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AUTHORITY
NSWC notice dtd 29 Aug 1975; NSWC notice dtd 29 Aug 1975

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 962

INTERIOR BALLISTIC STUDIES

35th Partial Report

TANGENTIAL STRAIN MEASUREMENTS OF NAVAL GUNS FROM 3" to 16"

1st Partial Report

Copy No. 8

Task Assignment NPG-Re5a-30-1-52

Classification CONFIDENTIAL SECURITY INFORMATION

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Tangential Strain Measurements of Naval Guns from 3" to 16"

PART A

SYNOPSIS

1. This report is a compilation of strain gage records and their measurements, together with firing information such as propellant, projectile, gun wear, velocity, pressure and special conditions of test. It is the first of a series of reports, which, when completed will contain a relatively complete collection of barrel strain records taken at the Naval Proving Ground.

2. It is not intended in this report to determine the effects of test variables on barrel strain, but rather to provide a convenient source of background information to assist in studies involving strains in gun barrels.

Tangential Strain Measurements of Naval Guns from 3" to 16"

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Tangential Strain Measurements of Naval Guns from 3" to 16"

PART B

INTRODUCTION

1. AUTHORITY:

The work reported herein was conducted under Task Assignment No. NPG-Re5a-30-1-52 as established by reference (a). Specific authority for the investigation is contained in reference (b).

2. REFERENCES:

a. BUORD ltr NP9 (Re5a-30) of 8 June 1949
b. BUORD ltr NP9 (Re5a-JHM:cmj) Ser 12840 of 20 September 1951
c. NPG Report No. 23-43
d. NPG Report No. 5-45

3. BACKGROUND:

a. During the past several years, strain measurements have been made at the Naval Proving Ground in conjunction with various firing tests. In general, the results were included in the reports of these tests and not reported individually as strain gage tests. As a result, there are on hand a great number of records which, if assembled and correlated with the test information, would aid in future studies involving barrel strains.

b. By reference (b), the Bureau of Ordnance requested tangential strain gage records and associated firing information on a wide variety of guns, to serve as background information in connection with current and future studies of strains in gun barrels.

c. References (c) and (d) are Naval Proving Ground Reports on strain gage measurements.

4. OBJECT OF TEST:

a. The object of the investigation was the compilation and organisation of barrel strain information on a wide variety of guns and under varied test conditions together with reproductions of the applicable strain-time oscillograms.

PART C

DETAILS OF TEST

5. PROCEDURE:

a. The data reported herein were obtained during firings conducted under other test directives. These firings were conducted over a period of years dating back to 1943.

b. The strain records presented in this report were prepared and photographed immediately following the firing programs in which they were obtained and were reprinted for this report. In a great many instances they represent only a portion of the records taken on each program. The remainder of the records of these programs, as well as records from other programs, were never prepared for photographing. Presentation of the records from this second group will require considerable research in non-current files; it is contemplated that some or all of the additional information will be released in subsequent reports as time permits.

c. The system for obtaining barrel strain measurements has not fundamentally changed over the period of these tests. This system employs a resistance type strain gage (Baldwin SR-4) which is securely bonded to the barrel at the desired location and orientation. This gage forms one leg of a standard wheatstone bridge, the remainder of which is in the laboratory. The bridge output is amplified and applied across the deflection plates of a cathode ray tube. A recording camera is placed in front of the tube. Calibration is obtained by recording known resistance changes immediately before each firing test.

6. RESULTS AND DISCUSSION:

a. The tangential strain gage records for sixty-one (61) rounds on guns 16"/50, 16"/45, 6"/47, 5"/38 and 3"/70 are contained in Appendix (B) (16 photographs). The strain gage records fall into two distinct patterns. The "normal" pattern shows a rather abrupt rise in strain, the expansion reaching a plateau and declining much more slowly than it rose. The "abnormal" pattern differs in that the strain rises abruptly to a peak value often considerably higher than the plateau, and then falls back equally sharply to the plateau. The customary slow decline in strain then follows. The plateau strains are in general proportional to powder pressure, while the oversize of the rotating band is responsible for the peak strains.

b. The barrel strain measurements, together with firing information for each round, are tabulated in Appendix (B), Pages 1 through 9 inclusive. It is noted that a slightly different arrangement by rounds appears on the data sheets than on the records of Appendix (A). In arranging the data sheets, it was felt that the firing information could be more clearly presented by a grouping as to original firing programs, i.e., gun number and date. However, in reporting the projects for which the data was originally taken, it was desirable to group the rounds according to other criteria. A cross reference is provided at the bottom of each data sheet.

c. The Equivalent Service Rounds (E.S.R.) is given as an indication of the state of gun wear; these values are as of the completion of each program. The gage position column indicates the gage location as measured from the muzzle.

d. A large number of the strain measurements included in this report were fired in connection with studies of the effect of oily bores on band pressures. The column, "Conditions of Bore" indicates the type of oil, if any, with which the bore surface was coated.

Tangential Strain Measurements of Naval Guns from 3" to 16"

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CONFIDENTIAL

NPG REPORT NO. 962

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

59211

Thirty-fifth Partial Report

on

Interior Ballistic Studies

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First Partial Report

on

Tangential Strain Measurements of Naval Guns from 3" to 16"

Project No.: NPG-Re5a-30-1-52
Copy No.: 8
No. of Pages: 5

Date:

APR 26 1952

CONFIDENTIAL
SECURITY INFORMATION

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 5"/38 MK 12 MOD. 1

Gun No: 11557

Date: 1 & 2 JULY 1946

E. S. R. on Gun: SEE NOTES

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. MK	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μ in/in	Strain Data Plateau μ in/in	Notes
1 JULY											
1	SPDN 9818	15.22	35	3		2571	NS 3065	12"	1150	480	E.S.R.: 94.09 AT
6	↓	↓	↓	↓		2606	DRY	12"	—	460	COMPLETION OF
14	↓	↓	↓	↓		2599	OS 1647	24"	710	495	PROGRAM (20 Rds)
2 JULY											
1	SPDN 9818	15.22	35	3		2576	OS 1647	12"	1003	485	E.S.R.: 114.09 AT
4	↓	↓	↓	↓		2592	OS 1647	12"	945	470	COMPLETION OF
6	↓	↓	↓	↓		2603	DRY	12"	—	485	PROGRAM (20 Rds)
9	↓	↓	↓	↓		2596	DRY	12"	—	455	↓
11	↓	↓	↓	↓		2579	NS 3065	12"	980	360	↓
13	↓	↓	↓	↓		2576	NS 3065	12"	850	460	↓

STRAIN RECORDS ON NPG PHOTOS 33642 & 33587 (PRINTS 1 & 2)

①

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 5"/38 MK 12 MOD 1

Gun No: 4698

Date: 12 & 14 JUNE 1946

E.S.R. on Gun: SEE NOTES

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μin/in	Strain Data Plateau μin/in	Notes
12 JUNE											
2	SPDN 9818	15.22	35	3	14.0	2481	NS 3065	6"		445	E.S.R.: 1113.86 AT
14	↓	↓	↓	↓	14.3	2466	NS 1647	6"		440	COMPLETION OF
17	↓	↓	↓	↓	14.2	2454	DRY	6"		455	PROGRAM (20 RDS)
13 JUNE											
2	SPDN 9818	15.22	35	3	—	2478	OS 1647	6"		435	E.S.R.: 1153.86 AT
10	↓	↓	↓	↓	—	2463	DRY	6"			COMPLETION OF
15	↓	↓	↓	↓	—	2474	N.S. 3065	6"		440	PROGRAM (50 RDS)
25	↓	↓	↓	↓	—	2476	NS 3065	12"			↓
32	↓	↓	↓	↓	—	2460	NS 1647	12"		440	↓
37	↓	↓	↓	↓	—	—	DRY	12"		455	↓
14 JUNE											
4	SPDN 9818	15.22	35	3	—	2483	OS 1647	12"		445	ESR 1173.86 AT
6	↓	↓	↓	↓	—	2482	DRY	12"		460	COMPLETION OF
14	↓	↓	↓	↓	—	2470	NS 3065	12"		420	PROGRAM (20 RDS)
					STRAIN RECORDS ON NPG PHOTOS 33587 & 33641 (PRINTS 2&3)						
								②			

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 5"/38 MK 12 MOD 1

Gun No: 4186-8803-8325

Date: 16 & 22 JUNE, 17 JULY 1943

E.S.R. on Gun: SEE NOTES

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μin/in	Strain Data Plateau μin/in	Notes
16 JUNE											
1	IHBE 76	12.00	35	6		2237	—	24"	942	337	E.S.R: 1826 AT COMPLETION OF PROGRAM (20 RDS) GUN NO. 4186
22 JUNE											
1	IHBE 76	12.00	35	6		2236	—	24"	996	362	E.S.R: 1810 AT
2	↓	14.52	35	6		2606	—	24"	—	429	COMPLETION OF PROGRAM (21 RDS) GUN NO. 8325
17 JULY											
3	IHBE 76	11.4	35	3	12.0	2189	—	24"	725	345	E.S.R: 3986 AT
4	↓	11.4	31	E	11.7	2178	—	24"	465	345	COMPLETION OF PROGRAM (12 RDS) GUN NO. 8803
					STRAIN RECORDS ON NPG PHOTO 33639 (PRINT 4)						

(3)

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 3"/70 TYPE A MOD. 1

Gun No: 24462

Date: 31 & 17 OCT. 1946

E.S.R. on Gun: SEE NOTES

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μin/in	Strain Data Plateau μin/in	Notes
31 OCT											
1	PAE 1	7.73	Ex6	1	22.8	—	NS 3065	6"	2720	525	ESR 302.27 AT
2	↓	↓	Ex6	1	23.9	—	NS 3065	6"	1705	495	COMPLETION OF
3	↓	↓	32	0	23.2	—	NS 3065	6"	1580	480	PROGRAM (6 RDS)
17 OCT											
4	PAE 1	7.73	Ex6	1	—	3367	DRY	6"	—	550	ESR 271.27 AT
6	↓	↓	Ex6	1	—	3373	DRY	6"	—	525	COMPLETION OF PROGRAM (3 RDS)
											STRAIN RECORDS ON NPG PHOTOS 34001 & 34000 (PRINTS 5 & 6)

④

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 3"/70 TYPE B MOD. 0

Gun No: 24461

Date: 5 & 12 MARCH 1947

E.S.R. on Gun: SEE NOTES

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μin/in	Strain Data Plateau μin/in	Notes
5 MARCH											
1	PAE 1	7.75	32	0	21.2	3298	NS 3065	9"	4040	1175	ESR: 28.18 AT
2			32	0	21.6	3352	DRY			1085	COMPLETION OF
3			Ex6		20.7	3247	NS. 3065		3330	1060	PROGRAM (6 RDS)
4			6		20.7	3316	DRY			1040	
5			Ex6	1	20.4	3264	NS 3065		3650	1100	
6			6	1	20.5	3301	DRY			935	
7		7.77	32	0	21.7	3321	NS 3065	110"		455	
9			Ex6		21.0	3316	NS 3065			495	
11			Ex6	1	20.4	3275	NS 3065			490	
12 MARCH											
1	PAE 1	7.76	Ex6	1	22.4	—	NS 3065	9"	3100	1000	ESR: 42.18 AT
3			32	0	24.1	3468			1850	1000	COMPLETION OF
5			Ex6		22.9	3437			2440	950	PROGRAM (8 RDS.)
7			Ex6	1	22.2	3435			2890	1030	
	STRAIN RECORDS ON NRDF NOTOS 34541, 34542, 34543 & 34544 (PRINTS 7, 8, 9, 10)										
								(5)			

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 6"/47 MK 16 MOD 0

Gun No: 977

Date: 17 JAN 1946

E.S.R. on Gun: 1094.62

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μ in/in	Strain Data Plateau μ in/in	Notes
17 JAN											
3	NPF 8 241	32.40	36	1	13.3	2327	—	15"	—	470	ROUNDS ON
5	↓	↓	↓	↓	13.4	2331	—	15"	—	450	PROGRAM: 21
					PROJECTILES NOT SEATED						
					STRAIN RECORDS ON NPG PHOTO 33640 (PRINT 11)						

(4)

U. S. NAVAL PROVING GROUND

DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 6"/47 MK 16

Gun No: 1538

Date: 18 JULY 1946

E.S.R. on Gun: 220.19

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μin/in	Strain Data Plateau μin/in	Notes
18 JULY											
3	NPFB 241	23.46	34	7	–	2566	NS 3065	15"	1130	435	ROUNDS ON
6					–	2601	DRY	15"	–	440	PROGRAM (20)
15					–	2597	OS 1647	15"	670	455	
					STRAIN RECORDS ON APG PHOTO 33643 (PRINT 12)						

⑦

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 16"/50 MK 7

Gun No: 312 & 315

Date: 25 JUNE & 2 JULY 1943

E.S.R. on Gun: SEE NOTES

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μin/in.	Strain Data Plateau μin/in.	Notes
25 JUNE											ESR: 7.35 AT
1	IHIC 2	423	—	—	6.9	1725	—	36"	1369	348	COMPLETION OF PROGRAM. GUN No. 312 (19 RDS)
2 JULY											
1	IHIC 2	423	—	—	7.8	1757	—	36"	1240	185	ESR: 7.33 AT
8	↓	↓	9	1	7.4	1739	—	36"	1030	300	COMPLETION OF
9	↓	↓	9	1	6.7	1722	—	36"	950	300	PROGRAM.
10	IHFD 22	324	Ex 2	—	6.4	1904	—	36"	775	230	GUN No. 315
11	IHI-G2 A	↓	Ex 2	—	5.7	1790	—	36"	845	250	(19 RDS.)
			STRAIN RECORDS ON NPG PHOTOS 33637 & 33638 (PRINTS 13 & 14)								

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

INVESTIGATION OF TANGENTIAL BARREL STRAINS

Gun: 16"/45 MK 16 MOD 1

Gun No: 262

Date: 25 MAY 1943

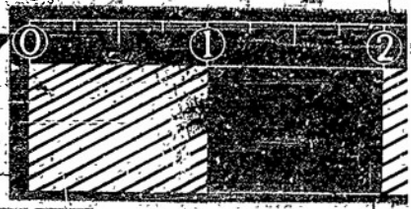
E.S.R. on Gun: 5.15

Other:

Rd.	Charge Index	Charge Wt. lbs.	Proj. Mk	Proj. Mod	Pres. (cu.) tons	Vel. ft/sec	Cond. of Bore	Gage Position	Strain Data Peak μin/in	Strain Data Plateau μin/in	Notes
1	SPD 3907	382	9	1	8.0	1743	-	60"	1090	386	REDUCED BAND DIA.
2		532	9		16.3	2276	-	60"	-	526	REDUCED BAND DIA
4		532	9		17.2	2292	-	60"	933	532	
5		532	9		16.9	2298	-	60"	983	498	
6		382	9		8.9	1791	-	60"	1156	397	
9		377	Ex.1		6.6	1905	-	60"	1109	381	
											ROUNDS ON PROGRAM (10)
		STRAIN RECORDS ON NPG PHOTOS								33635 & (PRINTS	33636 15 & 16)
								(9)			

N.P.G. Photo
#33642

Strain Gage Records
5"/38 Gun No. 11557
Service Rounds



1 July 1946
Gage 12" from muzzle
Oil N.S. 3065, Rd #1

1/60 Sec.

1 July 1946
Gage 12" from muzzle
Dry bore, Rd #6

1/60 Sec.

1 July 1946
Gage 24" from Muzzle
Oil O.S. 1647, Rd #14

1/60 Sec.

2 July 1946
Gage 12" from muzzle
Oil O.S. 1647, Rd #1

1/60 Sec.

2 July 1946
Gage 12" from muzzle
Dry bore, Rd #8

1/60 Sec.

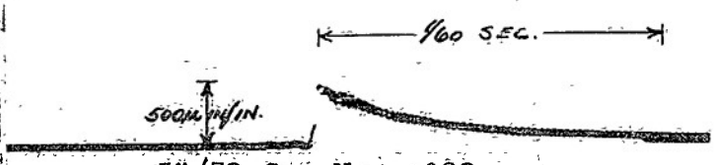
2 July 1946
Gage 12" from muzzle
Oil O.S. 3065, Rd #11

1/60 Sec.

N.P.G. Photo
#33587

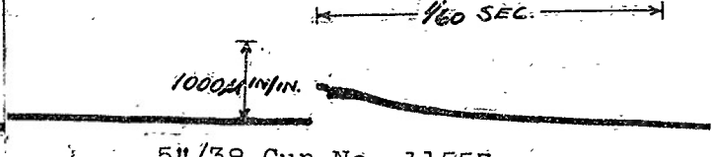
Strain Gage Records
5"/38 Guns
Service Rounds

5"/38 Gun No. 4698
12 June 1946
Gage 6" From Muzzle
Oil N.S. 3065, Rd. #2



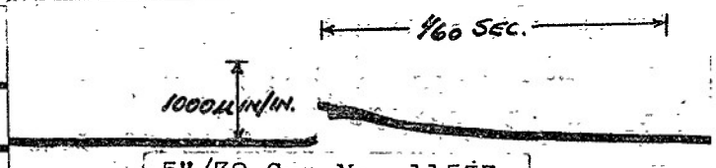
5"/38 Gun No. 4698
13 June 1946
Gage 12" From Muzzle
Dry Bore, Rd. #37

5"/38 Gun No. 4698
12 June 1946
Gage 6" From Muzzle
Oil O.S. 1647, Rd. #14

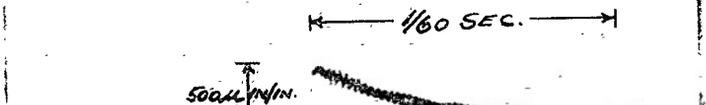


5"/38 Gun No. 11557
2 July 1946
Gage 12" From Muzzle
Oil N.S. 3065, Rd. #13

5"/38 Gun No. 4698
12 June 1946
Gage 6" From Muzzle
Dry Bore, Rd. #17



5"/38 Gun No. 11557
2 July 1946
Gage 12" From Muzzle
Oil O.S. 1647, Rd. #4



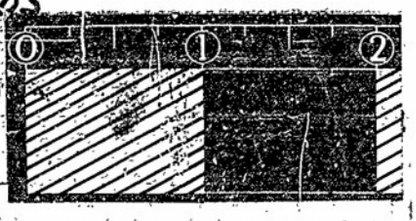
5"/38 Gun No. 4698
13 June 1946
Gage 12" From Muzzle
Oil N.S. 3065, Rd. #25

5"/38 Gun No. 11557
2 July 1946
Gage 12" From Muzzle
Dry Bore, Rd. #6

5"/38 Gun No. 4698
13 June 1946
Gage 12" From Muzzle
Oil O.S. 1647, Rd. #32

N.P.G. Photo #33641

Strain Gage Records
5"/38 Gun No. 4698
Service Rounds



13 June 1946
Gage 6" from muzzle
Oil O.S. 1647, Rd #2

1/60 Sec.

13 June 1946
Gage 6" from muzzle
Dry bore, Rd #10

1/60 Sec.

13 June 1946
Gage 6" from muzzle
Oil N.S. 3065, Rd #15

1/60 Sec.

14 June 1946
Gage 12" from muzzle
Oil O.S. 1647, Rd #4

1/60 Sec.

14 June 1946
Gage 12" from muzzle
Dry bore, Rd #6

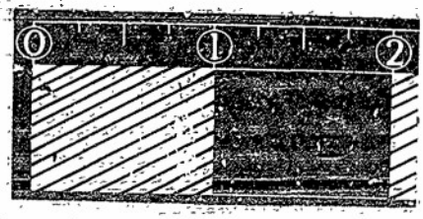
1/60 Sec.

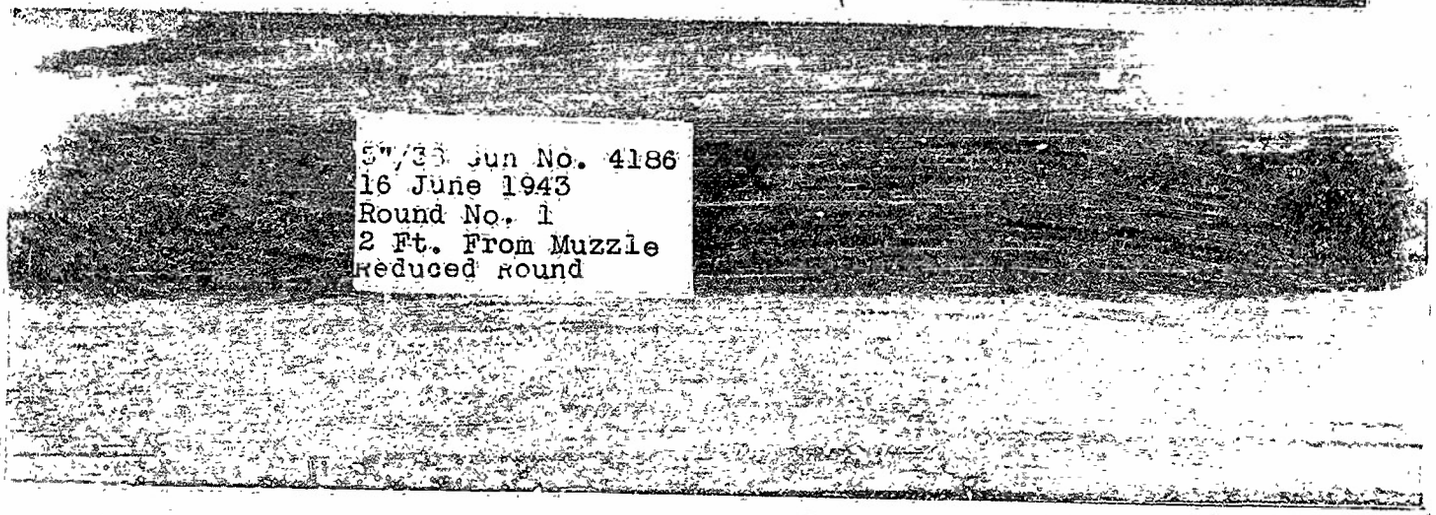
14 June 1946
Gage 12" from muzzle
Oil N.S. 3065, Rd #14

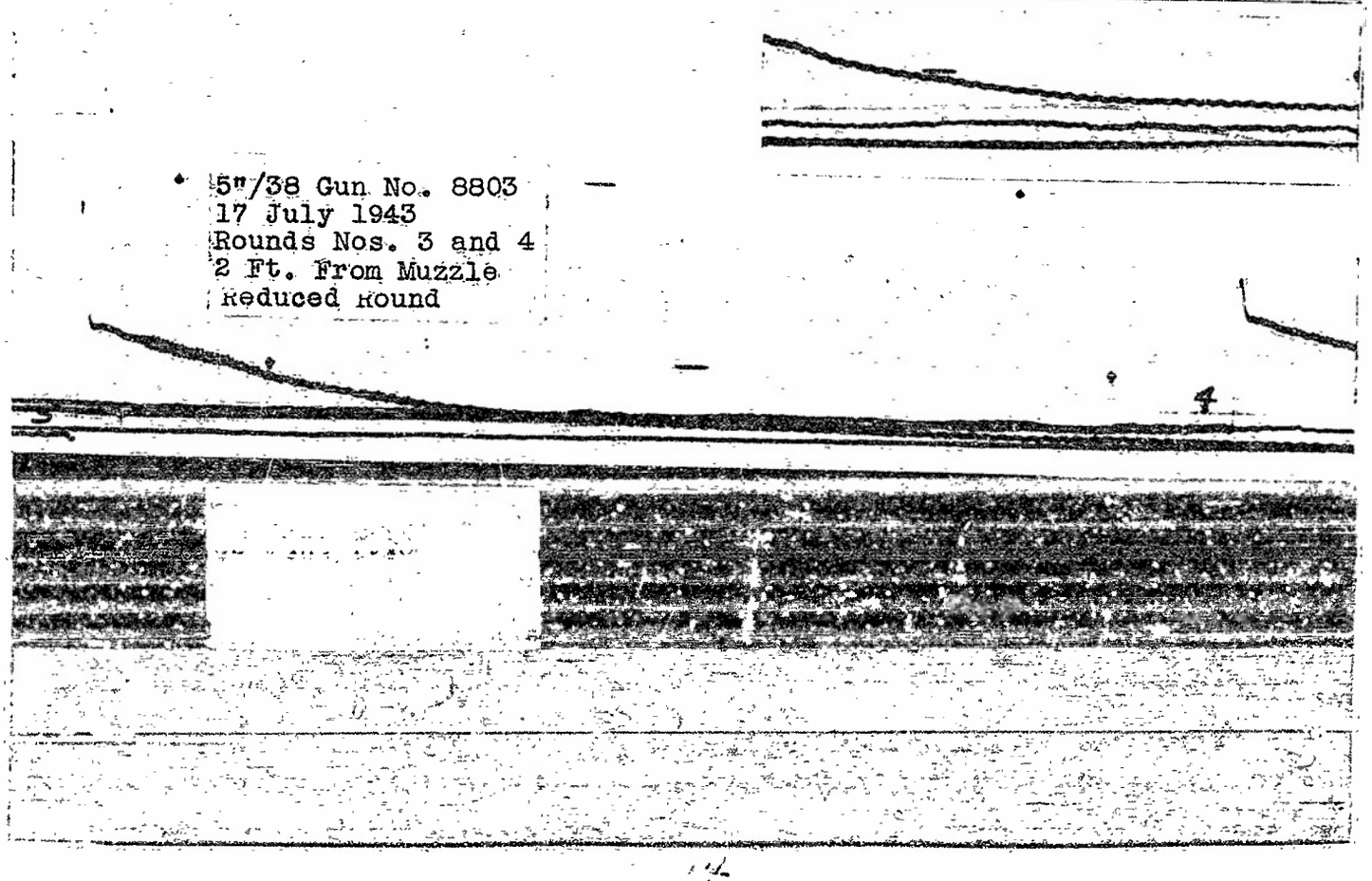
1/60 Sec.

N.P.G. Photo
#33639

Strain Gage Records
5"/38 Guns



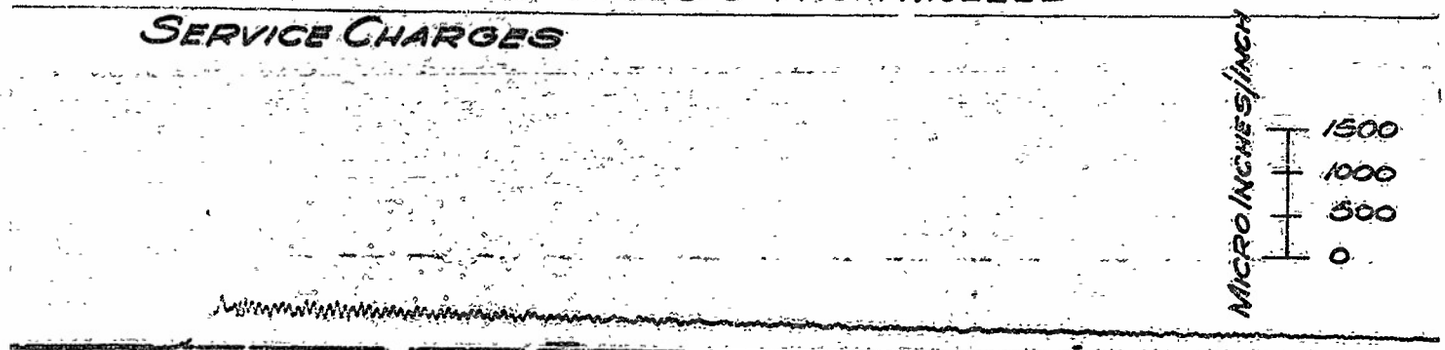




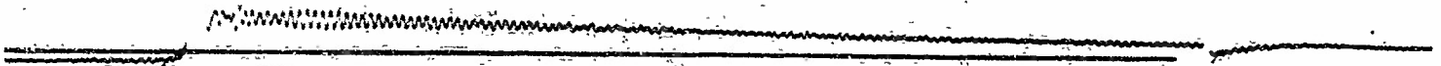
N.P.G. 34001

STRAIN MEASUREMENTS
3"/70 GUN #24462
31 OCT. 1946

OILY BORE N.S 3065
CIRCUMFERENTIAL GAGES 6" FROM MUZZLE
SERVICE CHARGES

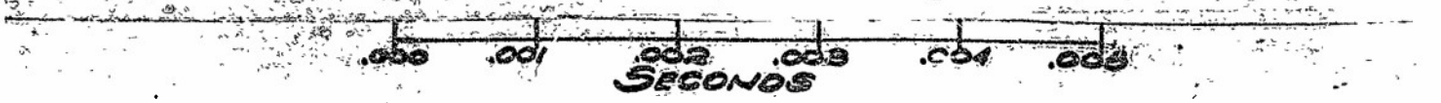


RD. #3 PROJECTILE MK. 32



RD. #2 PROJECTILE EX 6

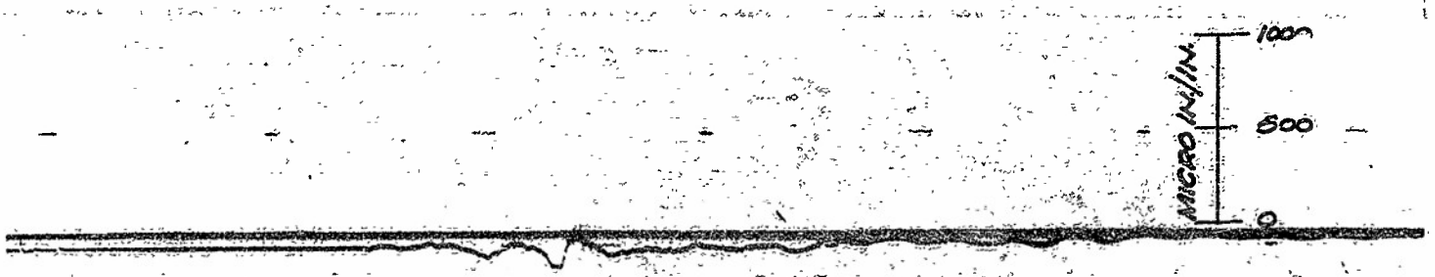
RD. #1 PROJECTILE EX 6 MOD. 1



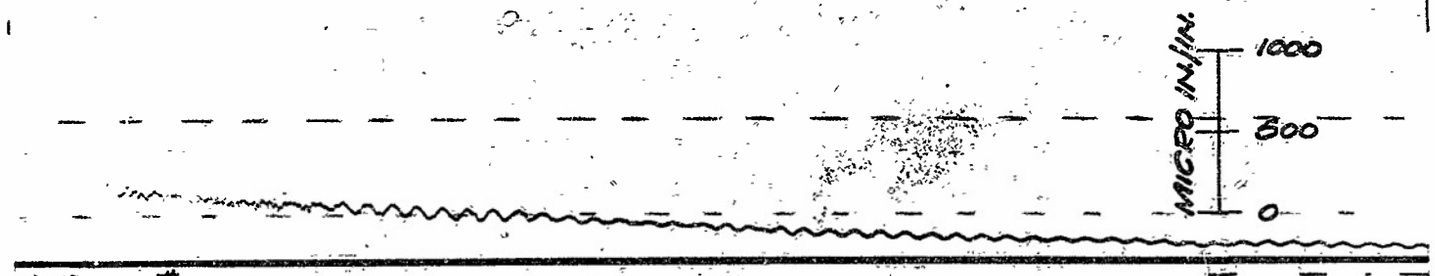
NPG 34000

STRAIN MEASUREMENTS
3"/70 GUN #24462
17 OCT. 1946

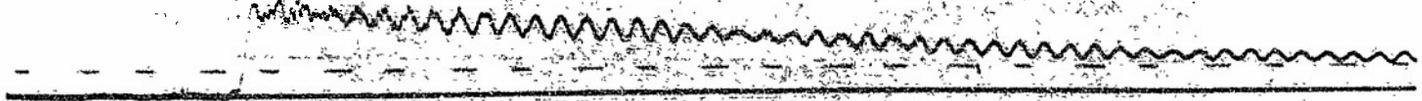
DRY BORE
SERVICE CHARGES



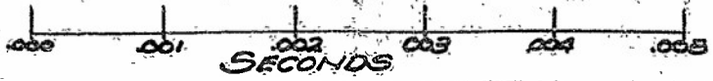
RD #7 LONGITUDINAL GAGE 15" TO 28" FROM MUZZLE
PROJECTILE EX6



RD #6 CIRCUMFERENTIAL GAGE 6" FROM MUZZLE
PROJECTILE EX6 MOD. 1



RD #4 CIRCUMFERENTIAL GAGE 6" FROM MUZZLE
PROJECTILE EX6 MOD. 1

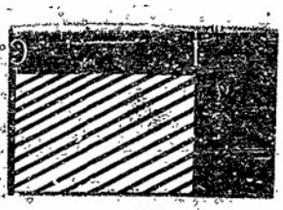


NDRC 24641

STRAIN MEASUREMENTS

3"/70 GUN No. 24461

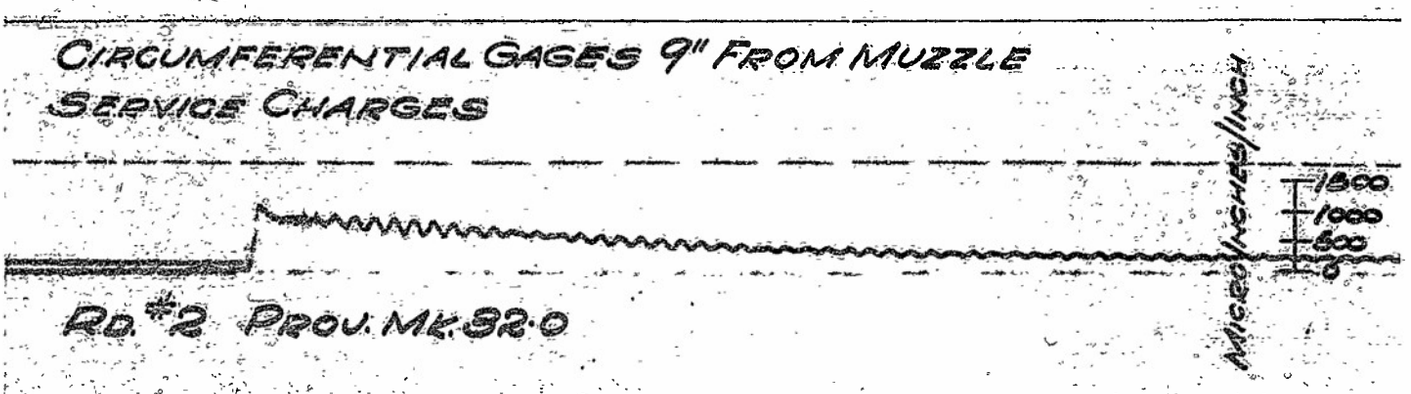
5 MARCH 1947



DRY BORE

CIRCUMFERENTIAL GAGES 9" FROM MUZZLE

SERVICE CHARGES



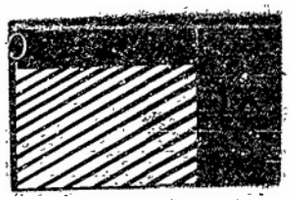
Rd. #2 Proj. Mk. 32-0

Rd. #1 Proj. Mk. 6

Rd. #6 Proj. Mk. 6-1

NDG 34542

STRAIN MEASUREMENTS
3"/70 GUN No. 24461
5 MARCH 1947



OILY BORE NS 3065

CIRCUMFERENTIAL GAGE 110" FROM MUZZLE

SERVICE CHARGES

MICRO INCHES/INCH

1000
500
0

Rd. #7 PROJ. MK. 32-0

Rd. #9 PROJ. EX6

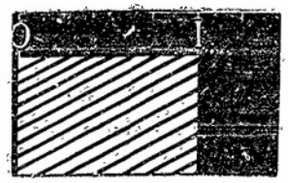
Rd. #11 PROJ. EX6-1

.000 .001 .002 .003 .004 .005

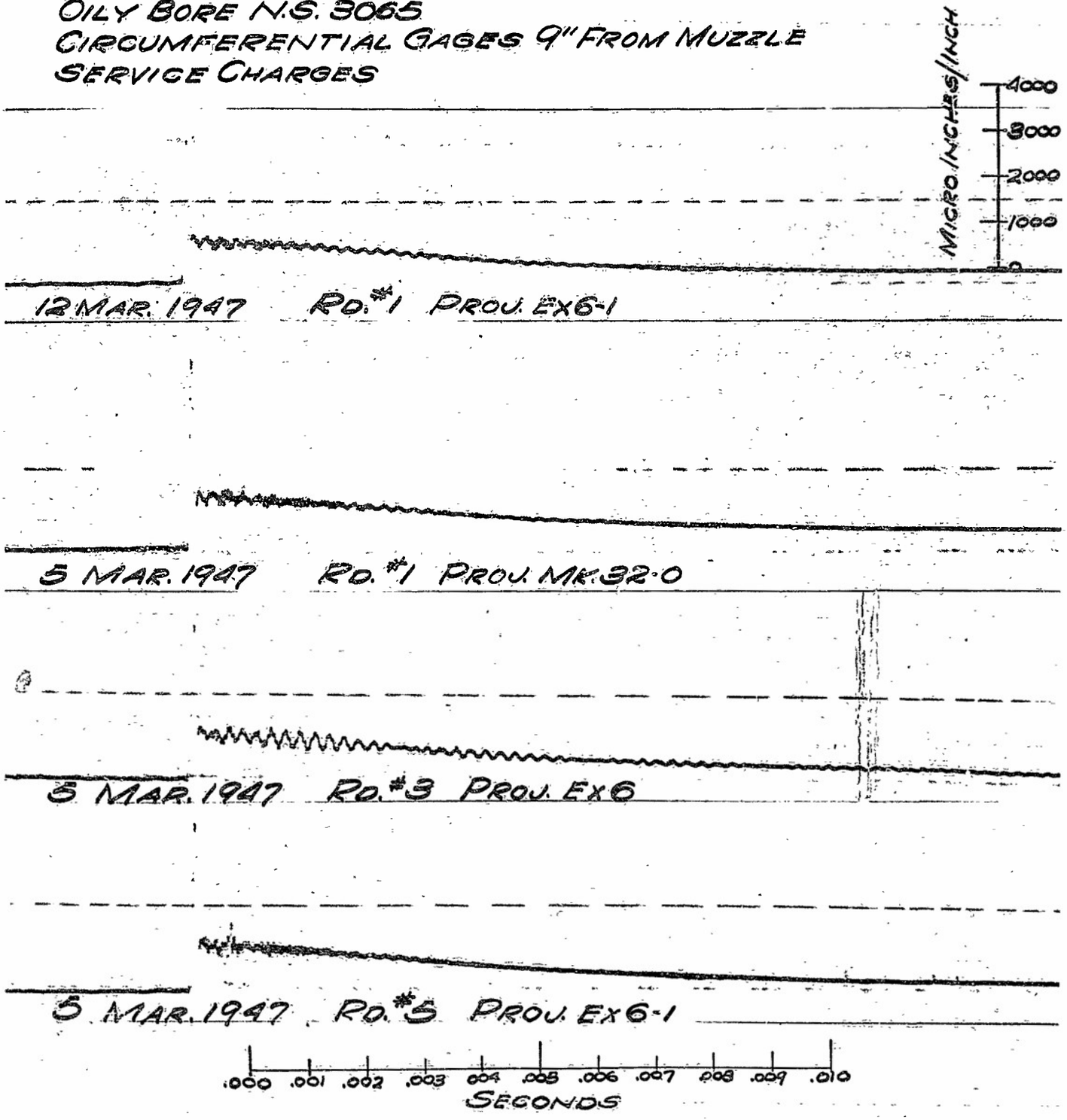
SECONDS

NPG 34543

STRAIN MEASUREMENTS
3"/70 GUN NO. 24461

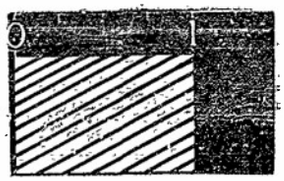


OILY BORE N.S. 3065
CIRCUMFERENTIAL GAGES 9" FROM MUZZLE
SERVICE CHARGES



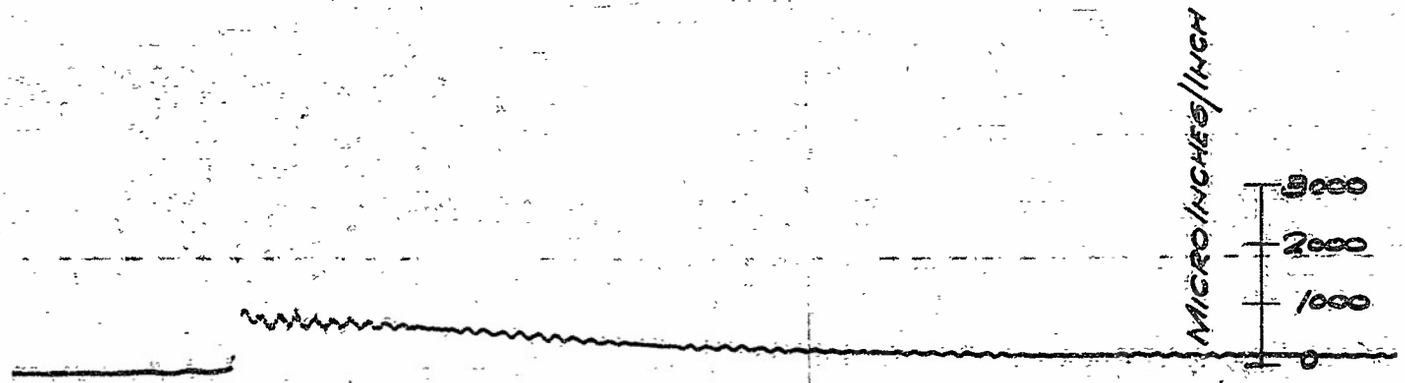
NPG 34544

STRAIN MEASUREMENTS
3"/70 GUN NO. 24461
12 MARCH 1947



OILY BORE NS 3065
CIRCUMFERENTIAL GAGES 9" FROM MUZZLE

SERVICE CHARGES



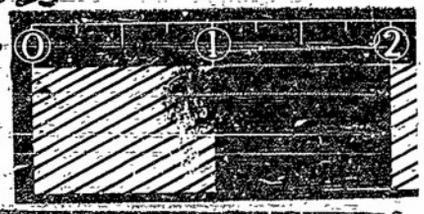
RD. #3 PROJ. MK. 32-0

RD. #5 PROJ. EX. 6

RD. #7 PROJ. EX 6-1

N.P.G. Photo
#33640

Strain Gage Records
6"/47 Gun No. 977



1/60 Sec.

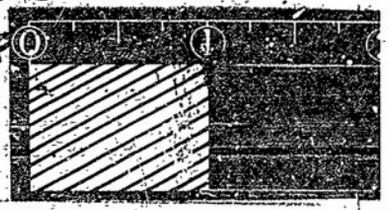
6"/47 Gun No. 977
17 January 1946
Round No. 3
15 in. From Muzzle
Service Round

1/60 Sec.

6"/47 Gun No. 977
17 January 1946
Round No. 5
15 in. From Muzzle
Service Round

N.P.G. PHOTO
33643

STRAIN GAGE RECORDS
6"/47 GUN NO. 1538
SERVICE ROUNDS



1/60 SEC

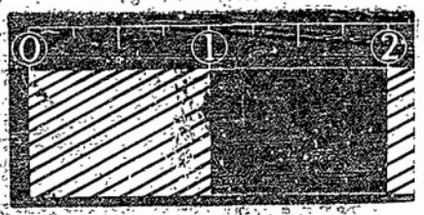
18 July 1946
Gage 15" from muzzle
011 N.S. 3065, Rd #3

18 July 1946
Gage 15" from muzzle
Dry bore, Rd #6

18 July 1946
Gage 15" from muzzle
011 O.S. 1647, Rd #15

N. P. G. Photo
#33637

Strain Gage Records
16"/50 Guns



16"/50 Gun No. 312
25 June 1943

100 Sec.

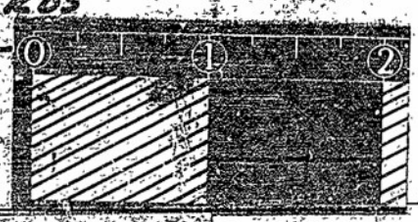
16"/50 Gun No. 315
2 July 1943
Round No. 1
3 Ft. From Muzzle
Reduced Round

①

16"/50 Gun No. 315
2 July 1943
Round No. 8
3 Ft. From Muzzle
Reduced Round

N.P.G. Photo
#33638

Strain Gage Records
16"/50 Gun No. 315



16"/50 Gun No. 315
2 July 1943
Rounds Nos. 9 and 10
3 Ft. From Muzzle
Reduced Round

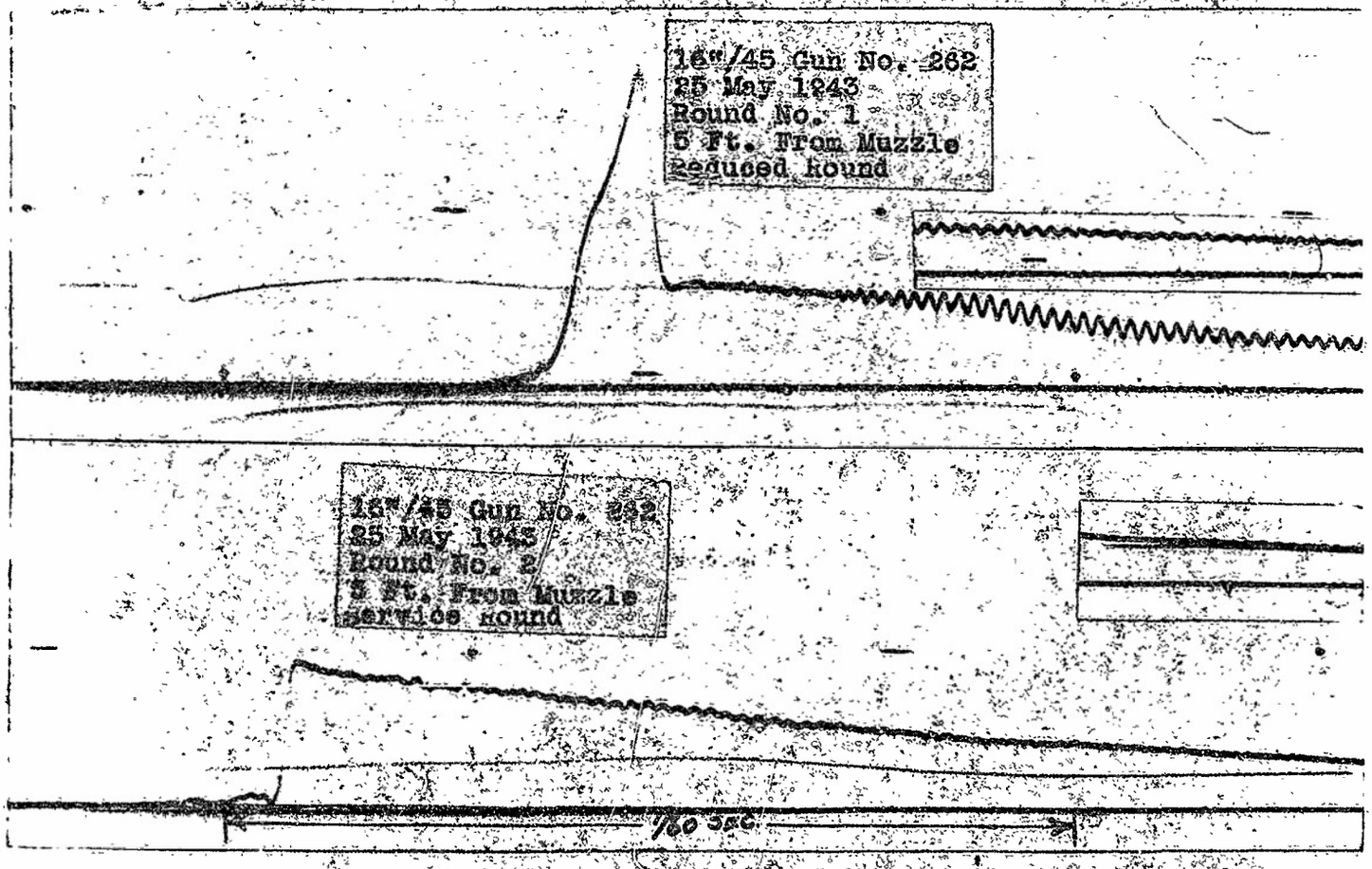
10

9

16"/50 Gun No. 315
2 July 1943
Round No. 11
3 Ft. From Muzzle
Reduced Round

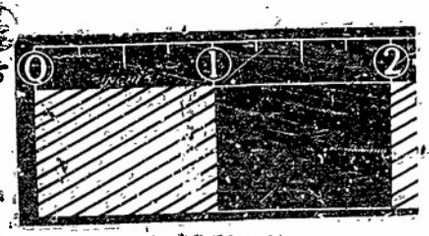
N.P.G. PHOTO
#33635

STRAIN GAGE RECORDS
16"/45 GUN NO. 262



N.P.G. PHOTO #33636

STRAIN GAGE RECORDS 16"/45 GUN NO. 262



16"/45 Gun No. 262
25 May 1943
Round No. 4
5 Ft. From Muzzle
Service Round

16"/45 Gun No. 262
25 May 1943
Round No. 5
5 Ft. From Muzzle
Service Round

16"/45 Gun No. 262
25 May 1943
Round No. 6
5 Ft. From Muzzle
Reduced Round

16"/45 Gun No. 262
25 May 1943
Round No. 9
5 Ft. From Muzzle
Reduced Round

Tangential Strain Measurements of Naval Guns from 3" to 16"

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