

REPORT NO. B-1847

DATE 5 March 1942

ER-1847

SUBJECT

Report of Test on Navy Types B-1, B-2, B-5, and B-6 Bells, B-7 and

B-8 Bar Chimes, H-1 and H-2 Horns, and Z-1 and Z-2 Buzzers

NAVAL RESEARCH LABORATORY  
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## NAVY DEPARTMENT

## Report of Test

on

Navy Types B-1, B-2, B-5, and B-6 Bells,  
B-7 and B-8 Bar Chimes,  
H-1 and H-2 Horns, and  
Z-1 and Z-2 Buzzers.

Submitted by

Edwards and Company,  
Norwalk, Connecticut.

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON, D. C.

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Date of Test: February 1942

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Distribution:  
BuShips (6)

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

Reference: (a) BuShips ltr. S65-4(355) of 5 February 1942  
(b) Specification 17S11(INT) of 1 October 1941  
(c) Edwards and Co. Plan No. 6764 (B-1 and B-2)  
(d) Edwards and Co. Plan No. 6755 (B-5 and B-6)  
(e) Edwards and Co. Plan No. 6762 (B-7 and B-8)  
(f) Edwards and Co. Plan No. 6765 (H-1 and H-2)  
(g) Edwards and Co. Plan No. 6763 (Z-1 and Z-2)  
(h) Edwards and Co. ltr. of 21 January 1942 to BuShips  
(i) NRL ltr. S65-4/L5(ICD) of 23 February 1942 to BuShips

#### OBJECT OF TEST

2. The object of this test was to determine conformance of the samples with the specification, reference (b), and their suitability for Naval use.

#### ABSTRACT OF TEST

3. The sample audible signals were set up at this Laboratory in suitable test circuits where their performance was carefully observed for compliance with the specification. An inspection of the samples to determine compliance in the matter of materials, design, and workmanship concluded the test.

RECOMMENDATIONS

(a) It is recommended that the types B-1, B-2, B-5, and B-6 bells, B-7 and B-8 bar chimes, H-1 and H-2 horns, and the Z-2 buzzer be granted type approval subject to the correction of the minor departures noted under "Conclusions".

(b) It is recommended that approval of the type Z-1 buzzer be withheld pending demonstration of its ability to satisfactorily complete the required endurance test.

DESCRIPTION OF MATERIAL UNDER TEST

4. The subject audible signals, submitted by Edwards and Company, Norwalk, Connecticut, are shown by drawings, references (c) to (g), and photographs, Plates 5 to 14, inclusive. The acoustical analyses are given by Plates 1 to 4, inclusive.

METHOD OF TEST

5. The samples, following tests to determine their electrical and acoustical characteristics at rated voltage and frequency, were subjected to further tests in the following order:

- (a) Inclination
- (b) Endurance and temperature rise
- (c) Sound pressure output following endurance
- (d) Shock
- (e) Vibration
- (f) Dielectric
- (g) Insulation resistance
- (h) Splashproof
- (i) Watertight
- (j) Salt spray

6. The tests were concluded with a careful examination of the samples to determine compliance with the specification, pertaining to design, quality of workmanship and materials, and any defects resulting from the tests.

RESULTS OF TEST

7. The test results obtained on the types B-1 and B-2 bells were as follows:

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type B-1</u>	<u>Type B-2</u>
Voltage: 115 volts	Tested at 115 volts d.c.	Tested at 115 volts a.c.
Amperes: Not specified.	0.052 ampere	0.083 ampere
Watts: Shall not exceed 7.5 watts	6.0 watts	6.0 watts
Sound pressure output: Shall be 40-45 decibels at 18 feet in a soundproof room under the following conditions:		
(a) Before the endurance test	67 db	68 db
(b) Following the endurance test	72 db	72 db

Pitch of note: Not specified.	See Plate 1.	See Plate 1.
Inclination: Shall operate in any position when supplied with rated voltage and frequency and $\pm 7$ volts and 5 cycles.	Complied.	Complied.
Endurance test: Shall operate 1500 cycles of "one minute on" and "one minute off", the first 750 cycles at 60° C. and the second at 0° C. ambient temperatures.	Complied.	Complied.
Temperature rise: Maximum temperature shall not exceed 115° C. during the endurance test. (55° C. rise at 60° C. ambient temperature.)	Complied. 25.3° C. above 60° C. ambient temperature.	Complied. 27.6° C. above 60° C. ambient temperature.
Shock test: Shall withstand 20 shocks of 250 foot pounds each as specified in paragraph F-2g.	Complied.	Complied.
Vibration test: Shall be mounted on a standard Navy 3 foot pound vibration machine and subjected to six tests of 30 minutes each at frequencies of 100, 150, 200, 250, 300 and 350 shocks per minute.	Complied.	Complied.
Dielectric test: Shall withstand twice the rated voltage plus 1250 volts, 60 cycles, for one minute between electrical circuits and between electrical circuits and ground.	Complied.	Complied.
Insulation resistance: Shall be not less than 5 megohms at not less than 500 volts, d.c.	Complied. Greater than 200 megohms by 1000 volt megger.	Complied. Greater than 200 megohms by 1000 volt megger.
Splashproof integrity: Shall be subjected to a 1-inch stream of water, under a pressure head of 35 feet, played from a hose at a distance of 5 feet, for 5 minutes, without the entry of water into the case.	Complied.	Complied

Type B-1

Type B-2

Salt spray test: Shall be subjected, under ultra-violet light, to a 20 per cent salt spray at 55°C. for a period of 3 minutes, followed by an air blast at 55° C. for 3 minutes, the cycle being repeated continuously for 100 hours.

Not conducted due to similarity to Type B-2.

Satisfactory.

Weight: Shall not exceed 2 pounds.

\*2 pounds,  
4 ounces.

\*2 pounds,  
4 ounces.

Nameplate: Shall be in accordance with N.D. Specification 42N2.

Complied. Copper-nickel alloy.

Complied. Copper-nickel alloy.

Dissimilar metals: Contact of dissimilar metals, except steel, with aluminum alloys shall be avoided as much as practicable in the assembly of parts. Where contact cannot be avoided, an approved spar varnish or other approved material shall be used between the faying surfaces.

Complied.

Complied.

Protection against corrosion: All aluminum surfaces shall be protected with one coat of zinc chromate paint, or an approved anodic treatment, over which finishing coats of approved gray paint shall be applied.

Complied.

Complied

Protection of exterior surfaces: Exterior surfaces of the equipment, except nameplates, gongs, and strikers, shall be finished with two coats of gray paint specifically approved by the bureau concerned.

Complied.

Complied.

Clearances: Clearances between any two electrical circuits or between any electrical circuit and ground, where not separated by at least 1/16-inch of approved insulating material, shall be not less than 1/8-inch, unless otherwise approved.

Complied.

Complied.

Wiring: All wiring shall be in accordance with the requirements of N. D. Specification 15C1, unless otherwise approved.

\*Does not comply with Spec.15C1.

\*Does not comply with Spec.15C1.

Coil windings: May be either single or double silk or cotton covered enameled copper wire.	Complied. Single silk enameled copper wire.	Complied. Single silk enameled copper wire.
Protective covering for coils: Shall be nonhygroscopic, not glued or cemented to the coils, but shall be overlapped and cemented in the lap.	Complied.	Complied.
Waterproofing of coils: All coils shall be impregnated with an approved synthetic resinous material or other suitable and approved waterproofing and insulating compound.	Complied.	Complied.
Magnetic circuits: Shall be of laminated punchings of the best available grade for the purpose and shall be protected against corrosion.	Complied.	Complied.
Terminal block: Shall be of approved material and type, and readily accessible.	Complied.	Complied.
Terminal lugs: Shall be in accordance with Bureau of Engineering drawing 9-S-1841-L, unless otherwise specified by the bureau concerned.	Complied.	Complied.
Supply leads: Shall enter through the casing attached to the mounting bulkhead and not through any removable part.	Complied.	Complied.
Terminal wiring: Shall be lead in through a boss drilled and tapped for a Navy standard terminal tube. The case shall be provided with two bosses, one located at the top and the other at the bottom of the case, unless otherwise approved by the bureau concerned.	Complied.	Complied.
Springs: All springs which form a part of the electrical circuit shall be of beryllium copper, phosphor bronze, or their approved equivalent.	Complied.	Complied.

Contacts: All contacts for making and breaking an electrical circuit shall be of tungsten.

Complied.

Complied.

Agreement with test plans: Blueprint plans of sufficient detail to show all essential components of the equipment to be tested shall be furnished, and shall check with the equipment.

Complied.

Complied.

8. The test results obtained on the types B-5 and B-6 bells were as follows:

Requirements

Test Values

Type B-5

Type B-6

Voltage: 115 volts

Tested at 115 volts d.c.

Tested at 115 volts a.c.

Amperes: Not specified.

0.084 ampere.

0.22 ampere.

Watts: Shall not exceed 25 watts

9.66 watts.

10.4 watts.

Sound pressure output; Shall be not less than 65 decibels at 18 feet in a soundproof room under the following conditions;

(a) Before the endurance test

84 db

92 db

(b) Following the endurance test

87 db

86 db

Stroke frequency: 40-60 per second.

56 per second

59 per second

Inclination: Shall operate in any position when supplied with rated voltage and frequency and  $\pm 7$  volts and 5 cycles,

Complied.

Complied.

Endurance test: Shall operate 1500 cycles of "one minute on" and "one minute off", the first 750 cycles at 60°C. and the second at 0°C. ambient temperatures.

Complied.

Complied.

Temperature rise: Maximum temperature shall not exceed 115°C. during the endurance test. (55°C. rise at 60°C. ambient temperature.)

Complied, 11.4°C. above 60°C. ambient temperature.

Complied, 8.8°C. above 60°C. ambient temperature.

Shock test: Shall withstand 20 shocks of 250 foot pounds each as specified in paragraph F-2g.

Complied.

Complied.

Vibration test: Shall be mounted on a standard Navy 3 foot pound vibration machine and subjected to six tests of 30 minutes each at frequencies of 100, 150, 200 250, 300 and 350 shocks per minute.

Complied.

Complied.

Dielectric test: Shall withstand twice the rated voltage plus 1250 volts, 60 cycles, for one minute between electrical circuits and between electrical circuits and ground.

Complied.

Complied.

Insulation resistance: Shall be not less than 5 megohms at not less than 500 volts, d.c.

Complied. Greater than 200 megohms by 1000 volt megger.

Complied. Greater than 200 megohms by 1000 volt megger.

Splashproof integrity: Shall be subjected to a 1-inch stream of water, under a pressure head of 35 feet, played from a hose at a distance of 5 feet, for 5 minutes, without the entry of water into the case.

Complied.

Complied.

Salt spray test: Shall be subjected, under ultra-violet light, to a 20 per cent salt spray at 55°C. for a period of 3 minutes, followed by an air blast at 55°C. for 3 minutes, the cycle being repeated continuously for 100 hours.

Not conducted due to similarity to type B-6.

Slight rusting of steel drive pin in gong post and pins securing nameplate to case.

Weight: Shall not exceed 8 pounds.

Complied. 7 pounds, 4 ounces.

Complied. 7 pounds, 4 ounces.

Nameplate: Shall be in accordance with N. D. Specification 42N2.

Complied. Copper-nickel alloy.

Complied. Copper-nickel alloy.

Dissimilar metals: Contact of dissimilar metals, except steel, with aluminum alloys shall be avoided as much as practicable in the assembly of parts. Where contact cannot be avoided, an approved spar varnish or other approved material shall be used between the faying surfaces.

Complied.

Complied.

RequirementsTest Values

	<u>Type B-5</u>	<u>Type B-6</u>
Protection against corrosion: All aluminum surfaces shall be protected with one coat of zinc chromate paint, or an approved anodic treatment, over which finishing coats of approved gray paint shall be applied.	Complied.	Complied.
Protection of exterior surfaces: Exterior surfaces of the equipment, except nameplates, gongs, and strikers, shall be finished with two coats of gray paint specifically approved by the bureau concerned.	Complied.	Complied.
Clearances: Clearances between any two electrical circuits or between any electrical circuit and ground, where not separated by at least 1/16-inch of approved insulating material, shall be not less than 1/8-inch, unless otherwise approved.	Complied.	Complied.
Wiring: All wiring shall be in accordance with the requirements of N. D. Specification 15C1, unless otherwise approved.	*Does not comply with Spec. 15C1.	*Does not comply with Spec. 15C1.
Coil windings: May be either single or double silk or cotton covered enameled copper wire.	Complied. Single silk covered enameled copper wire.	Complied. Single silk covered enameled copper wire.
Protective covering for coils: Shall be nonhygroscopic, not glued or cemented to the coils, but shall be overlapped and cemented in the lap.	Complied.	Complied.
Waterproofing of coils: All coils shall be impregnated with an approved synthetic resinous material or other suitable and approved waterproofing and insulating compound.	Complied.	Complied.
Magnetic circuits: Shall be of laminated punchings of the best available grade for the purpose and shall be protected against corrosion.	Complied.	Complied.

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type B-5</u>	<u>Type B-6</u>
Terminal block: Shall be of approved material and type, and readily accessible.	Complied.	Complied.
Terminal lugs: Shall be in accordance with Bureau of Engineering drawing 9-S-1841-L, unless otherwise specified by the bureau concerned.	Complied.	Complied.
Supply leads: Shall enter through the casing attached to the mounting bulkhead and not through any removable part.	Complied.	Complied.
Terminal wiring: Shall be lead in through a boss drilled and tapped for a Navy standard terminal tube. The case shall be provided with two bosses, one located at the top and the other at the bottom of the case, unless otherwise approved by the bureau concerned.	Complied.	Complied.
Springs: All springs which form a part of the electrical circuit shall be of beryllium copper, phosphor bronze, or their approved equivalent.	Complied.	Complied.
Contacts: All contacts for making and breaking an electrical circuit shall be of tungsten.	Complied.	Complied.
Agreement with test plans: Blueprint plans of sufficient detail to show all essential components of the equipment to be tested shall be furnished, and shall check with the equipment.	*Electrical data and interior wiring are not in agreement with the sample.	*Electrical data and interior wiring are not in agreement with the sample.

9. The test results obtained on the types B-7 and B-8 bar chimes were as follows:

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type B-7</u>	<u>Type B-8</u>
Voltage: 115 volts	Tested at 115 volts, d.c.	Tested at 115 volts, a.c.
Amperes: Not specified.	0.148 ampere.	0.145 ampere.

RequirementsTest values

	<u>Type B-7</u>	<u>Type B-8</u>
Watts: Shall not exceed 25 watts	16.6 watts	12.2 watts
Sound pressure output: Shall be not less than 45 decibels at 18 feet in a soundproof room under the following conditions:		
(a) Before the endurance test	77 db	79 db
(b) Following the endurance test	81 db	79 db
Inclination: Shall operate in any position when supplied with rated voltage and frequency and $\pm 7$ volts and 5 cycles.	Complied.	Complied.
Endurance test: Shall operate at the rate of 10 cycles per minute every alternate minute for 12 hours, the first half at 60°C. and the second half at 0°C. ambient temperatures. (By agreement with the Bureau on previous samples of the same design).	Complied.	Complied.
Temperature rise: Maximum temperature shall not exceed 115°C. during the endurance test. (55°C. rise at 60°C. ambient temperature.	Complied. 47.4°C. above 60°C. ambient temperature.	Complied. 35.9°C. above 60°C. ambient temperature.
Shock test: Shall withstand 20 shocks of 250 foot pounds each as specified in paragraph F-2g.	Complied.	Complied.
Vibration test: Shall be mounted on a standard Navy 3 foot pound vibration machine and subjected to six tests of 30 minutes each at frequencies of 100, 150, 200, 250, 300 and 350 shocks per minute.	Complied.	Complied.
Dielectric test: Shall withstand twice the rated voltage plus 1250 volts, 60 cycles, for one minute between electrical circuits and between electrical circuits and ground.	Complied.	Complied.
Insulation resistance: Shall be not less than 5 megohms at not less than 500 volts, d.c.	Complied. Greater than 200 megohms by 1000 volt megger.	Complied. Greater than 200 megohms by 1000 volt megger.

RequirementsTest ValuesType B-7Type B-8

Splashproof integrity: Shall be subjected to a 1-inch stream of water, under a pressure head of 35 feet, played from a hose at a distance of 5 feet, for 5 minutes, without the entry of water into the case.

Complied.

Complied.

Salt spray test: Shall be subjected, under ultra-violet light, to a 20 per cent salt spray at 55°C. for a period of 3 minutes, followed by an air blast at 55°C. for 3 minutes, the cycle being repeated continuously for 100 hours.

Not conducted due to similarity to type B-8.

Paint came off resonator, pc. 3 of reference (e)

Weight: Shall not exceed 3 pounds.

Complied. 2 pounds, 11 ounces.

Complied. 2 pounds, 11 ounces.

Nameplate: Shall be in accordance with N. D. Specification 42N2.

Complied. Copper-nickel alloy.

Complied. Copper-nickel alloy.

Dissimilar metals: Contact of dissimilar metals, except steel, with aluminum alloys shall be avoided as much as practicable in the assembly of parts. Where contact cannot be avoided, an approved spar varnish or other approved material shall be used between the faying surfaces.

Complied.

Complied.

Protection against corrosion: All aluminum surfaces shall be protected with one coat of zinc chromate paint, or an approved anodic treatment, over which finishing coats of approved gray paint shall be applied.

Complied.

Complied.

Protection of exterior surfaces: Exterior surfaces of all equipment, except nameplates, gongs, and strikers, shall be finished with two coats of gray paint specifically approved by the bureau concerned.

Complied.

Complied.

Clearances: Clearances between any two electrical circuits or between any electrical circuit and ground, where not separated by at least 1/16-inch of approved insulating material, shall be not less than 1/8-inch, unless otherwise approved.

Complied.

Complied.

RequirementsTest ValuesType B-7Type B-8

Wiring: All wiring shall be in accordance with the requirements of N. D. Specification 15C1, unless otherwise approved.	*Does not comply with Spec. 15C1.	*Does not comply with Spec. 15C1.
Coil windings: May be either single or double silk or cotton covered enameled copper wire.	Complied. Single silk covered enameled copper wire.	Complied. Single silk covered enameled copper wire.
Protective covering for coils: Shall be nonhygroscopic, not glued or cemented to the coils, but shall be overlapped and cemented in the lap.	Complied.	Complied.
Waterproofing of coils: All coils shall be impregnated with an approved synthetic resinous material or other suitable and approved waterproofing and insulating compound.	Complied.	Complied.
Magnetic circuits: Shall be of laminated punchings of the best available grade for the purpose and shall be protected against corrosion.	Plunger holder, pc.15 of solid stainless steel.	Plunger holder, pc.15 of solid stainless steel.
Terminal block: Shall be of approved material and type, and readily accessible.	Complied.	Complied.
Terminal lugs: Shall be in accordance with Bureau of Engineering drawing 9-S-1841-L, unless otherwise specified by the bureau concerned.	*None furnished.	*None furnished.
Supply leads: Shall enter through the casing attached to the mounting bulkhead and not through any removable part.	Complied.	Complied.
Terminal wiring: Shall be lead in through a boss drilled and tapped for a Navy standard terminal tube. The case shall be provided with two bosses, one located at the top and the other at the bottom of the case, unless otherwise approved by the bureau concerned.	Complied.	Complied.

RequirementsTest ValuesType B-7Type B-8

Springs: All springs which form a part of the electrical circuit shall be of beryllium copper, phosphor bronze, or their approved equivalent.

None used.

None used.

Contacts: All contacts for making and breaking an electrical circuit shall be of tungsten.

None used.

None used.

Agreement with test plans: Blueprint plans of sufficient detail to show all essential components of the equipment to be tested shall be furnished, and shall check with the equipment.

Complied.

Complied.

10. The test results obtained on the types H-1 and H-2 horns were as follows:

RequirementsTest ValuesType H-1Type H-2

Voltage: 115 volts

Tested at 115 volts d.c.

Tested at 115 volts a.c.

Amperes: Not specified

0.082 ampere

0.167 ampere

Watts: Shall not exceed 25 watts

9.4 watts

18.8 watts

Sound pressure output: Shall be not less than 75 decibels at 18 feet in a soundproof room under the following conditions:

(a) Before the endurance test

82 db

86 db

(b) Following the endurance test

86 db

87 db

Pitch of note: 100-600 CPS

See Plate 3

See Plate 3

Inclination: Shall operate in any position when supplied with rated voltage and frequency and  $\pm 7$  volts and 5 cycles.

Complied.

Complied.

Endurance test: Shall operate 1500 cycles of "one minute on" and "one minute off", the first 750 cycles at 60° C. and the second at 0° C. ambient temperatures.

Complied.

Complied.

RequirementsTest Values

	<u>Type H-1</u>	<u>Type H-2</u>
Temperature rise: Maximum temperature shall not exceed 115°C. during the endurance test. (55°C. rise at 60°C. ambient temperature.)	Complied. 23.8°C. above 60°C. ambient temperature.	Complied. 51.8°C. above 60°C. ambient temperature.
Shock test: Shall withstand 20 shocks of 250 foot pounds each as specified in paragraph F-2g.	Complied.	Complied.
Vibration test: Shall be mounted on a standard Navy 3 foot pound vibration machine and subjected to six tests of 30 minutes each at frequencies of 100, 150, 200, 250, 300 and 350 shocks per minute.	Complied.	Complied.
Dielectric test: Shall withstand twice the rated voltage plus 1250 volts, 60 cycles, for one minute between electrical circuits and between electrical circuits and ground.	Complied.	Complied.
Insulation resistance: Shall be not less than 5 megohms at not less than 500 volts, d.c.	Complied. Greater than 200 megohms by 1000 volt megger.	Complied. Greater than 200 megohms by 1000 volt megger.
Watertight integrity: Shall be submerged under 3 feet of standard sea water for a period of 3 hours without the entry of water into the case.	Complied.	Complied.
Salt spray test: Shall be subjected, under ultra-violet light, to a 20 per cent salt spray at 55°C. for a period of 3 minutes, followed by an air blast at 55°C. for 3 minutes, the cycle being repeated continuously for 100 hours.	Not conducted due to similarity to type H-2.	Satisfactory.
Weight: Shall not exceed 6 pounds.	Complied. 4 pounds.	Complied. 3 pounds, 12 ounces.
Nameplate: Shall be in accordance with N. D. Specification 42M2.	Complied. Copper-nickel alloy.	Complied. Copper-nickel alloy.

	<u>Type H-1</u>	<u>Type H-2</u>
Dissimilar metals: Contact of dissimilar metals, except steel, with aluminum alloys shall be avoided as much as practicable in the assembly of parts. Where contact cannot be avoided, an approved spar varnish or other approved material shall be used between the faying surfaces.	Complied.	Complied.
Protection against corrosion: All aluminum surfaces shall be protected with one coat of zinc chromate paint, or an approved anodic treatment, over which finishing coats of approved gray paint shall be applied.	Complied.	Complied.
Protection of exterior surfaces: Exterior surfaces of the equipment, except nameplates and diaphragms shall be finished with two coats of gray paint specifically approved by the bureau concerned.	Complied.	Complied.
Clearances: Clearances between any two electrical circuits or between any electrical circuit and ground, where not separated by at least 1/16-inch of approved insulating material, shall be not less than 1/8-inch, unless otherwise approved.	Complied.	Complied.
Wiring: All wiring shall be in accordance with the requirements of N. D. Specification 15C1, unless otherwise approved.	*Does not comply with Spec. 15C1. See para. 3, ref. (h).	*Does not comply with Spec. 15C1. See para. 3, ref. (h).
Diaphragm: Shall be of nickel-chromium alloy unless otherwise approved.	Complied. Nickel-chromium alloy.	Complied. Nickel-chromium alloy.
Coil windings: May be either single or double silk or cotton covered enameled copper wire.	Complied. Single silk covered enameled copper wire.	Complied. Single silk covered enameled copper wire.
Protective covering for coils: Shall be nonhygroscopic, not glued or cemented to the coils, but shall be overlapped and cemented in the lap.	Complied.	Complied.

Waterproofing of coils: All coils shall be impregnated with an approved synthetic resinous material or other suitable and approved waterproofing and insulating compound.	Complied	Complied
Magnetic circuits: Shall be of laminated punchings of the best available grade for the purpose and shall be protected against corrosion.	Complied.	Complied.
Terminal block: Shall be of approved material and type, and readily accessible.	Complied.	Complied.
Terminal lugs: Shall be in accordance with Bureau of Engineering drawing 9-S-1841-L, unless otherwise specified by the bureau concerned.	Complied.	Complied.
Supply leads: Shall enter through the casing attached to the mounting bulkhead and not through any removable part.	Complied.	Complied.
Terminal wiring: Shall be lead in through a boss drilled and tapped for a Navy standard terminal tube. The case shall be provided with two bosses, one located at the top and the other at the bottom of the case, unless otherwise approved by the bureau concerned.	Complied.	Complied.
Springs: All springs which form a part of the electrical circuit shall be of beryllium copper, phosphor bronze, or their approved equivalent.	*Lower contact spring, pc. 48, is of steel.	None used.
Contacts: All contacts for making and breaking an electrical circuit shall be of tungsten.	Complied.	None used.
Agreement with test plans: Blueprint plans of sufficient detail to show all essential components of the equipment to be tested shall be furnished, and shall check with the equipment.	Complied.	Complied.

RequirementsTest Values

	<u>Type Z-1</u>	<u>Type Z-2</u>
Voltage: 115 volts	Tested at 115 volts d.c.	Tested at 115 volts a.c.
Amperes: Not specified.	0.042 ampere	0.093 ampere
Watts: Shall not exceed 7.5 watts	4.8 watts	4.4 watts
Sound pressure output: Shall be not less than 40 decibels at 18 feet in a soundproof room under the following conditions:		
(a) Before the endurance test	71 db	73 db
(b) Following the endurance test	Not measured due to failure under endurance.	66 db
Pitch of note: 100-500 CPS	See Plate 4	See Plate 4
Inclination: Shall operate in any position when supplied with rated voltage and frequency $\pm$ 10 per cent.	Complied	Complied
Endurance test: Shall operate 1500 cycles of "one minute on" and "one minute off", the first 750 cycles at 60° C. and the second at 0° C. ambient temperatures.	*Failed after 41 hours due to contact failure.	Complied
Temperature rise: Maximum temperature shall not exceed 115° C. during the endurance test. (55° C. rise at 60° C. ambient temperature.)	Complied. 30.9° C. above 60° C. ambient temperature.	Complied. 40.9° C. above 60° C. ambient temperature.
Shock test: Shall withstand 20 shocks of 250 foot pounds each as specified in paragraph F-2g.	Not conducted due to failure under the endurance test.	Complied.
Vibration test: Shall be mounted on a standard Navy 3 foot pound vibration machine and subjected to six tests of 30 minutes each at frequencies of 100, 150, 200, 250, 300 and 350 shocks per minute.	Not conducted due to failure under the endurance test.	Complied.

	<u>Type Z-1</u>	<u>Type Z-2</u>
Dielectric test: Shall withstand twice the rated voltage plus 1250 volts, 60 cycles, for one minute between electrical circuits and between electrical circuits and ground.	Complied.	Complied.
Insulation resistance: Shall be not less than 5 megohms et not less than 500 volts, d.c.	Complied. Greater than 200 megohms by 1000 volt megger.	Complied. Greater than 200 megohms by 1000 volt megger.
Watertight integrity: Shall be submerged under 3 feet of standard sea water for a period of 3 hours without the entry of water into the case.	Complied.	Complied.
Salt spray test: Shall be subjected under ultra-violet light, to a 20 per cent salt spray at 55° C. for a period of 3 minutes, followed by an air blast at 55°C. for 3 minutes, the cycle being repeated continuously for 100 hours.	Not conducted due to similarity to type Z-2.	Satisfactory.
Weight: Shall not exceed 22 ounces.	*23 ounces.	Complied. 21 ounces.
Nameplate: Shall be in accordance with N. D. Specification 42N2.	Complied. Copper-nickel alloy.	Complied. Copper-nickel alloy.
Dissimilar metals: Contact of dissimilar metals, except steel, with aluminum alloys shall be avoided as much as practicable in the assembly of parts. Where contact cannot be avoided, an approved spar varnish or other approved material shall be used between the faying surfaces.	Complied.	Complied.
Protection against corrosion: All aluminum surfaces shall be protected with one coat of zinc chromate paint, or an approved anodic treatment, over which finishing coats of approved gray paint shall be applied.	Complied.	Complied.
Protection of exterior surfaces: Exterior surfaces of the equipment, except the nameplate shall be finished with two coats of gray paint specifically approved by the bureau concerned.	Complied.	Complied.

RequirementsTest ValuesType Z-1Type Z-2

Clearances: Clearances between any two electrical circuits or between any electrical circuit and ground, where not separated by at least 1/16-inch of approved insulating material, shall be not less than 1/8-inch, unless otherwise approved.

Complied.

Complied.

Wiring: All wiring shall be in accordance with the requirements of N. D. Specification 15C1, unless otherwise approved.

\*Does not comply with N.D. Spec. 15C1.

\*Does not comply with N.D. Spec. 15C1.

Coil windings: May be either single or double silk or cotton covered enameled copper wire.

Complied.

Complied.

Protective covering for coils: Shall be nonhygroscopic, not glued or cemented to the coils, but shall be overlapped and cemented in the lap.

Complied.

Complied.

Waterproofing of coils: All coils shall be impregnated with an approved synthetic resinous material or other suitable and approved waterproofing and insulating compound.

Complied.

Complied.

Magnetic circuits: Shall be of laminated punchings of the best available grade for the purpose and shall be protected against corrosion.

Complied.

Complied.

Terminal block: Shall be of approved material and type, and readily accessible.

Complied.

Complied.

Terminal lugs: Shall be in accordance with the Bureau of Engineering drawing 9-S-1841-L, unless otherwise specified by the bureau concerned.

Complied.

Complied.

Supply leads: Shall enter through the casing attached to the mounting bulkhead and not through any removable part.

Complied.

Complied.

RequirementsTest ValuesType Z-1Type Z-2

Terminal wiring: Shall be lead in through a boss drilled and tapped for a Navy standard terminal tube. The case shall be provided with two bosses, one located at the top and the other at the bottom of the case, unless otherwise approved by the bureau concerned.

Complied.

Complied.

Springs: All springs which form a part of the electrical circuit shall be of beryllium copper, phosphor bronze, or their approved equivalent.

Complied.

None used.

Contacts: All contacts for making and breaking an electrical circuit shall be of tungsten.

Complied.

None used.

Agreement with test plans: Blue-printing plans of sufficient detail to show all essential components of the equipment to be tested shall be furnished, and shall check with the equipment.

\*Terminal plates  
and contacts are  
not clearly  
identified.

Complied.

\*Denotes failure to comply with the specifications.

## CONCLUSIONS

12. The subject audible signals are of good design, of first class workmanship, and meet the specification except in the following minor particulars:

- (a) Types B-1 and B-2 Bells
  - (1) Para. E-1: The weight allowed (2 pounds) is exceeded by 4 ounces.
  - (2) Para. D-6a: The wire used is not in accordance with N.D.Spec.15C1.
- (b) Types B-5 and B-6 Bells
  - (1) Para. D-6a: The wire used is not in accordance with N.D.Spec.15C1.
  - (2) Para. H-3b: Electrical data and interior wiring of the samples are not in agreement with drawing, reference (d).
- (c) Types B-7 and B-8 Bar Chimes
  - (1) Para. D-6a: The wire used is not in accordance with N.D.Spec.15C1.
  - (2) Para. D-10b: Terminal lugs are not provided.
- (d) Types H-1 and H-2 Horns
  - (1) Para. D-6a: The wire used is not in accordance with N.D.Spec.15C1.
  - (2) Para. D-11d: Lower contact spring pc. 48, ref. (f), is of steel in lieu of phosphor bronze or beryllium copper.
- (e) Types Z-1 and Z-2 Buzzers
  - (1) Para. F-2m(1): The type Z-1 buzzer satisfactorily completed the first half of the endurance test at 60°C., but failed after 16 hours during the latter half at 0°C. due to breaking of the fixed contact from the line terminal plate. The contacts and terminal plates are not clearly identified on drawing, reference (g). This is the second failure to complete the required endurance test, the first having been reported by reference (i).
  - (2) Para. D-6a: The wire used on both samples is not in accordance with N.D.Spec.15C1.
  - (3) Para. E-1: The weight of the Z-1 buzzer exceeds that allowed (22 ounces) by 1 ounce.

13. The wire designated by drawings, references (c) to (g), is referred to in paragraph 3 of reference (h).

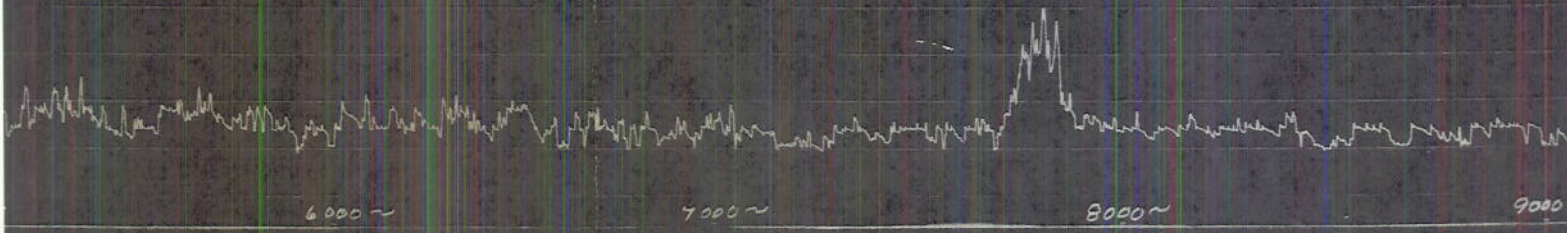
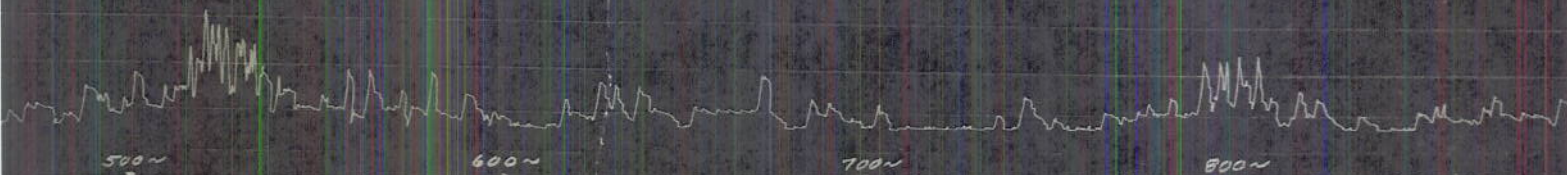
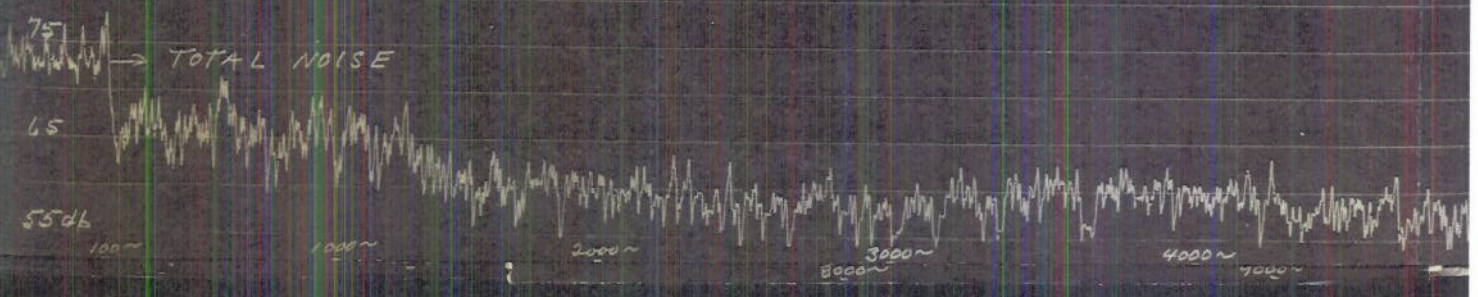
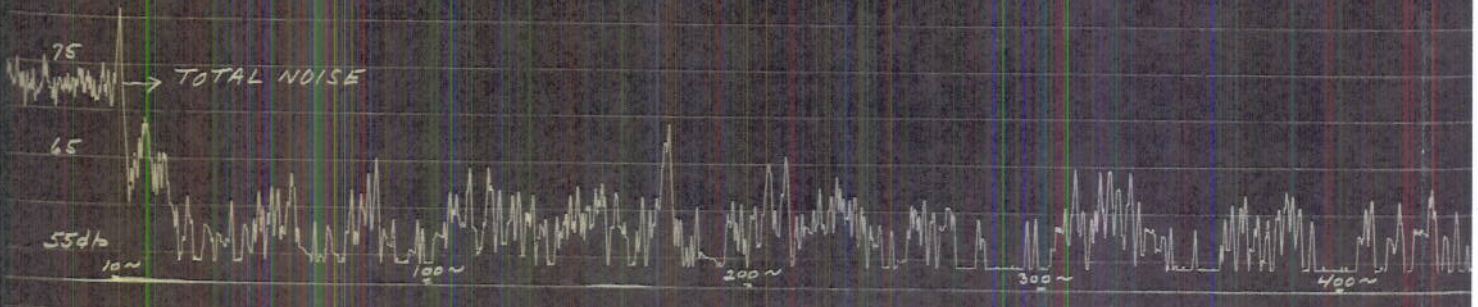
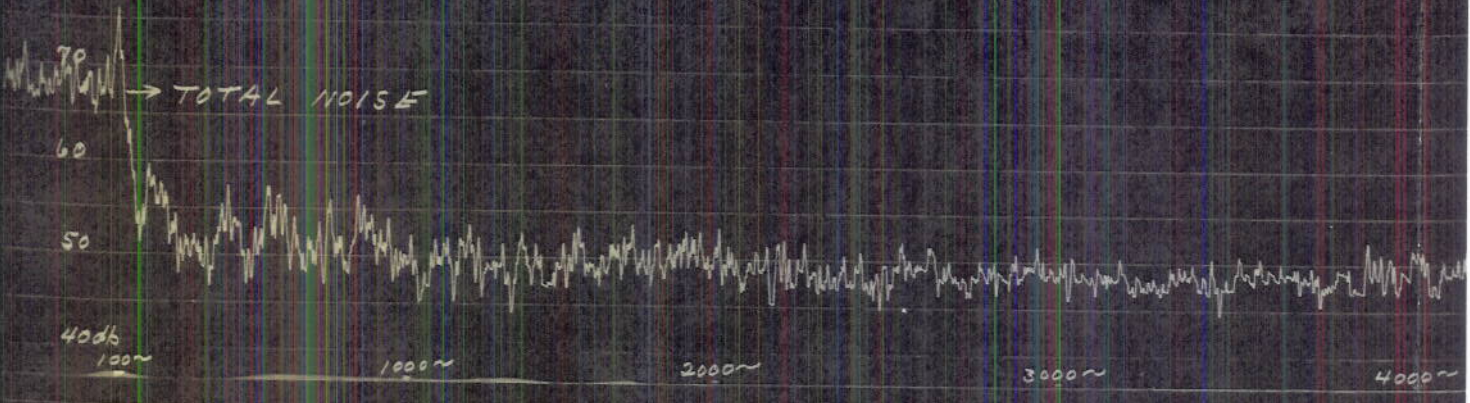
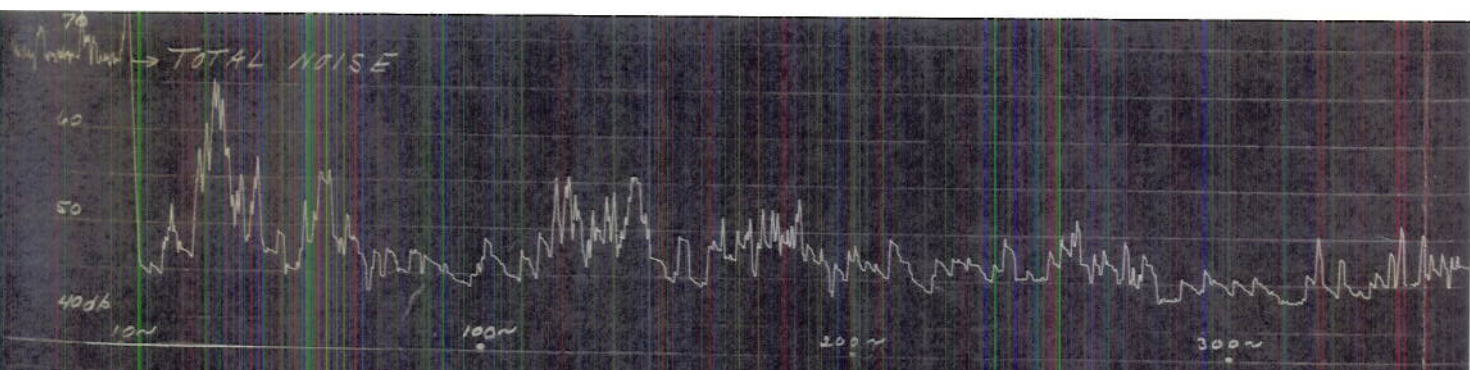


PLATE 1



500~

600~

700~

800~

900~

2

6000~

7000~

8000~

9000~

3

600~

700~

800~

900~

1000~

4

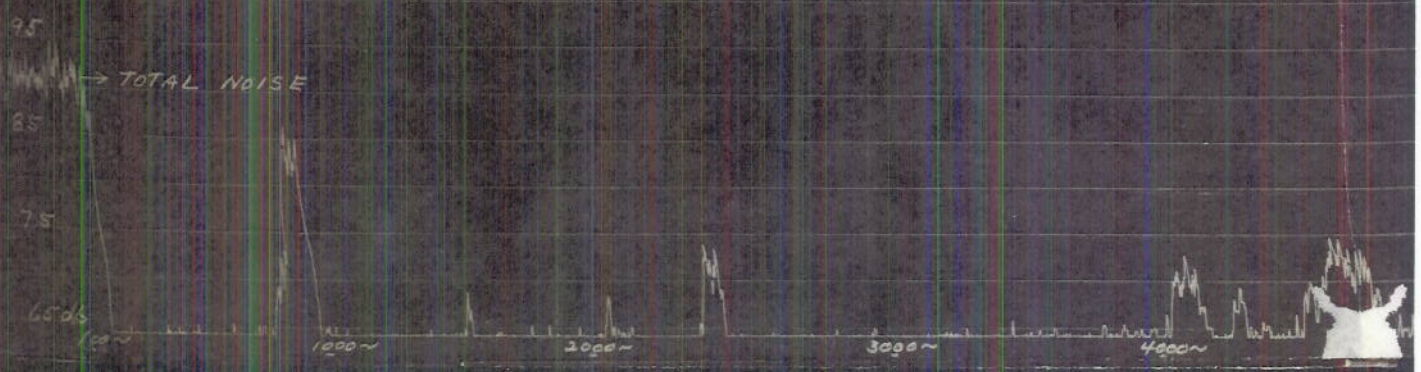
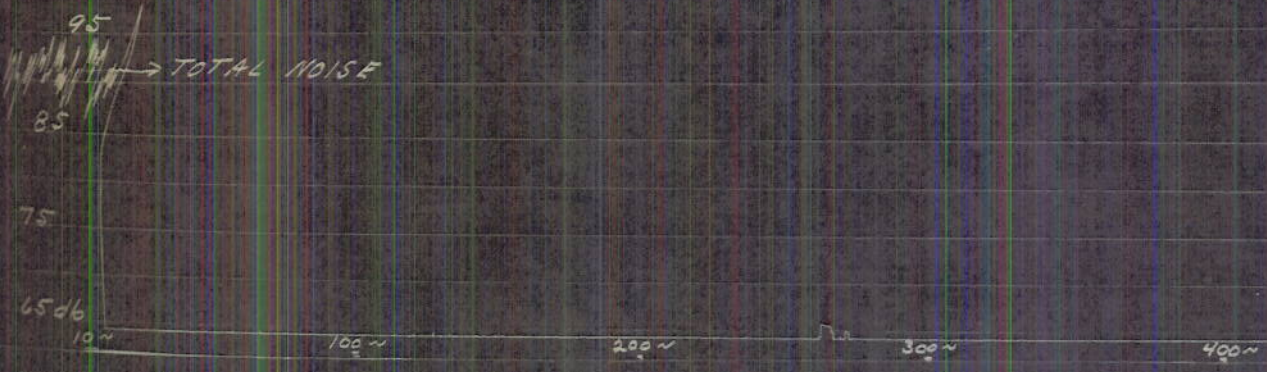
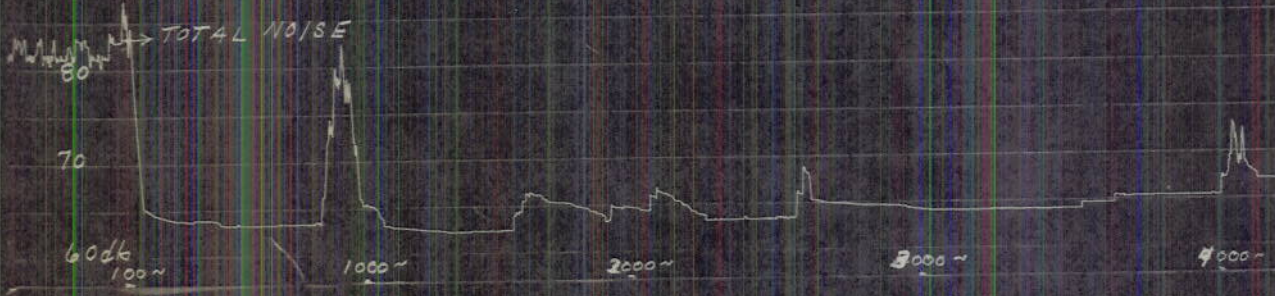
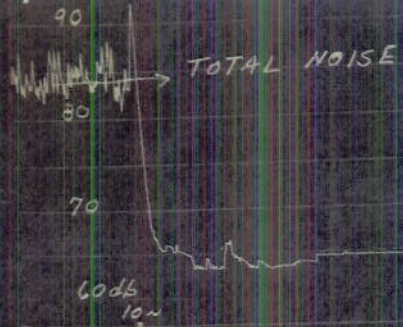
6000~

7000~

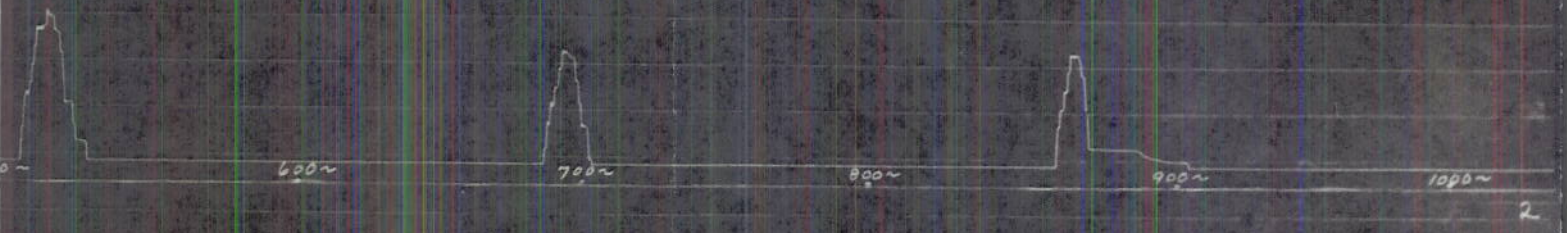
8000~

9000~

PLATE 2



H-1 HORN



2

H-1 HORN



3

H-2 HORN



4

H-2 HORN



PLATE 3



BUZZER

50~ 600~ 700~ 800~ 900~ 1000~ 2

BUZZER



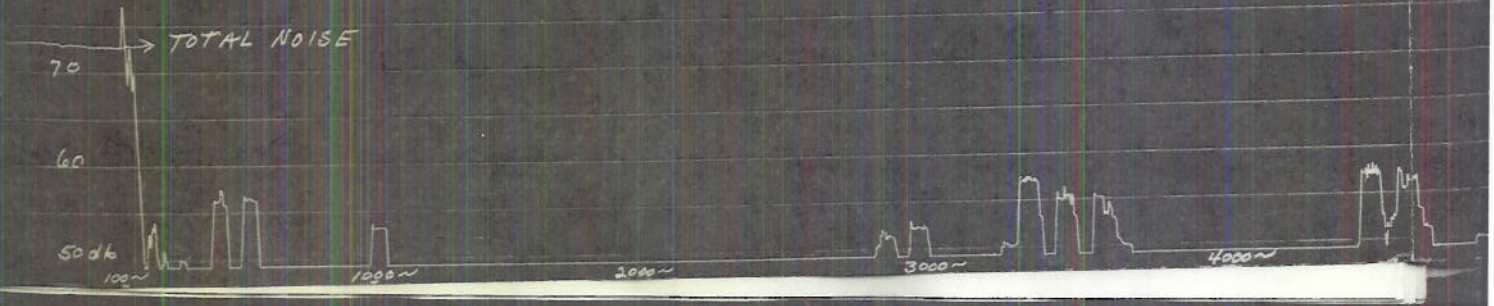
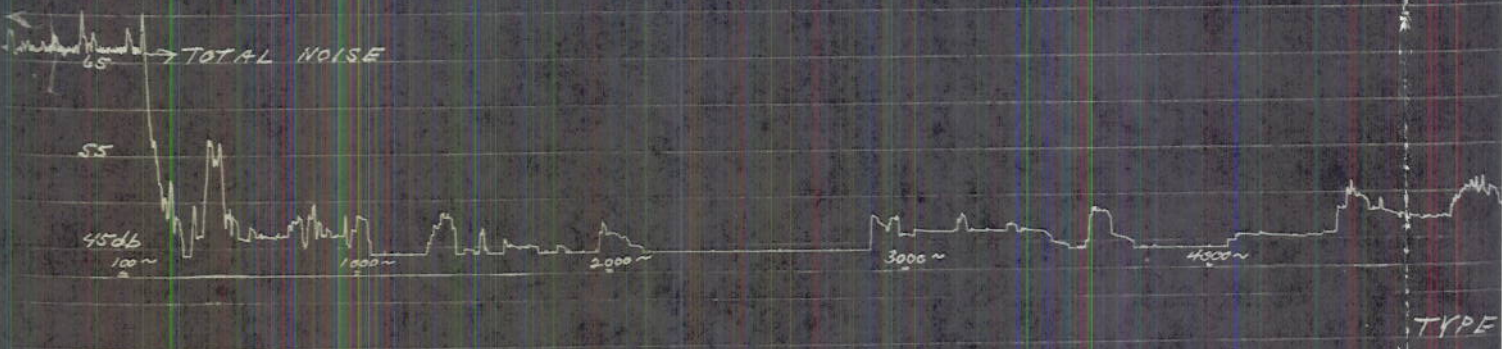
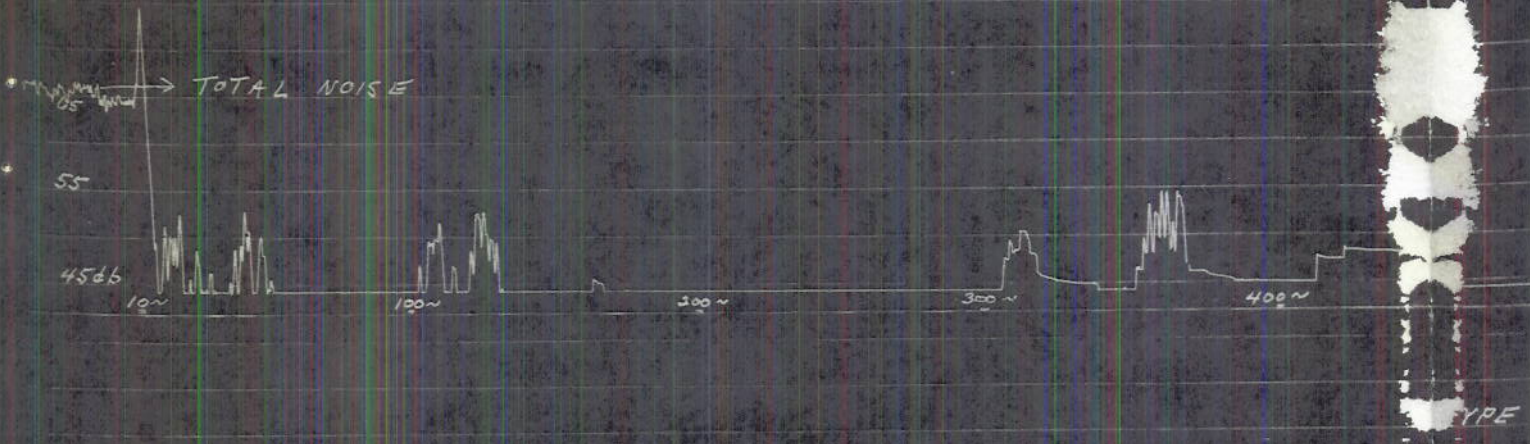
-2 BUZZER

50~ 600~ 700~ 800~ 900~ 1000~ 4

-2 BUZZER



PLATE 4



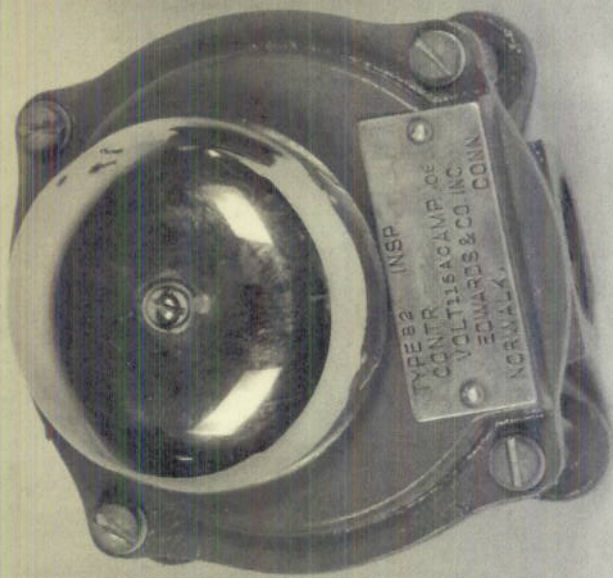
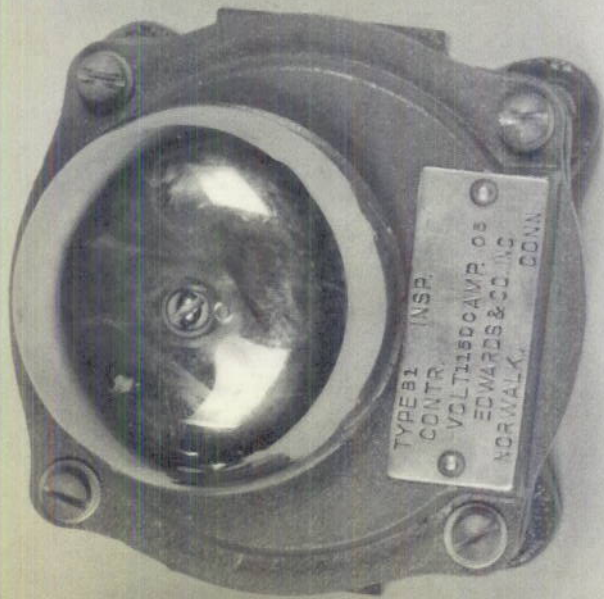


PLATE 5

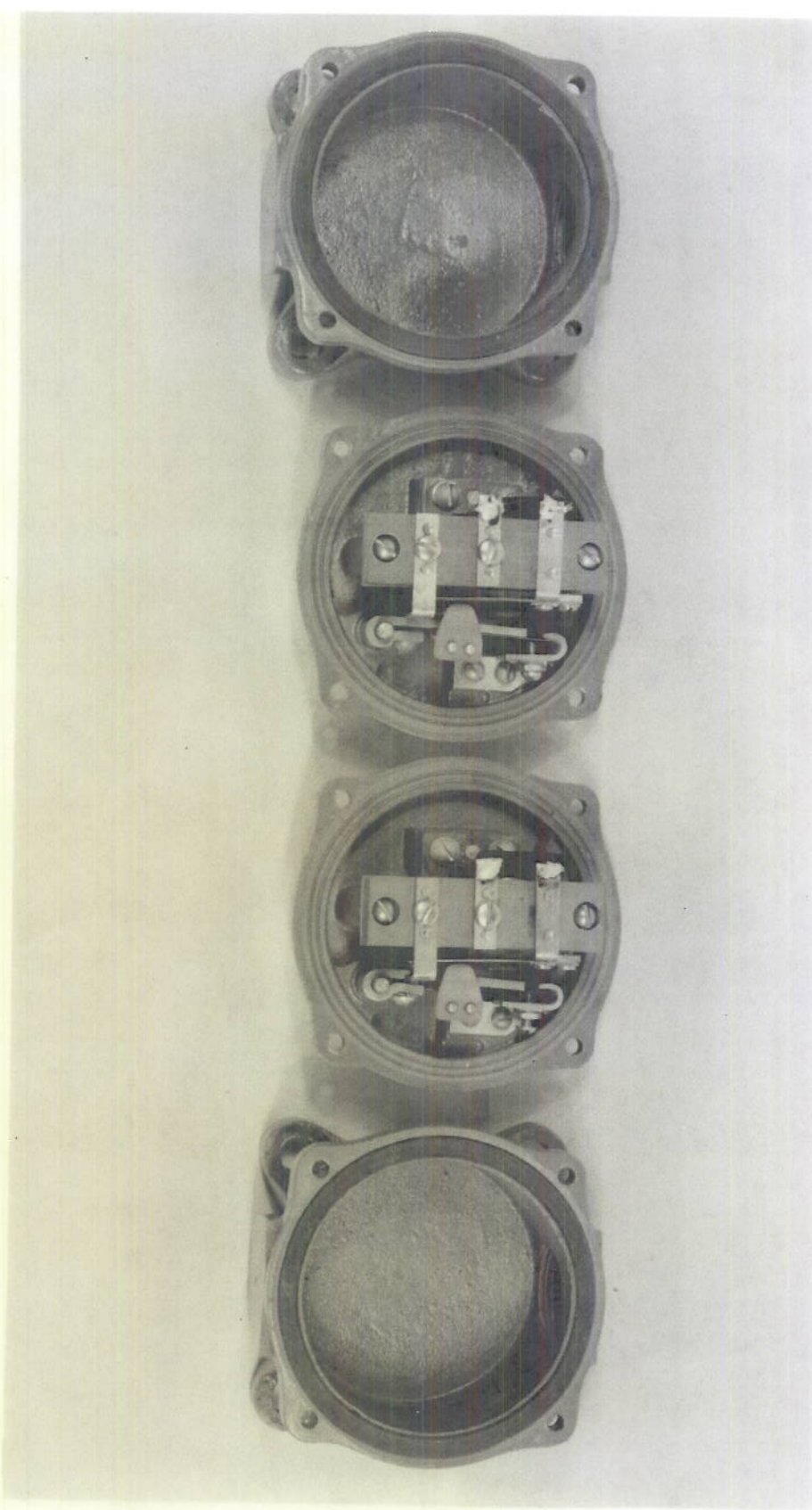


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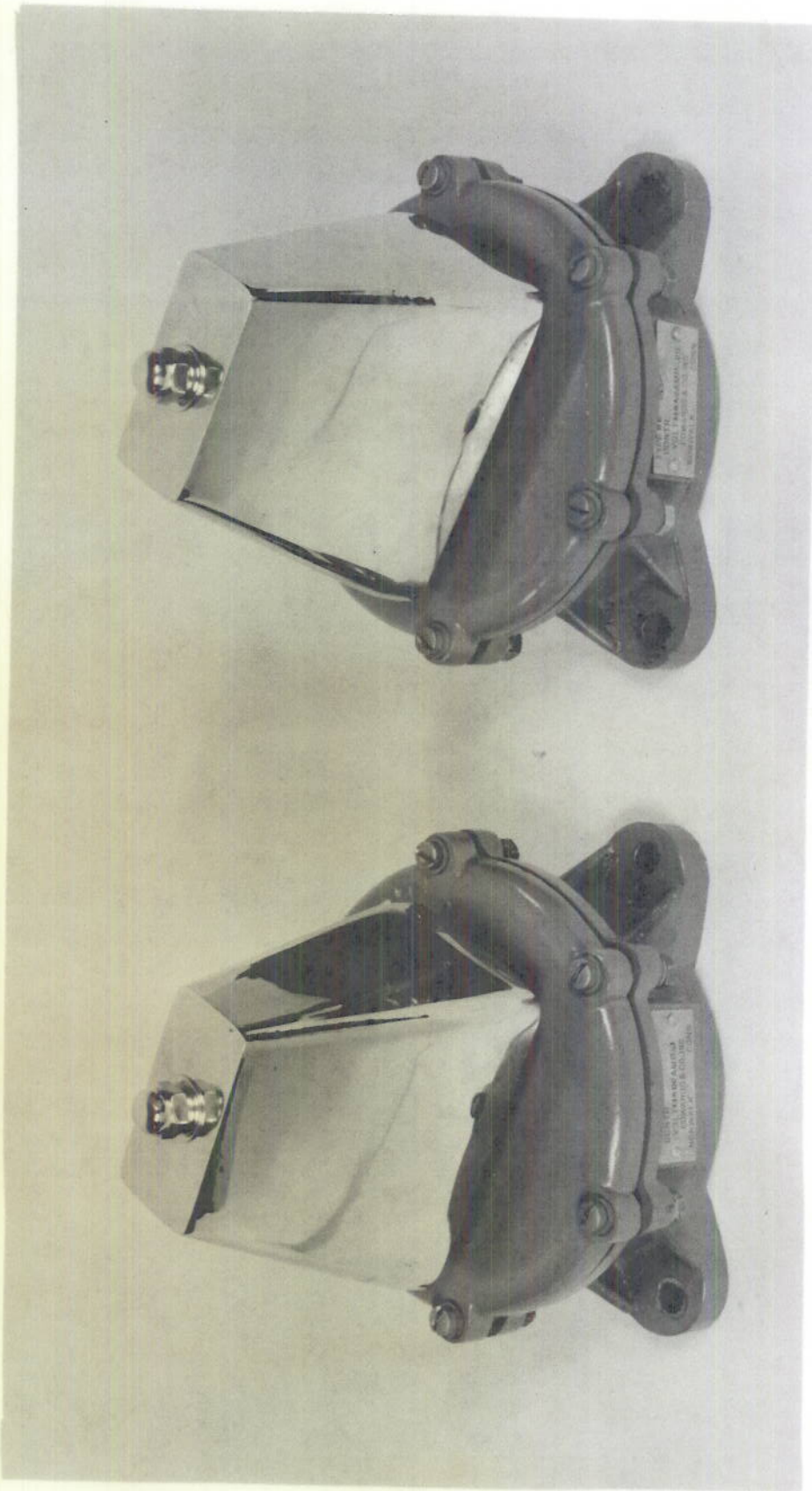


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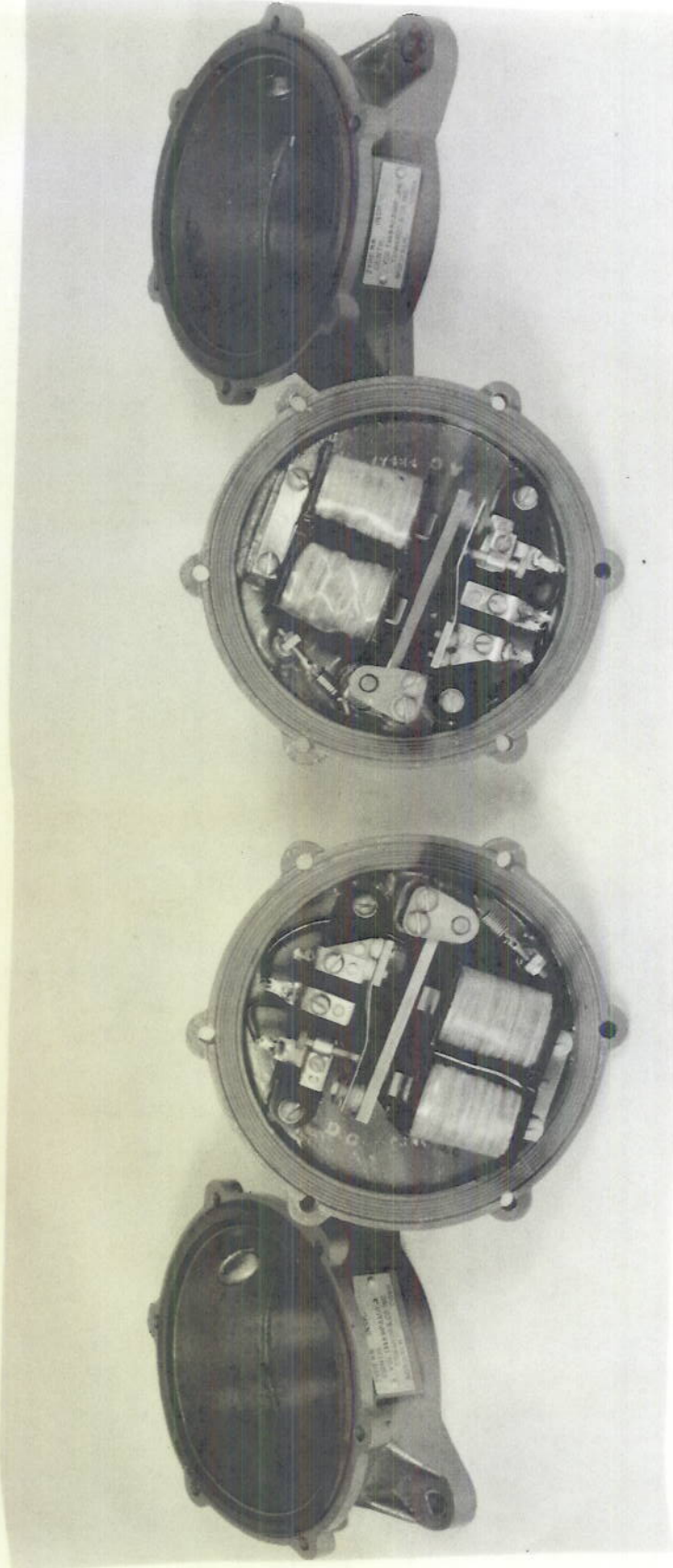


PLATE 8

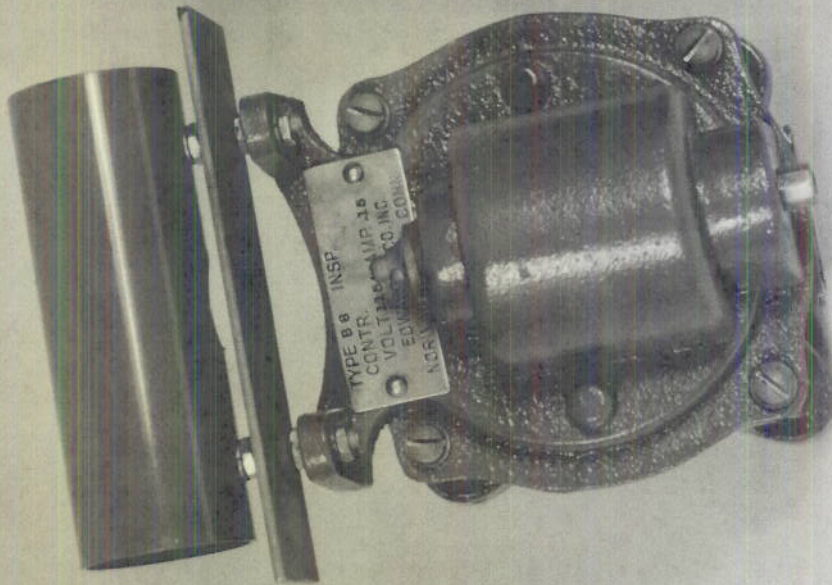
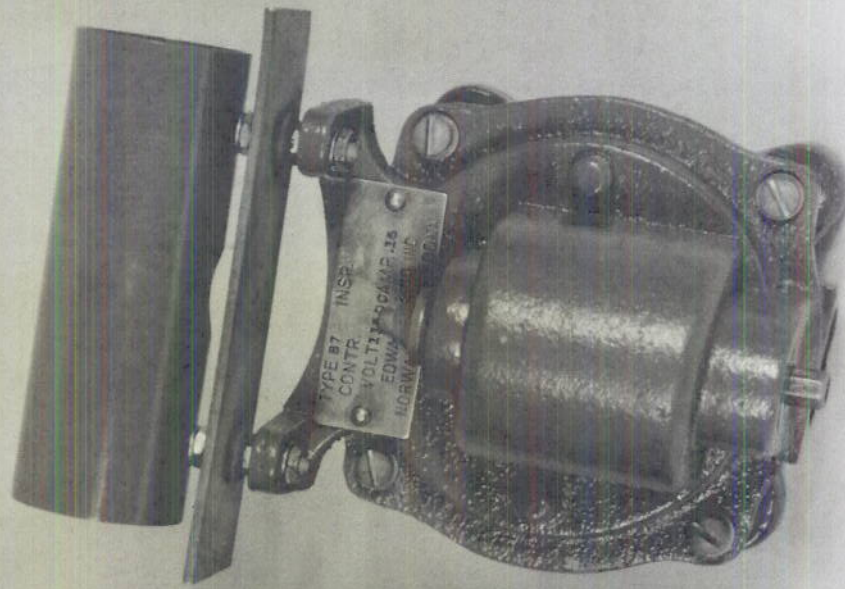


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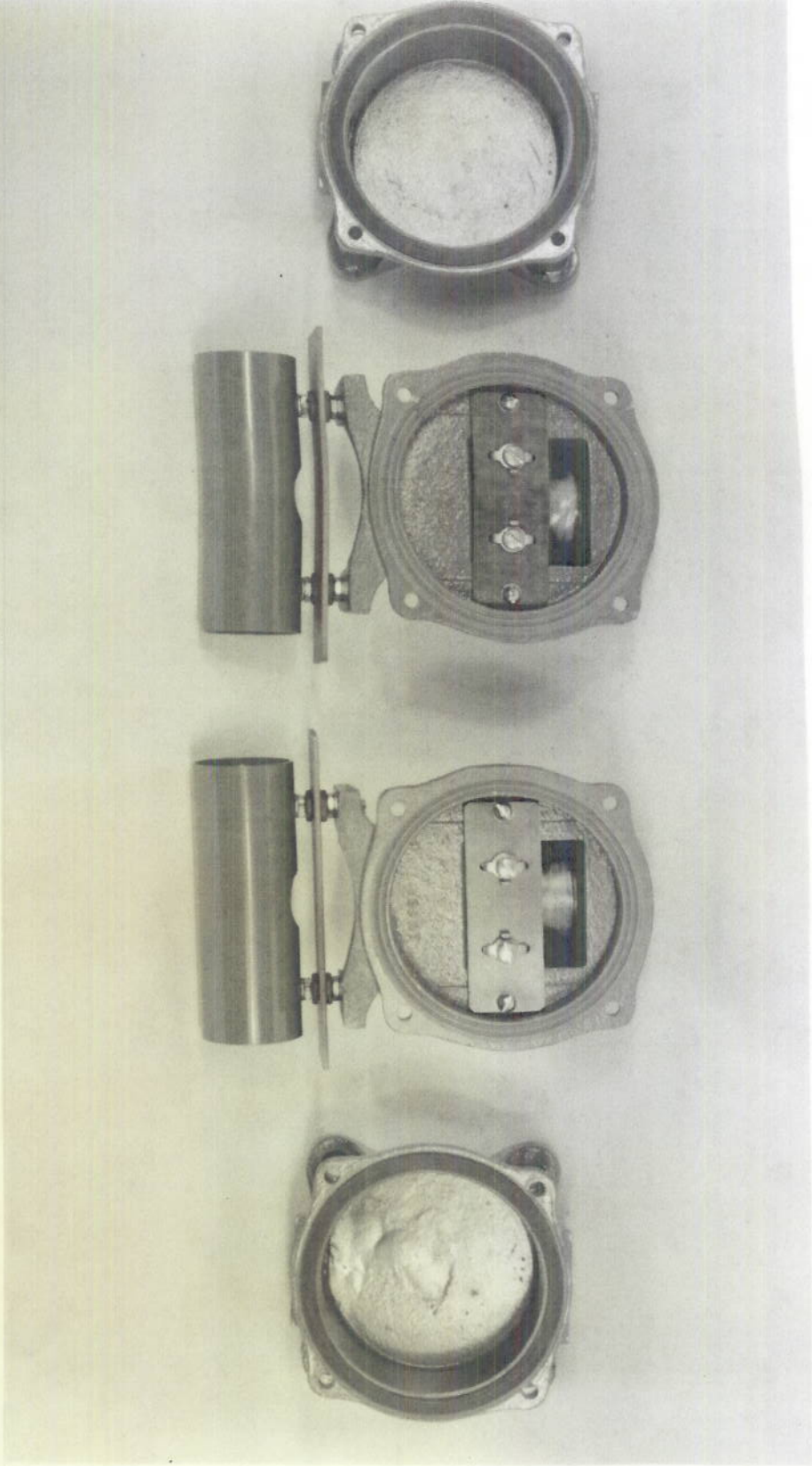


PLATE 10



PLATE II

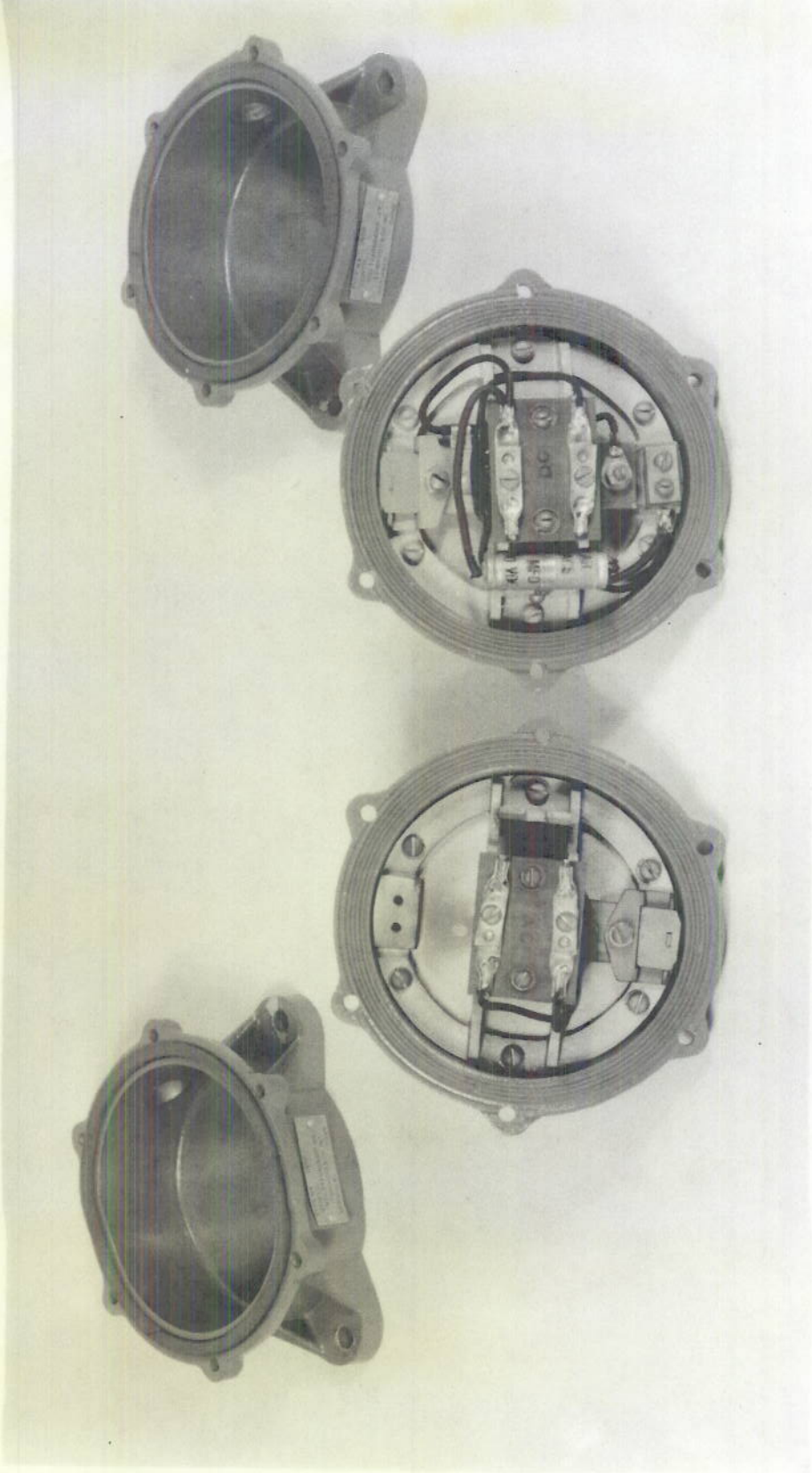


PLATE 12



PLATE 13