing 87 Rounds.

D-14

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~~SECRET~~

12:00 O'clock



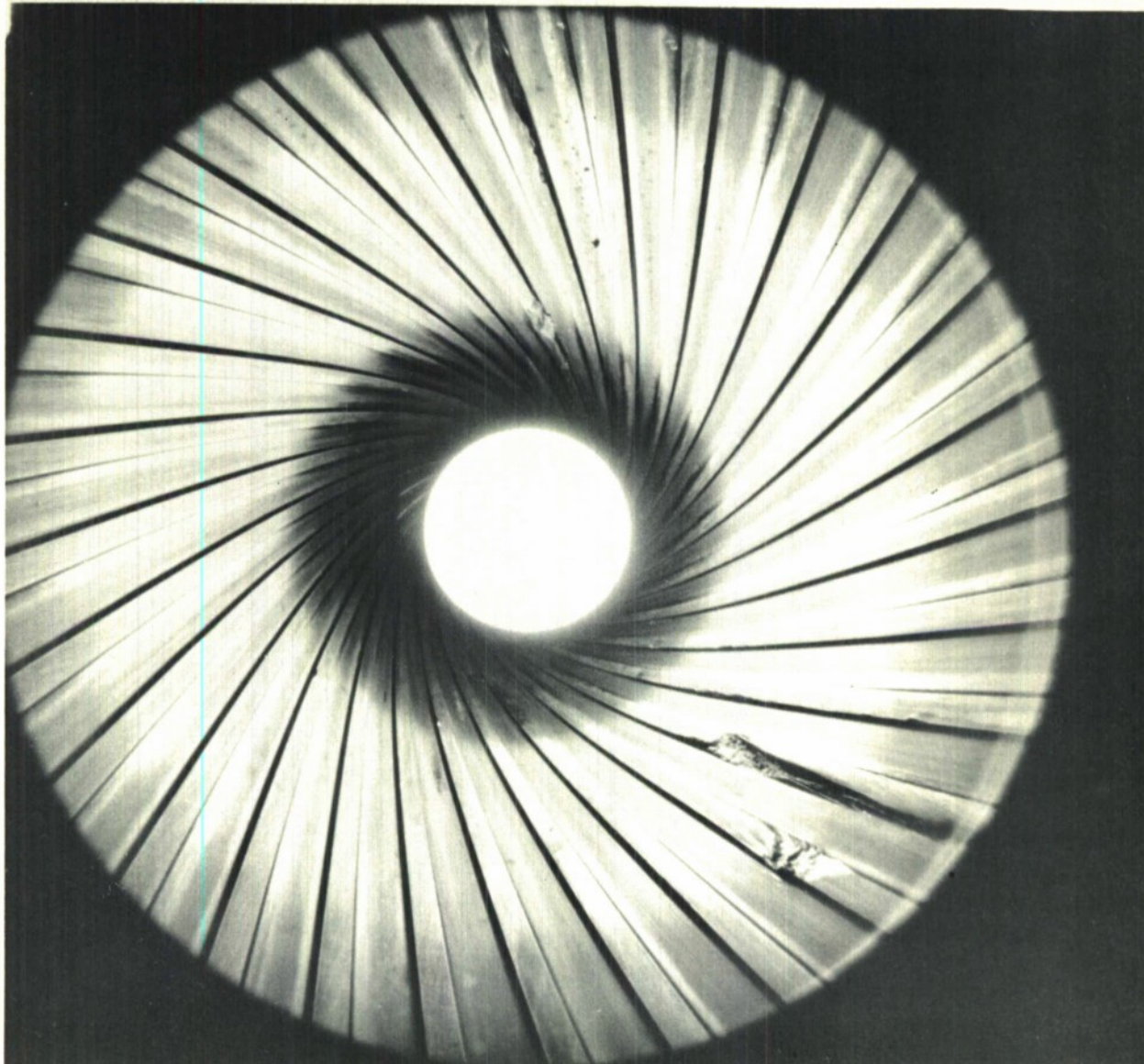
59T2326 Bore Photograph Showing Condition of Rifling from 190.00 in. to 198.00 in. from Rear Face of Tube, after Firing 87 Rounds.

D-15

~~SECRET~~

~~SECRET~~

12:00 O'clock



59T2327 Bore Photograph Showing Condition of Rifling from 198.00 in. to 206.00 in. from Rear Face of Tube, after Firing 87 Rounds.

D-16

~~SECRET~~

APPENDIX E

NAME-P.A. DOVER, N.J. ORDER FORM 43 7-26-58					Quatrochi		EXPERIMENTAL AMMUNITION DATA CARD		NO. 91190		
F. P. R. NO.		KIND								AMM. LOT NO.	
SPEC. NO.		Primer Electric, XM80 (Modified)								PA-E-29473	
										QUANTITY IN LOT	
										100	
DRG. NO. DXP-108327		DRG. DATE OR REV. 30 April 1959		ALLOT. ADVICE		PROJECT NO.		RAD OR EPO NO.		QUANTITY IN SHIPMENT	
										95	
P. A. X. O. 6171-31		PROP. CHARGE		EXPECTED M. V.		EXPECTED PRESSURE		ASSEMBLED BY PA		DATE OF ASSEMBLY June, 1959	

REMARKS: Packed: 15 Primers/cardboard carton; 4 cartons/wood box.
Ammunition lot released based upon satisfactory local line inspection. T42E1, Electric
Igniter used in lieu of XM59 Electric Igniter. Primer marked with rubber type in lieu
of Steel Type. *one primer defective due to lack of primer released*
By ENS.

COMPONENT	Body and	Igniter	Benite	Plug	Liner		
KIND	Head	Electric	Strands	Closing	Paper		
	Assembly	T42EL			Foil		
DRG. NO.	DXP-108329	P-85509	Spec. X	XP-97295	XP-108330		
DRG. DATE OR REV.	4-30-59	7-26-58	PA-PD-1741	unk	4-30-59		
MFG'D BY	Dice	PA	PA	unk	PA		
DATE	1959	1959	1959	unk	1959		
LOT NO.	086-1-5	PA-E-28928	PA-E-29408	none	None		

PREPARED BY G. Bromley CERTIFIED TO BY: WG Knapp, INSPECTOR
Ars Ops PICATINNY ARSENAL 204 Inspection
DIVISION DOVER, NEW JERSEY DIVISION

APPENDIX F

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