

FR-1221

REPORT NO. B-1221

DATE 5 December 1935

SUBJECT

Report on  
Bells, Vibrating, 3-inch and 10-inch

Submitted by

Chas. Cory Corporation  
745 Lexington Avenue  
Brooklyn, N. Y.

by

J. S. Bryant  
W. B. Roberts

Naval Research Laboratory  
Office of Naval Research  
Navy Department  
Washington 25, D. C.

APPROVED FOR PUBLIC  
RELEASE - DISTRIBUTION  
UNLIMITED

5 December 1935

NRL Report No. B-1221

NAVY DEPARTMENT  
BUREAU OF ENGINEERING

Report

Bells, Vibrating, 3-inch and 10-inch

Submitted by

Chas. Cory Corporation

745 Lexington Avenue

Brooklyn, N. Y.

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON, D. C.

Number of Pages: Text - 6            Plates - 4

Authorization: BuEng. ltr. S65-4/L5 (10-10-Ds) of 12 October 1935.

Date of Tests: October and November 1935.

Tested by: \_\_\_\_\_  
J.S. Bryant, Senior Engineering Aide.

Prepared by: \_\_\_\_\_  
W.B. Roberts, Principal Engineering Aide,  
Chief of Section.

Reviewed by: \_\_\_\_\_  
W.M. Haynsworth, Jr., Lieutenant, USN

Approved by: \_\_\_\_\_  
H.M. Cooley, Captain, USN, Director.

Distribution:  
BuEng. (5)

ejj

DEC 11 1935

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>PAGE</u>
1. Authorization for Test .....	1
2. Object of Test .....	1
3. Abstract of Test .....	1
(a) Conclusions .....	1-a
(b) Recommendations .....	1-b
4. Description of Material under Test .....	2
5. Method of Test .....	3
6. Results of Test .....	3
7. Comments on Results of Test .....	5
8. Conclusions .....	6

APPENDICES

Photograph of 10-inch Bell, Assembled .....	Plate 1
Photograph of 10-inch Bell, Disassembled .....	" 2
Photograph of 3-inch Bell, Assembled .....	" 3
Photograph of 3-inch Bell, Disassembled .....	" 4

### AUTHORIZATION FOR TEST

1. This problem was authorized by reference (a) and other references pertinent to this problem are listed as references (b), (c) and (d).

Reference: (a) BuEng. ltr. S65-4/L5 (10-10-Ds) of 12 October 1935.  
(b) Navy Dept. Specs. SGS(65)-102 of 2 January 1935.  
(c) Navy Dept. Specs. 17S11a of 1 April 1931.  
(d) USS YORKTOWN and USS ENTERPRISE (CV5-CV6) bells for I.C. system.

### OBJECT OF TEST

2. The object of this test was to determine how closely the 3-inch and 10-inch vibrating type bells comply with the specifications, references (b) and (c), and their suitability for use on the USS YORKTOWN and the USS ENTERPRISE (CV5-CV6).

### ABSTRACT OF TEST

3. The subject bells as received were first set up in standard test circuits and their current consumption and power factor measured, while operating at rated voltage and frequency. The usual tests for endurance and temperature rise of the windings at ambient temperature of 40°C. then followed. Each was then tested for shock integrity, inclination at over and under voltage and frequency, watertight integrity, audibility range, insulation resistance and dielectric strength. The test was concluded with an inspection of the materials, design and workmanship.

### Conclusions

(a) These bells are of good design and first class workmanship. Under test they complied with the major requirements of specifications, reference (b), with the exception of the size of the gongs. However, it is understood that this contract was awarded prior to the writing of these specifications. In view of this, the bells would be acceptable under specifications, reference (c), if modified in accordance with paragraphs 23 and 24.

(b) The sound output of these bells compares favorably with those of the 4-inch and 8-inch bells, tested and reported in NRL Report No. B-1174 of 10 July 1935.

Recommendations

(a) It is recommended that these bells be approved only for use on ships CV5 and CV6, subject to correction of defects noted under paragraphs 23 and 24 of this report, due to 3-inch and 10-inch bells not being acceptable under the latest specifications.

## DESCRIPTION OF MATERIAL UNDER TEST

4. Two bells, one 3-inch, Cory Plan No. CAL-740-1A5, and one 10-inch, Cory Plan No. CAL-740-4A5, were submitted for test. They are intended for installation in interior communication systems on the USS YORKTOWN and the USS ENTERPRISE (CV5 and CV6).

5. Each bell is of the vibrating type and designed for 115 volts, a.c., 60 cycles.

6. The magnetic circuit consists of a "U"-shaped, laminated core and a solid armature of rectangular cross section.

7. The laminated core supports two windings, connected in series. The total resistance of the coils by bridge at ambient temperature of 40°C. is 32.62 ohms for the 3-inch bell and 32.50 for the 10-inch bell. Each coil is held on its respective pole piece by bending over the outside laminations. They are of form wound enameled wire, bound with cotton thread and impregnated with insulating varnish.

8. The armature of each bell is provided with two (2) locking adjustments, one a contact which limits the stroke away from the poles; the other a spring to return the armature to its normal position.

9. A terminal strip of molded phenolic material is equipped with two (2) Navy terminal lugs and a bracket for supporting a flat contact spring. The spring is slotted at the unsupported end to fit an insulating bushing, riveted to the armature. There is some clearance in the bushing so that the armature may move further toward, and away from, the poles than the contact carrying spring.

10. The contacts are tungsten and are shunted by two (2) fixed resistors connected in series and having a total resistance of approximately 1280 ohms.

11. The striker arm is a bent piece of steel rod threaded to fit the steel striker ball. Where the arm enters the case cover, a water-tight packing gland of cadmium plated steel is provided. The striker ball, which may be adjusted by turning, is provided with a locknut and forms the only external adjustment of the bell. The entire mechanism is mounted on the aluminum alloy case cover.

12. A cast steel bracket is secured to a boss on the case cover by a tapered steel pin, threaded at one end to accommodate a locknut. The other end of the bracket is provided with a square boss, fitting a hole in the bell gong and preventing its turning.

13. The gongs, 3-inch and 10-inch diameter and of cast bell material, are clamped to their brackets by brass cap screws, nickel plated, having cadmium plated steel washers and lockwashers.

14. All internal metallic parts, with exception of the laminated core, are protected against corrosion by nickel or cadmium plating.

15. The case is also of cast aluminum alloy, having four (4) mounting lugs and two (2) external bosses, one tapped for a 3/4-inch Navy terminal tube. The case cover is secured with six (6) 1/4-inch - 20 oval fillister head cadmium plated steel machine screws, used as through bolts and provided with cadmium plated steel washers and nuts.

16. Four (4) circular "V"-shaped edges, cut in the case cover, imbed themselves in the rubber gasket, recessed in the case, when the cover is bolted down.

#### METHOD OF TEST

17. The bells, manufacturer's adjustment unchanged, were first tested for current consumption and power factor and then subjected to shock tests, outlined in paragraph F-5c of SGS(65)-102.

18. Without readjusting, they were tested for endurance by placing them in a compartment having an ambient temperature of 65°C., and operating them one minute every alternate minute for 24 hours. The ambient temperature was then reduced to 40°C., and the test continued for an additional 24 hours. During this test the temperature rises of the windings were obtained by the resistance method.

19. Both bells were then tested for satisfactory operation at over and under voltage and frequency when inclined 30° from the vertical in all planes.

20. The usual tests for insulation resistance, dielectric strength, audibility range, sound output, and watertight integrity, were then made.

21. The test was concluded with a careful examination of the design and quality of workmanship and materials.

#### RESULTS OF TEST

22. The results given below were obtained when the bells were tested for conformance with specifications SGS(65)-102 and 17S11a.

<u>Requirements</u>	<u>Test Values</u>	
	<u>3-inch Bell</u>	<u>10-inch Bell</u>
Voltage: 115 volts	115 volts	115 volts
Current: Alternating	Alternating	Alternating
Frequency: 60 cycles	60 cycles	60 cycles

<u>Requirements</u>	<u>Test Values</u>	
	<u>3-inch Bell</u>	<u>10-inch Bell</u>
Amperes:	0.185 amps.	0.215 amps.
Watts: Not over 15 watts for 4-inch bell nor 20 watts for 8-inch.	11.6 watts	12.0 watts
Power factor: Not less than 30%.	54.5%	48.5%
Sound output in decibels, measured at 18 feet in sound-proof room, using General Radio noise meter, type 559-A.	46 db.	58 db.
Endurance: Shall operate one minute every alternate minute for 24 hours at ambient temperature of 65°C. and 24 hours at 40°C.	Satisfactory	See Comments, par. 23.*
Temperature rise: Shall not exceed 30°C. at ambient temperature of 40°C. during endurance test.	13.18°C.	13.45°C.
Shock test: Shall be tested as specified in par. F-5c.	Satisfactory under all tests.	Satisfactory under all tests.
Inclination: Shall operate satisfactorily in any plane 30° from the vertical at over and under voltage and frequency.	Satisfactory under all tests.	Satisfactory under all tests.
Dielectric test: Shall withstand 1230 volts, a.c., 60 cycles, for a period of one minute applied before, and 500 volts, a.c., 60 cycles applied for one minute after the immersion test.	Satisfactory under all tests.	Satisfactory under all tests.
Insulation resistance: Shall be not less than 5 megohms upon completion of dielectric test and 1 megohm following the immersion test.	150 megohms (By 1000 volt megger)	175 megohms
Waterproof test: No leaks shall occur when submerged in salt water to a depth of 3 ft. for a period of 1/2 hour.	Satisfactory, no leaks occurring.	Satisfactory, no leaks occurring.

<u>Requirements</u>	<u>Test Values</u>	
	<u>3-inch Bell</u>	<u>10-inch Bell</u>
Audibility range: A minimum distance of 50 yds. for 4-inch bells and 100 yds. for 8-inch bells.	Approximately 316 yds.	Approximately 425 yds.
Case material: Shall be made of aluminum alloy.	Alluminum alloy.	Aluminum alloy.
Bell material: Cast bell metal permitted.	Cast bell metal.	Cast bell metal.
Contact material: Shall be made of tungsten.	Tungsten.	Tungsten.
Assembly screws and bolts: Steel, cadmium plated.	Steel, cadmium plated.	Steel, cadmium plated.
Weight: Not specified.	5 lbs. 4 oz. (Total)	10 lbs. (Total)
Dimension: Not specified.	Depth, 5 $\frac{1}{2}$ Height, 6 $\frac{3}{8}$ $\frac{7}{8}$	Depth, 6 $\frac{1}{2}$ $\frac{1}{2}$ Height, 13 $\frac{1}{2}$
Workmanship: First class in every respect.	First class.	First class.

#### COMMENTS ON RESULTS OF TEST

23. Under endurance, the insulator rivet on the armature of the 10-inch bell became loose after 26 of the required 48 hours of operation. After tightening the rivet, the bell satisfactorily completed the remainder of the endurance test.

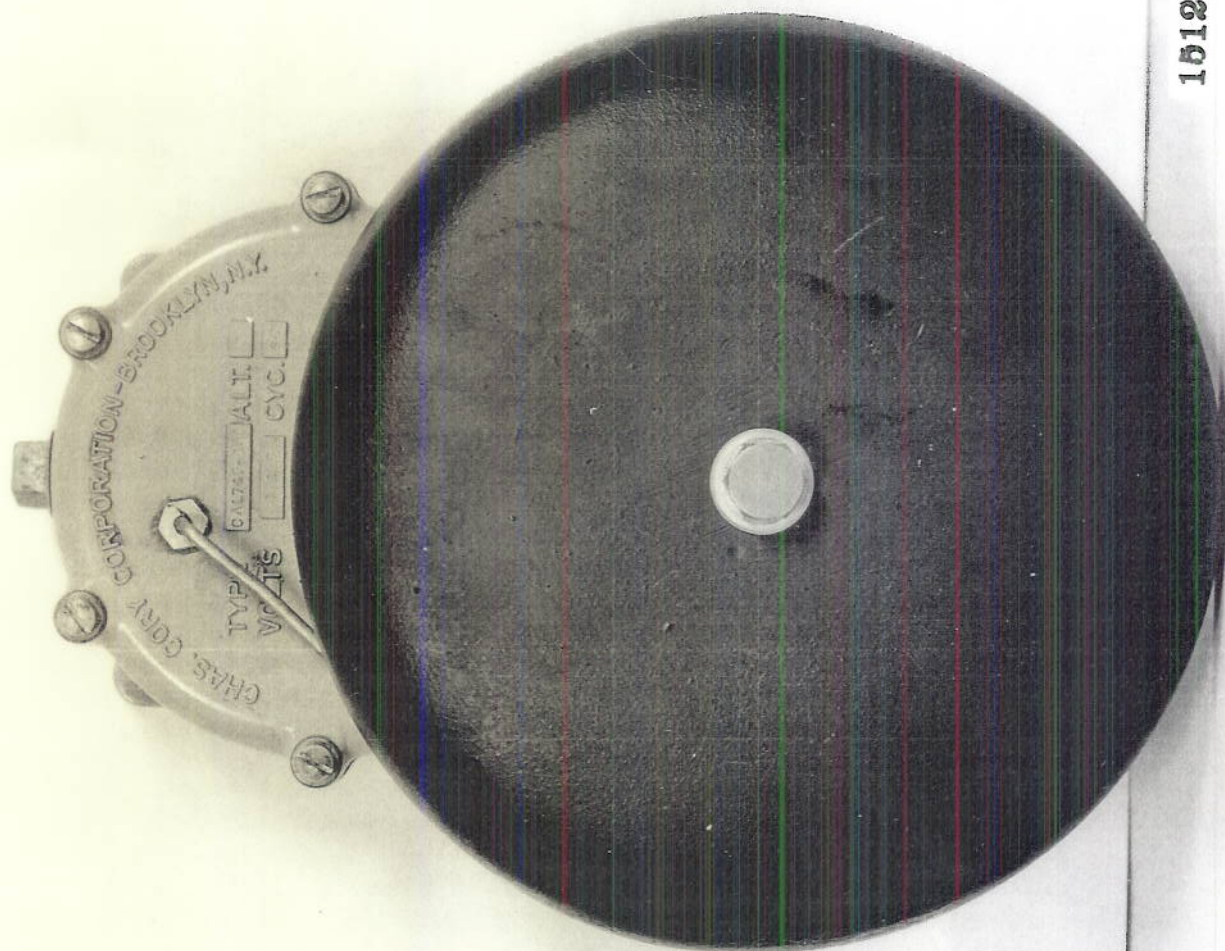
24. Under inspection of the materials for conformance with the specifications, the following defects were observed:

- (a) The magnet cores are not coated with insulating varnish for protection against corrosion.
- (b) Steel inserts have not been provided for the screws securing the terminal strip and fixed resistor bracket.
- (c) Pins are not provided in the gong brackets to prevent the gong from being replaced in other than the original position.

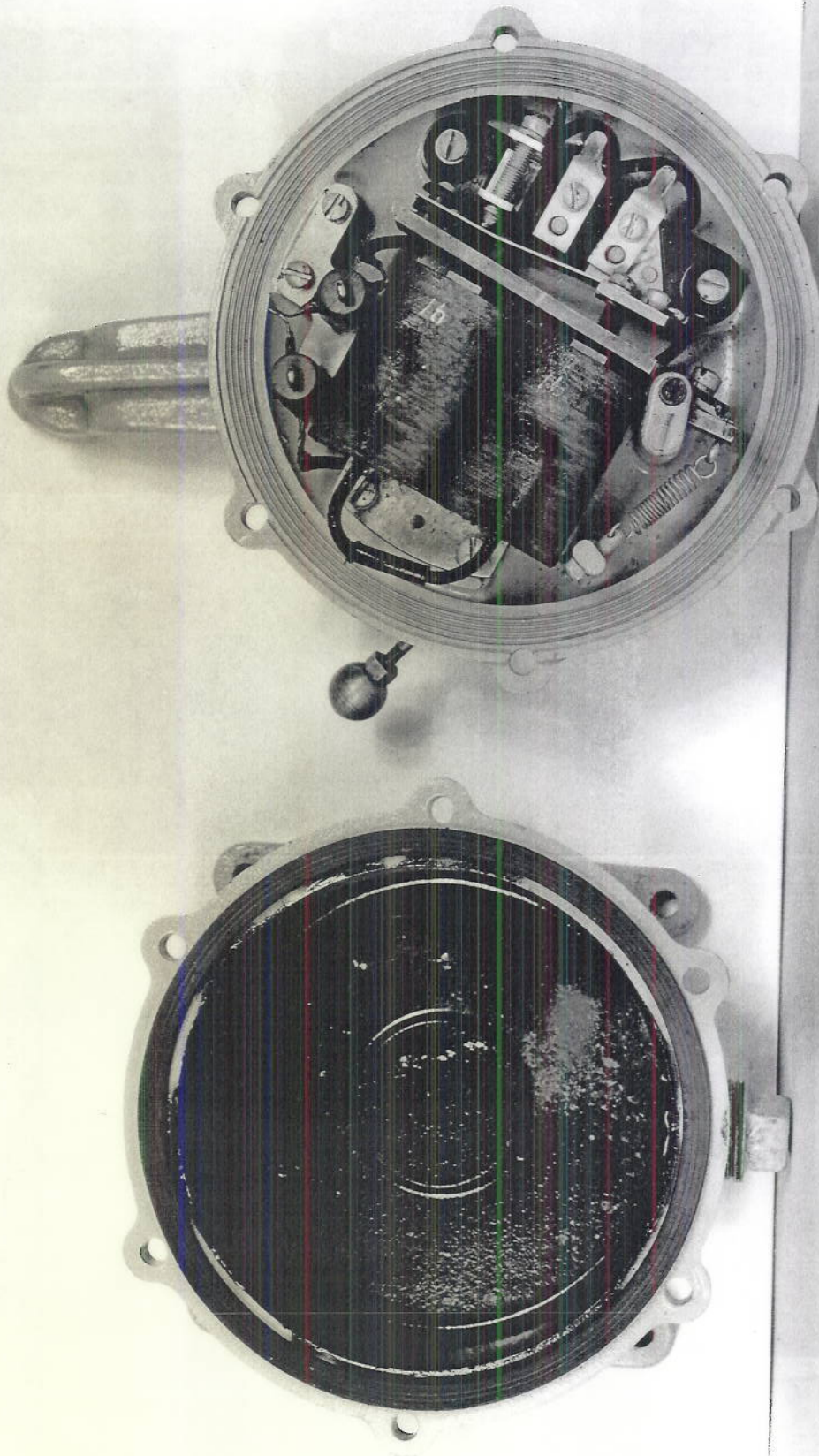
## CONCLUSIONS

25. These bells are of good design and first class workmanship. Under test they complied with the major requirements of specifications, reference (b), with the exception of the size of the gongs. However, it is understood that this contract was awarded prior to the writing of these specifications. In view of this, the bells would be acceptable under specifications, reference (c), if modified in accordance with paragraphs 23 and 24.

26. The sound output of these bells compares favorably with those of the 4-inch and 8-inch bells, tested and reported in NRL Report No. B-1174 of 10 July 1935.

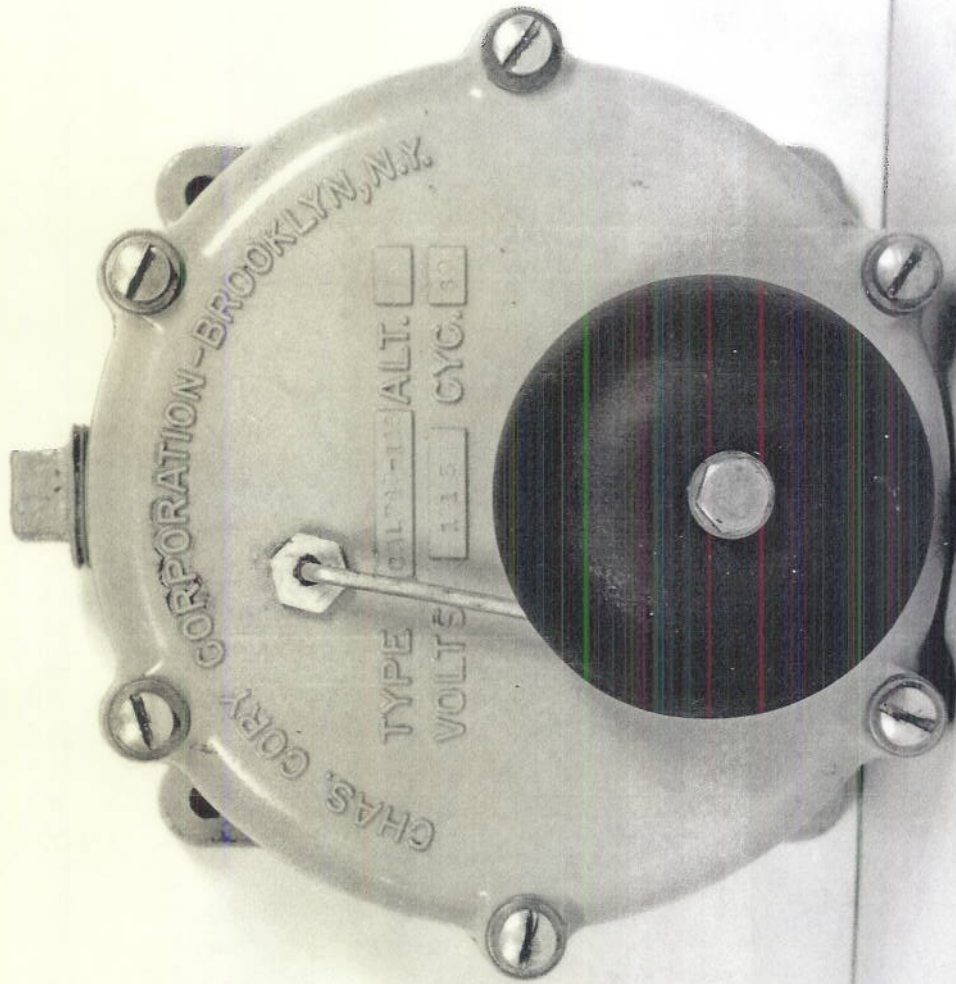


1512

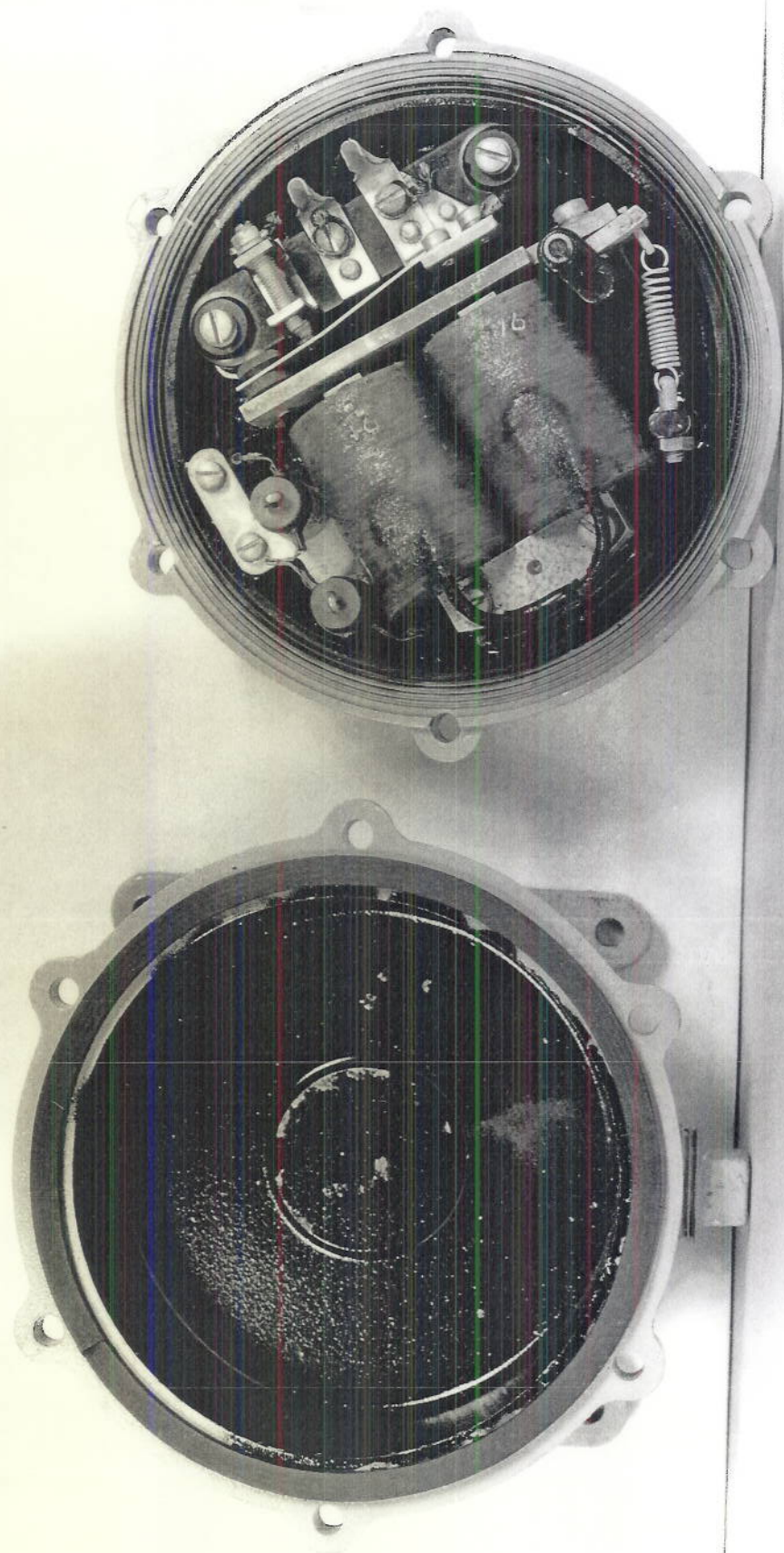


1513

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON, D. C.



1516



1517

Plate 4