

18 December 1936

NRL Report No. B-1335

NAVY DEPARTMENT  
BUREAU OF ENGINEERING

Report of

Test on Bells and Buzzer

Manufactured and Submitted by Navy  
Yard, Portsmouth, N.F.

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON D.C.

Number of Pages: Text - 9      Plates - 8

Authorization: Bu.Eng.ltrs. S65-4/L5(10-2-Ps) of 5 Oct and 6 Nov.  
1936 and Bu.Eng.ltr.S65-4/L5(11-28-0s) of 30 Nov. 1936.

Date of Test: October, November and December 1936.

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## AUTHORIZATION

1. This test was authorized by reference (a); other additional references pertinent to this problem are listed as references (b) to (h) inclusive.

- Reference: (a) Bu.Eng.ltrs. S65-4/L5(10-2-Ds) of 5 Oct. and 6 Nov. 1936, and S65-4/L5(11-28-Ds) of 30 Nov. 1936.  
(b) Comdt., Portsmouth, N.H., ltr.S65-4 (46194-2MG) of 25 Aug. 1936 to Bu.Eng.  
(c) Specifications SGS(65)-102a of 1 June 1936, and SGS(65)-103a of 1 June 1936.  
(d) Bu.Eng.ltr.S65-4(10-11-Df) of 31 Dec. 1935 to Comdt., Navy Yard, Portsmouth, N.H.  
(e) Portsmouth Dwg. 29335 - Bu.Eng.Dwg. 11-T-1132-L, Alt. 1-Type A4 - 115 V.A.C. Bell - Vibrating.  
(f) Portsmouth Dwg. 29336 - Bu.Eng.Dwg. 11-T-1133-L Type A8 - 115 V. A.C. Bell - Vibrating.  
(g) Portsmouth Dwg. 29338 - Bu.Eng.Dwg. 11-T-1135-L Type A12 - 115 V. A.C. Bell - Vibrating.  
(h) Portsmouth Dwg. 29599 Type A4 - 115 V. A.C. Low Pitch Low Intensity Buzzer.

## OBJECT OF TEST

2. The object of this test was to determine how closely the bells and buzzer submitted complied with the specifications, reference (c), and their suitability for the Naval Service. It was also desired to note whether the samples embodied the changes required under Bureau letter, reference (d).

## ABSTRACT OF TEST

3. The subject bells and buzzers, shown by Plates 1 to 8 inclusive, were set up at this Laboratory in suitable test circuits and their performance carefully observed while under test in conformance with the specifications, reference (c). All tests were made in order as specified and were concluded with an inspection of the samples to ascertain whether the sample bells were in strict accordance with the requirements in the matter of materials, design and workmanship.

## CONCLUSIONS

(a) The subject bells are of rugged construction and of good workmanship. Their performance during the periods of the shock and endurance tests was particularly good, as no adjustments were necessary.

(b) Under test for watertight integrity conducted after the endurance tests, a small amount of water leaked into each of the cases, the leaks occurring at the striker shaft packing gland.

(c) The weight of the Type A8 bell exceeds the allowable weight by 2.75 lbs., and the power factor is approximately 10% too low.

(d) Under inspection to note whether the changes had been made in the bells in accordance with Bureau's letter reference (d), it was observed that the terminal blocks had not been equipped with standard terminals, plans 9-S-1841-L. In addition, it was noted that the contacts had not been shunted with a condenser, or condenser and resistor, to prevent radio interference, and the required hex-head steel inserts in the box for receiving the cover-securing screws had not been provided. The present inserts, being flush, permit the BE metal cover to contact the aluminum box when it is fully secured.

(e) Further inspection disclosed considerable wear on the 8-inch and 12-inch bell strikers. The strikers are of cast brass and were furnished as requested under reference (d). Possibly the use of a steel striker arm would be preferable.

(f) The Bureau's attention is called to the fact that raised and stamped lettering has been used on the case covers as a substitute for nameplates required under Specifications 17N1.

(g) The Type A4 low pitch low intensity buzzer is also of rugged construction and of good workmanship. Except for the following minor deficiencies, it would have complied with the specifications, reference (c).

- (1) The allowable power consumption of the buzzer is exceeded by 2.6 watts. However, the sound output was 54 db as compared with the required 35 db.
- (2) Under test for dielectric strength, the buzzer failed, the breakdown occurring between the coil and ground. Following this test, the insulation resistance by 1000 Volt Megger was zero.
- (3) The total weight of the buzzer is 2 lbs. 8 oz., while that allowed is 12 oz.
- (4) Raised and stamped lettering has also been used on the case cover as a substitute for the required nameplate, Specifications 17N1.
- (5) The terminal block is not equipped with the required terminals, plans 9-S-1841-L.

(h) An inspection of the buzzer at the conclusion of the tests disclosed a broken leaf in the phosphorous bronze member supporting the armature. However, there was no apparent change in the operation of the buzzer.

(i) The sound output of the Type A4 bell, when equipped with sample gongs (a), (b) and (c), varied but slightly as noted under paragraph 16. Tests on samples (d) and (e) verify the statement made in paragraph 4 of reference (b) as to their being unsuitable for the application.

(j) The sample brass gongs furnished with the Type A8 and Type A12 bells finished with nickel plate and "Glyptol" enamel had a difference of 2 decibels in sound output. However, both comply with the specifications. The use of a nickel-plated gong may prove objectionable due to its high light reflecting qualities.

(k) Upon completion of the salt spray test after having been washed in fresh water and dried, an inspection of the sample bells, buzzer and gongs disclosed no leaks in the cases and the bells and buzzer were found to be operative. It was noted that but little damage had occurred to the paint on the aluminum alloy cases, while that on the BE metal case covers was practically destroyed. The paint on the brass gongs showed considerable small blisters at the end of the test. It is understood that the "paint" used in each case was "Glyptol" enamel. Possibly the use of this enamel on Naval bells and buzzers will prove satisfactory, but it cannot be said to have satisfactorily withstood the severe conditions of the hot spray test. The nickel plated brass gongs were apparently unaffected by the test, but those of corrosion-resisting steel showed heavy rust on the unpolished edges and surfaces. It was further noted that the steel lockwashers placed under the gong securing nuts were badly rusted and should not be used. All nickel plated brass parts were unharmed. Inasmuch as the polished nickel plated brass gongs were unharmed by the salt spray test, it is believed possible that gongs finished in black nickel would prove a good substitute.

RECOMMENDATIONS

(a) In view of the bells and buzzer having satisfactorily complied with the major requirements of the specifications and being of rugged construction and good workmanship, it is recommended that they be approved for Naval use subject to the correction of the minor deficiencies noted under "CONCLUSIONS" herein.

## DESCRIPTION OF MATERIAL UNDER TEST

4. The material submitted for test was manufactured by the Navy Yard, Portsmouth, N.H., and consisted of one bell each of Types A4, A8, A12, and one Type A4 low pitch low intensity buzzer, all designed for 115 volts, A.C. 60 cycle operation. In addition, four 4-inch gongs were forwarded under reference (b) for inspection and comments.

5. The Type A4 bell, shown by Plates 1 and 2 and Portsmouth Plan 29335, is of the vibratory type. It employs a single form wound coil located on a laminated core of "U" shape, and a set of adjustable contacts for interrupting the current. The armature is of flat steel attached to the gong striker shaft and completes the magnetic circuit. A packing gland is provided where the striker shaft extends through the case. The entire mechanism and terminal block are mounted on bosses equipped with steel inserts located in the bottom of the aluminum alloy case. The BE metal case cover has three concentric grooves which contact the 3/16-inch square rubber gasket partly recessed into the rim of the case. Steel inserts are provided in the case for the brass cover-securing screws and gong post. A modified square hole in the gong definitely locates it with reference to the striker. The case is provided with four mounting lugs and two bosses, one tapped for a standard 3/4-inch terminal tube.

6. The Type A8 bell, shown by Plates 3 and 4 and Portsmouth Plan 29336, is also of the vibratory type and employs two form wound coils connected in parallel located on a laminated core of "W" shape and a set of contacts for interrupting the current. The mechanical design is similar to the type A4 bell except that it is proportionately larger.

7. The Type A12 bell, shown by Plates 5 and 6 and Portsmouth Plan 29338, is identical to the type A8 bell, varying only in the size of the striker and gong post for accommodation of the 12-inch gong.

8. The Type A4 low pitch low intensity buzzer, shown by Plates 7 and 8 and Portsmouth Plan 29599, is of the contactless type employing a single form wound coil located on a laminated core of "U" shape. A laminated armature secured to a laminated phosphorous bronze spring completes the magnetic circuit. The armature supporting spring is secured at one end with two brass screws threaded into bosses located on the BE metal cover. The noise is produced by an adjustable steel screw attached to the armature-supporting member striking against the head of a steel screw threaded into the case cover. Two brass studs threaded into bosses on the cover support the stationary part of the core. The terminal block is located on the case cover. The aluminum alloy case is provided with four mounting lugs and two bosses tapped for 3/4-inch terminal tubes.

## METHOD OF TEST

9. The samples, as received, were first tested for power consumption and sound output at rated voltage and frequency.

10. Following, they were placed on a Bureau of Engineering shock stand and given the required blows of 250 foot pounds each, under the conditions specified under reference (c).

11. They were next tested for endurance by operating them under the conditions specified in SGS(65)-102a, paragraph F-2i, and SGS(65)-103a, paragraph F-2h(1). During these tests, the temperature rise of each sample was obtained using the resistance method.

12. The remaining tests were conducted in the order required under the specifications, reference (c).

13. The usual inspection of the samples pertaining to the quality of workmanship and suitability of design and materials concluded the test.

RESULTS OF TEST

14. The test results obtained follow:

(Specifications SGS(65)-102a, Bells, Interior Communication)

<u>Requirements</u>	<u>Test Values</u>		
	<u>4"</u>	<u>8"</u>	<u>12"</u>
Voltage: 115 volts	115 V.	115 V.	115 V.
Frequency: 60 cycles	60	60	60
Amperes: Not specified	0.26	0.46	0.46
Watts: Not over			
4-inch - 15 watts	15		
8-inch - 25 watts		21	
12-inch - Not covered			23
Power Factor: Not less than 50%	50.1%	*39.7%	43.6%
Shock Integrity: Shall withstand 50 shocks of 250 foot pounds each under the conditions specified under par.F-2h.	Complied	Complied	Complied
Endurance: Shall be capable of operation under the conditions specified under par.F-2i.	Complied	Complied	Complied
Temperature rise: Shall not exceed 35°C at ambient temperature of 65°C during the period of the endurance tests.	27.1°C	18.9°C	18.4°C

<u>Requirements</u>	<u>Test Values</u>		
	<u>4"</u>	<u>8"</u>	<u>12"</u>
Voltage and frequency variations: Shall operate at 103.5 V. at 65 cycles and 126.5 V. at 55 cycles, under the conditions specified under par. F-2i.	Complied	Complied	Complied
Sound Output: Under the conditions specified under par.E-6: 4" - 47 db 8" - 55 db 12" - Not covered	57 db	61 db	69 db
Insulation Resistance: Shall be not less than 10 megohms preceding the immersion test and 1 megohm following.	Complied	Complied	Complied
Dielectric: Shall withstand 1500 V. A.C., 60 cycles, preceding the immersion test, and 500 V. A.C., 60 cycles, following.	Complied	Complied	Complied
Salt Spray: Specified under par. F-2f(1).	See statement under "CONCLUSIONS".		
Watertight Integrity: Shall not leak when placed in water to a depth of 3 feet for a period of 1 hour.	*5 cc	*10 cc	*15 cc
Total Weights: Not over 4" - 4 lbs. 8" - 9.5 lbs. 12" - Not covered	3.5 lbs.	*12 lbs.4 oz.	16 lbs.2 oz.
Inclination: Shall operate satisfactorily in any plane 45° from the vertical at 10% over and 15% under rated voltage.	Complied	Complied	Complied
Nameplates: Shall be in accordance with Spec.17N1.	*None furnished on any of the samples, raised and stamped lettering being substituted.		

RequirementsTest Values

	<u>4"</u>	<u>8"</u>	<u>12"</u>
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Terminal Block: Shall be of molded phenolic material equipped with 9-S-1841-L terminals.

\*Molded phenolic material blocks furnished on all samples but not equipped with 9-S-1841-L terminals.

NOTE: These test results were obtained when the bells were equipped with the following sample gongs.

Type A4 - Chase alloy, 3/32".  
 Type A8 - Brass, Nickel Plated.  
 Type A12 - Brass, Nickel Plated.

\* Denotes failure to comply with the specifications.

15. The results obtained from the low pitch low intensity buzzer, when tested in conformance with SGS(65)-103a, follow:

Requirements:Test Values

Voltage: 115 Volts

115 Volts

Current: Alternating

Alternating

Amperes: Not specified

0.170 amperes

Watts: Not over 5 watts.

\*7.6 watts

Temperature Rise: Not over 30°C at ambient temperature of 70°C by resistance method.

21.6°C rise

Sound Output: Shall be not less than 35 db under the conditions specified under par. E-5.

54 db measured 18 feet from the buzzer and on the axis thereof, in a sound-proof room, using a General Radio noise meter Type 559.

Inclination: Shall operate in any plane 45° from the vertical at 10% over and 10% under rated voltage.

Complied

Endurance: Shall operate satisfactorily 700 cycles of one minute on, every alternate minute, at ambient of 70°C and 700 cycles at 0°C. Also at 103.5 V. at 65 cycles and 126.5 V. at 55 cycles.

Complied

Shock Integrity: Shall withstand 20 blows of 250 foot pounds each, under the conditions specified under par. F-2g(3).

Complied

Requirements

Test Values

Dielectric: Shall withstand 1500 V. A.C. 60 cycles, prior to the immersion test; and 500 V. A.C. 60 cycles following.

\*Broke down at 1500 V. A.C. 60 cycles between coil and ground.

Pitch of Note: 60 to 500 CPS.

120 CPS at 60 cycle input.

Insulation Resistance: Shall be not less than 10 megohms following the dielectric test and 1 megohm following the immersion test.

\*Following dielectric test - Zero resistance by 1000 V. Megger.

Watertight Integrity: No leaks shall occur when immersed in water to a depth of 3 feet for a period of 12 hours.

Complied

Salt Spray Test: Specified under par. F-2e.

See statement under "CONCLUSIONS".

Total Weight: Shall not exceed 12 oz.

\*2 lbs. 8 oz.

Nameplate: Shall be in accordance with Specifications 17N1.

\*None furnished, raised and stamped lettering substituted.

\*Denotes failure to comply with the specifications.

16. The db output of each bell, when equipped with the sample gongs submitted and adjusted to its original power consumption at 115 volts, A.C., 60 cycles, was as follows:

Type A4 Bell

Samples (Covered by reference (b))

Sound Output

- |                       |       |
|-----------------------|-------|
| (a) Chase Alloy 3/32" | 57 db |
| (b) Sheet brass 3/32" | 56 db |
| (c) C.R. Steel 3/32"  | 55 db |
| (d) C.R. Steel 1/16"  | 53 db |
| (e) Chase Alloy 1/16" | 52 db |

Type A8 Bell

Samples (Covered by Portsmouth ltr. S65-4(46864-2MG) of 22 Oct. 1936)

- |                             |       |
|-----------------------------|-------|
| (a) Brass, Nickel Plated    | 61 db |
| (b) Brass, "Glyptol" enamel | 59 db |

Type A12 Bell

Samples (Covered by Portsmouth ltr.

S65-4(46964-2MG) of 22 Oct. 1936)

Sound Output

- (a) Brass, Nickel Plated
- (b) Brass, "Glyptol" Enamel

69 db

67 db

NOTE: The db output of the sample gongs was the average of five tests. The tests were conducted in a sound-proof room using a General Radio noise meter Type 559 located 18 feet from the bells and on the axis thereof.

## CONCLUSIONS

17. The subject bells are of rugged construction and of good workmanship. Their performance during the periods of the shock and endurance tests was particularly good, as no adjustments were necessary.

18. Under test for watertight integrity, conducted after the endurance tests, a small amount of water leaked into each of the cases, the leaks occurring at the striker shaft packing gland.

19. The weight of the Type A8 bell exceeds the allowable weight by 2.75 lbs., and the power factor is approximately 10% too low.

20. Under inspection to note whether the changes had been made in the bells in accordance with Bureau's letter reference (d), it was observed that the terminal blocks had not been equipped with standard terminals, plans 9-S-1841-L. In addition, it was noted that the contacts had not been shunted with a condenser, or condenser and resistor, to prevent radio interference, and the required hex-head steel inserts in the box for receiving the cover-securing screws had not been provided. The present inserts, being flush, permit the BE metal cover to contact the aluminum box when it is fully secured.

21. Further inspection disclosed considerable wear on the 8-inch and 12-inch bell strikers. The strikers are of cast brass and were furnished as requested under reference (d). Possibly the use of a steel striker arm would be preferable.

22. The Bureau's attention is called to the fact that raised and stamped lettering has been used on the case covers as a substitute for nameplates required under Specifications 17N1.

23. The Type A4 low pitch low intensity buzzer is also of rugged construction and of good workmanship. Except for the following minor deficiencies, it would have complied with the specifications, reference (c):

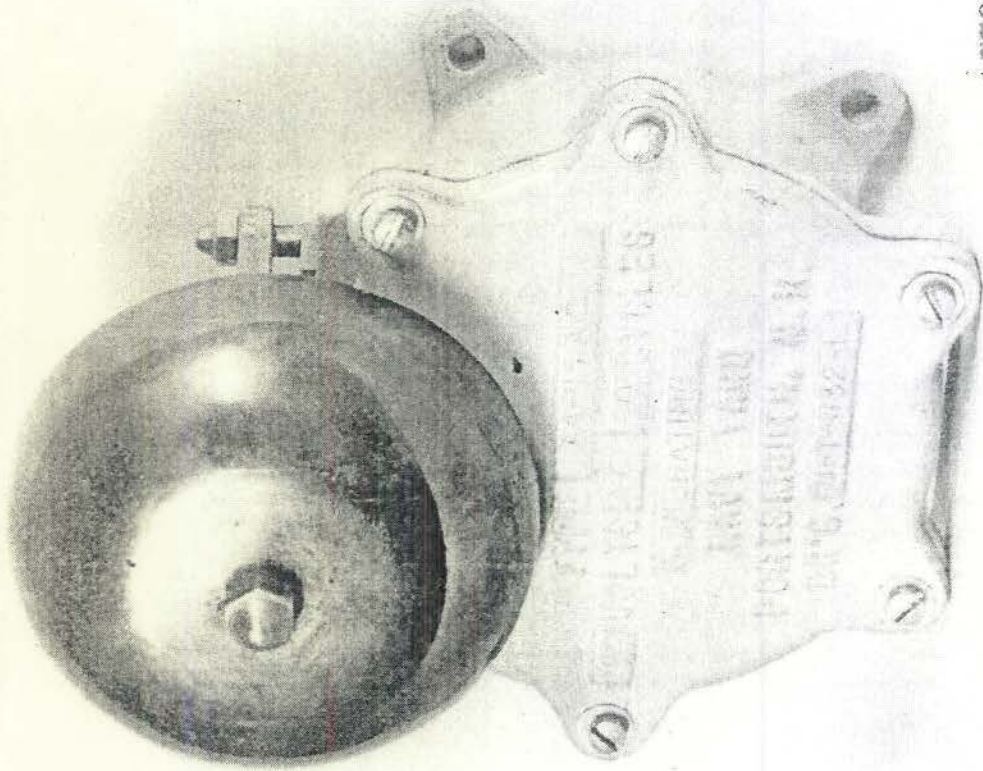
- (1) The allowable power consumption of the buzzer is exceeded by 2.6 watts. However, the sound output was 54 db as compared with the required 35 db.
- (2) Under test for dielectric strength the buzzer failed, the breakdown occurring between the coil and ground. Following this test, the insulation resistance by 1000 Volt Megger was zero.
- (3) The total weight of the buzzer is 2 lbs. 8 oz., while that allowed is 12 oz.
- (4) Raised and stamped lettering has also been used on the case cover as a substitute for the required nameplate, Specifications 17N1.
- (5) The terminal block is not equipped with the required terminals, plans 9-S-1841-L.

24. An inspection of the buzzer at the conclusion of the tests disclosed a broken leaf in the phosphorous bronze member supporting the armature. However, there was no apparent change in the operation of the buzzer.

25. The sound output of the Type A4 bell, when equipped with sample gongs (a), (b) and (c), varied but slightly, as noted under paragraph 15. Tests on samples (d) and (e) verify the statement made in paragraph 4 of reference (b) as to their being unsuitable for the application.

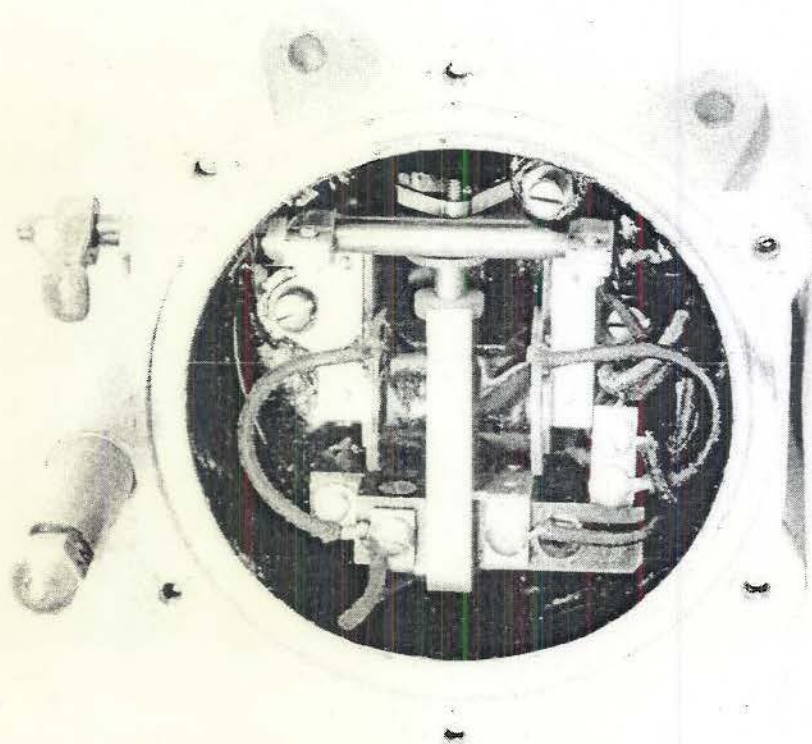
26. The sample brass gongs furnished with the Type A8 and Type A12 bells, finished with nickel plate and "Glyptol" enamel, had a difference of 2 decibels in sound output. However, both comply with the specifications. The use of a nickel plated gong may prove objectionable due to its high light reflecting qualities.

27. Upon completion of the salt spray test after having been washed in fresh water and dried, an inspection of the sample bells, buzzer and gongs disclosed no leaks in the cases and the bells and buzzer were found to be operative. It was noted that but little damage had occurred to the paint on the aluminum alloy cases, while that on the BE metal case covers was practically destroyed. The paint on the brass gongs showed considerable small blisters at the end of the test. It is understood that the "paint" used in each case was "Glyptol" enamel. Possibly the use of this enamel on Naval bells and buzzers will prove satisfactory, but it cannot be said to have satisfactorily withstood the severe conditions of the hot spray test. The nickel plated brass gongs were apparently unaffected by the test, but those of corrosion-resisting steel showed heavy rust on the unpolished edges and surfaces. It was further noted that the steel lockwashers placed under the gong securing nuts were badly rusted and should not be used. All nickel plated brass parts were unharmed. Inasmuch as the polished nickel plated brass gongs were unharmed by the salt spray test, it is believed possible that gongs finished in black nickel would prove a good substitute.



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Plate 2

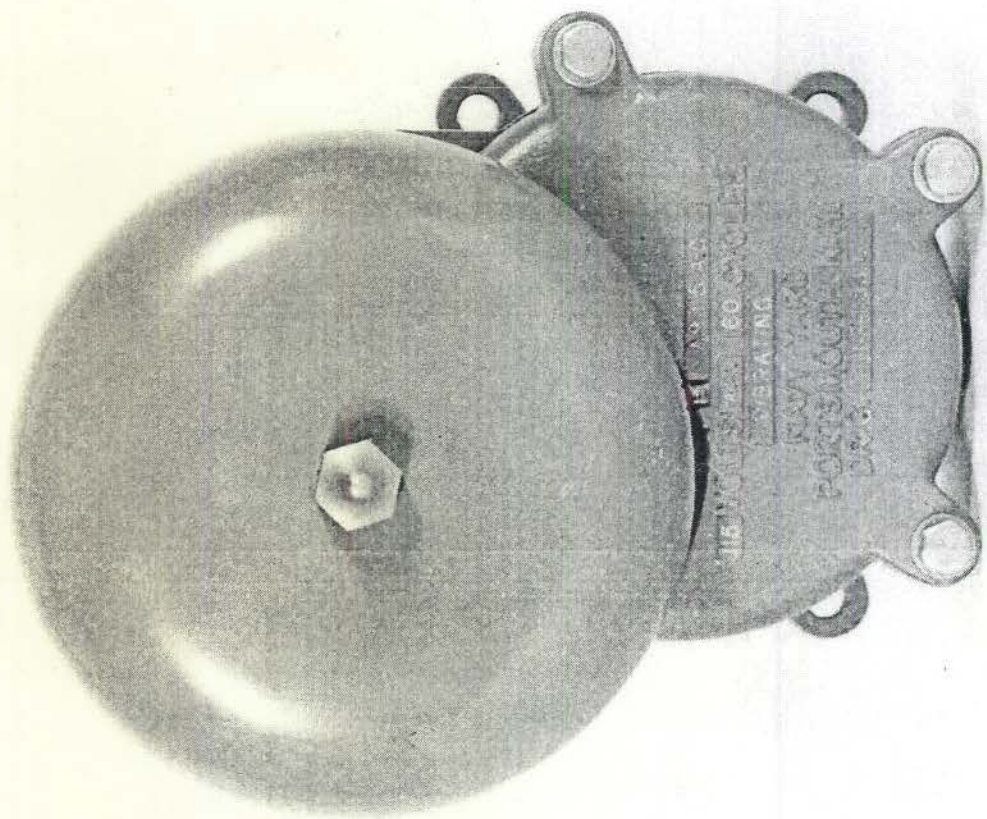
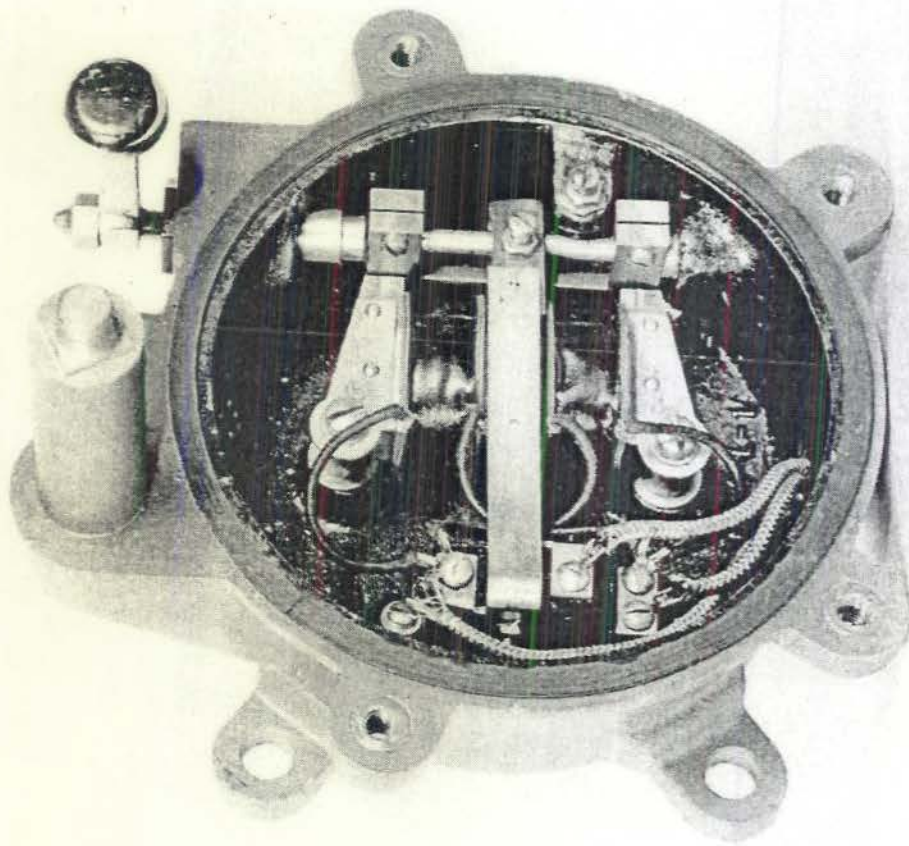


Plate 3

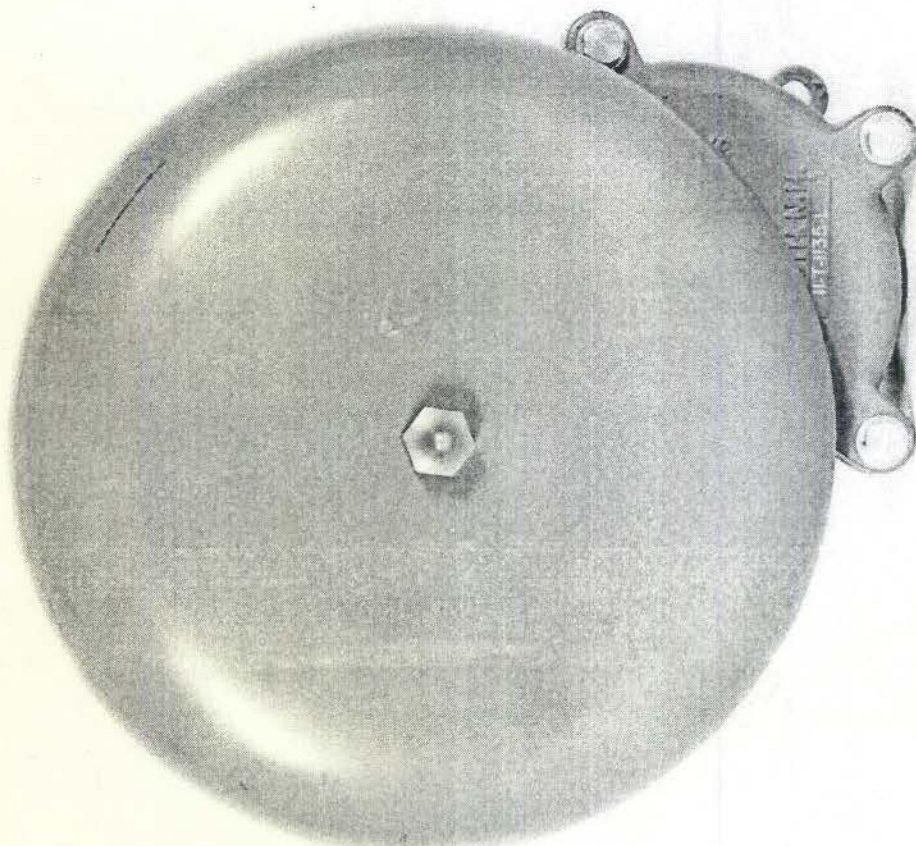
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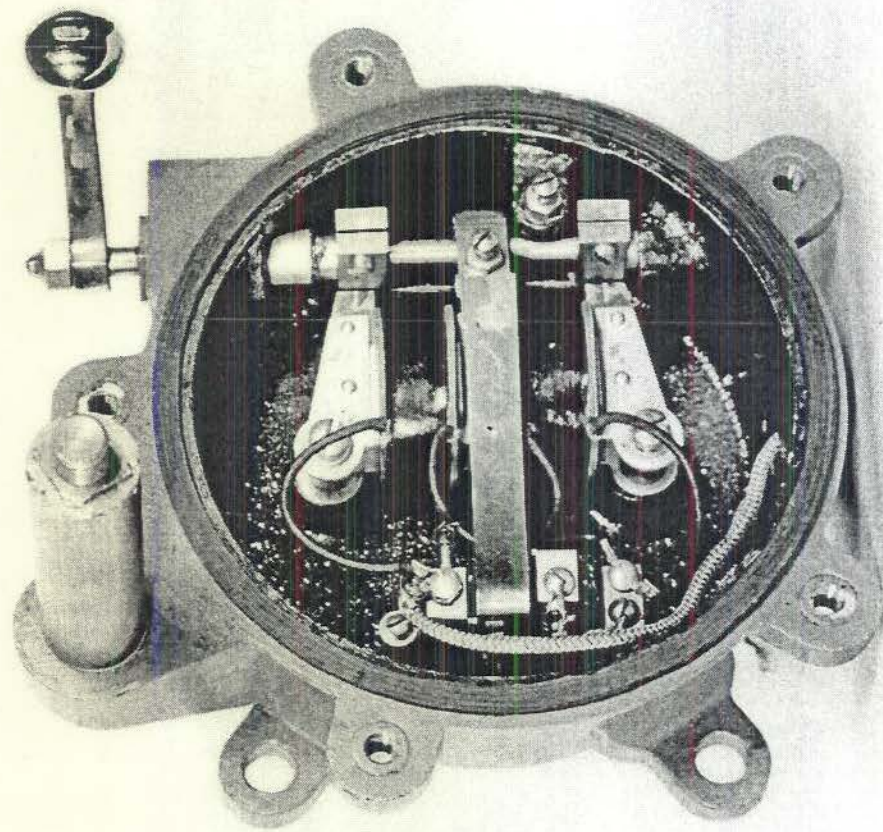
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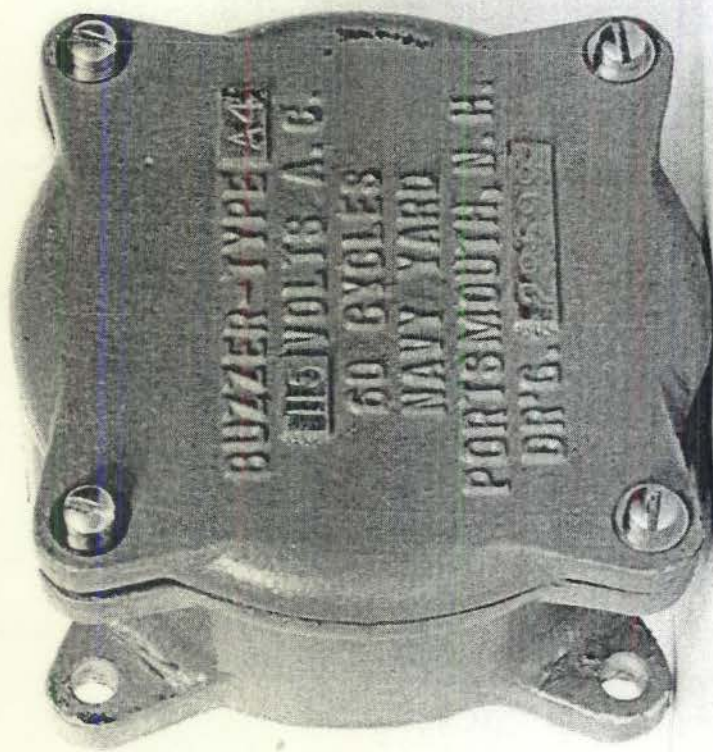
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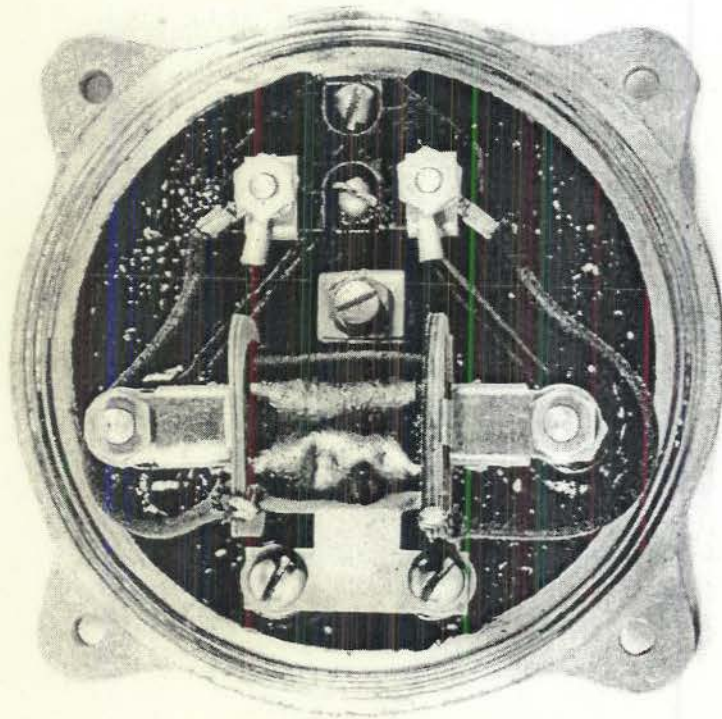


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