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NRL Report No. B-1993

NAVY DEPARTMENT

Report of Test

on

Horns, Types H-3 and H-4

Submitted by

Schwarze Electric Company
Adrian, Michigan

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

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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) S65-2(350) of 14 January 1943.
(b) Specification 17S11(INT) of 1 October 1941 and Amendment 2 of 1 March 1942.
(c) Specification 17E13(INT) of 1 March 1942.
(d) Schwarze Electric Company Drwg. EM-3248.

OBJECT OF TEST

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

ABSTRACT OF TEST

3. The sample horns 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.

4. For additional information, the sample horns, mounted as shown in Plate 4, were subjected to the HI shock test, specified in reference (c), at the conclusion of all other tests.

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CONCLUSIONS

(a) The subject horns were, in general, of good design and workmanship, but failed to comply with the specification in the following respects:

Type H-3

- (1) Faulty operation under endurance in that the pitch of note changed 80 times.
- (2) Failure under vibration in that the resistor connections were broken.
- (3) Inability to withstand the specified dielectric test.
- (4) "Formex" used for coil winding insulation in lieu of cotton or silk.
- (5) Two flats provided in lieu of bosses.
- (6) Contact spring material.
- (7) Agreement with test plans in several details.

Type H-4

- (1) Steel diaphragm furnished in lieu of a nickel-chromium alloy diaphragm.
- (2) "Formex" used for coil winding insulation in lieu of cotton or silk.
- (3) Two flats provided in lieu of bosses.
- (4) Necessity of removing grounded condenser from circuit.
- (5) Contact spring material.
- (6) Agreement with test plans in several details.

(b) It is believed that the use of six - 1/4-28 screws to assemble the base plate, pc. 51, to front plate, pc. 31, is not justified in view of the 6 screws, pc. 37, which assemble both these parts to front cover, pc. 6.

(c) The results of the HI shock test indicate that the strength of the sample horns is not adequate to withstand high impact shock. It is believed that some form of resilient mounting plate would provide the desired shock integrity. It is also possible that the use of a resilient mounting plate will improve the stability of the operation of the H-3 horn. Laboratory experience indicates that this type is sensitive to the flexibility of its mounting.

RECOMMENDATIONS

(a) That the sample tested as a type H-3 horn be NOT approved in its present form because of its faulty operation and deficiencies noted under "Conclusions".

(b) That the sample tested as a type H-4 horn be considered SATISFACTORY subject to the desires of the Bureau relative to the deficiencies noted under "Conclusions".

(c) That both samples be considered NOT satisfactory from the standpoint of high impact shock integrity because of the damage noted under "Conclusions".

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DESCRIPTION OF MATERIAL UNDER TEST

5. The two sample horns, submitted by Schwarze Electric Company, are identical in design and construction, except that one horn is provided with a steel diaphragm, and the other with a nickel-chromium alloy diaphragm. They are designed to be used as either Type H-3 (115 volts, d.c.) or Type H-4 (115 volts, a.c.). The horn with a steel diaphragm was tested as Type H-4, and the other as Type H-3.

6. The horns are of the resonated type, employing a single winding and adjustable contacts for interrupting the circuit. A 50,000 ohm resistor and an 0.1 microfarad condenser are connected across the contacts to suppress the arc.

7. The mechanism is mounted on a formed steel chassis secured to a steel projector collar by six 1/4-28 round-headed screws threaded into the projector collar. The chassis and projector collar are secured to a malleable iron housing cover by six No. 10-32 round headed screws threaded into the cover. A steel projector is threaded into the projector collar and secured by a lock nut.

8. The sheet steel housing has a turned-over rim which forms a flange drilled for six 1/4-20 round-headed screws. Welded to the back of the housing are 3 3/16" x 1" steel straps arranged symmetrically, having three extending lugs drilled for 1/4-inch mounting screws.

9. A rubber gasket, of 1/4-inch cross-section, recessed in the housing cover and contacting the rim of the housing, and a rubber gasket, 1/16" thick, between the housing cover and projector collar are provided to obtain watertightness. There are also two fiber gaskets; one used between the diaphragm and projector collar, and one between the diaphragm and chassis.

10. The horn is finished with gray paint applied over zinc chromate paint.

11. The acoustical analyses of the horns are given by Plate 1. Further details in the design and construction of the horns are shown by drawing, reference (d), and photographs, Plates 2 and 3.

METHOD OF TEST

12. The sample horns, following tests to determine 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) Acoustical analysis
- (d) Shock
- (e) Vibration
- (f) Dielectric
- (g) Insulation resistance
- (h) Splashproof
- (i) Salt spray
- (j) HI Shock

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RESULTS OF TEST (Cont'd)

Requirements

Test Values

Terminal wiring: Para. D-10d.

Type H-3
*Two flats are provided in the sides of the case.

Type H-4
*Two flats are provided in the sides of the case.

Springs: Para. D-11d.

*Contact spring, pc. 40, is of steel.

*Contact spring, pc. 40, is of steel.

Fiber: Para. D-11a.

Complied.

Complied.

Contacts: Para. D-11e.

Complied.

Complied.

Agreement with test plans:
Para. H-3b.

*Test plan shows terminal, pc. 12, extending beyond rim of case. The sample horns, however, had sufficient clearance. The horn tested as Type H-4 had a steel diaphragm rather than "inconel" as indicated on drawing. The 1/4- 28 screws securing the chassis to the projector collar are not shown or identified on drawing.

*Denotes failure to comply with the specification.

15. The results of the HI shock test are as follows:

Type H-3

On the first blow (back), the projector was broken off at its fitting. The mounting straps were loosened from the housing.

Type H-4

The first two blows (vertical) produced no apparent damage. On the third and fourth blows (back), the projector was loosened in the collar and the mounting straps were torn loose from the housing.

CONCLUSIONS

16. The subject horns were, in general, of good design and workmanship, but failed to comply with the specification in the following respects:

Type H-3

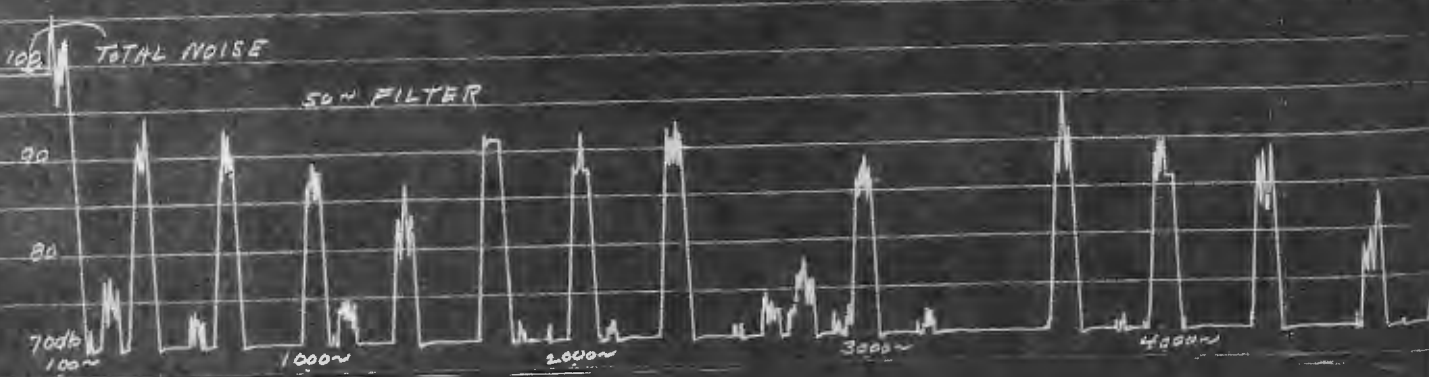
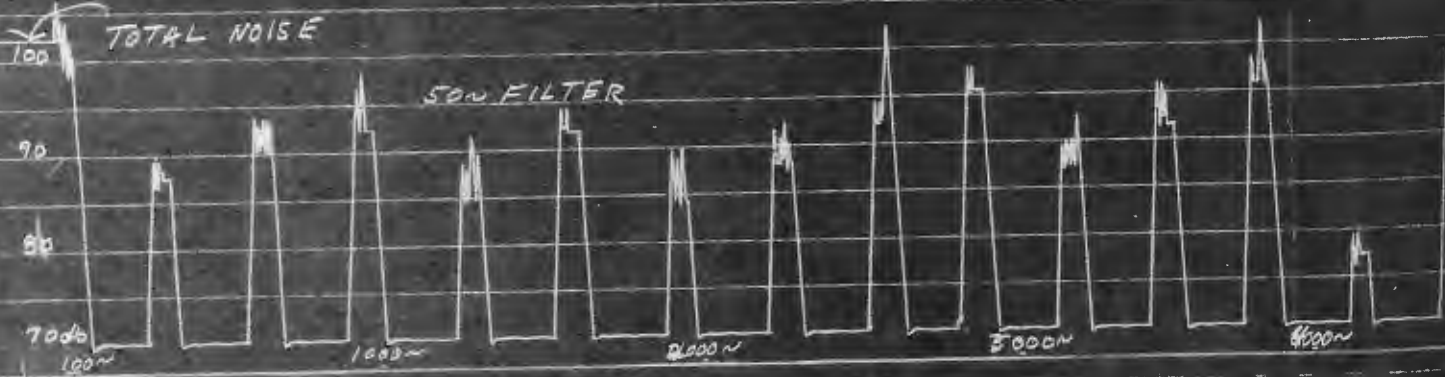
- (1) Faulty operation under endurance in that the pitch of note changed 80 times.
- (2) Failure under vibration in that the resistor connections were broken.
- (3) Inability to withstand the specified dielectric test.
- (4) "Formex" used for coil winding insulation in lieu of cotton or silk.
- (5) Two flats provided in lieu of bosses.
- (6) Contact spring material.
- (7) Agreement with test plans in several details.

Type H-4

- (1) Steel diaphragm furnished in lieu of a nickel-chromium alloy diaphragm.
- (2) "Formex" used for coil winding insulation in lieu of cotton or silk.
- (3) Two flats provided in lieu of bosses.
- (4) Necessity of removing grounded condenser from circuit.
- (5) Contact spring material.
- (6) Agreement with test plans in several details.

17. It is believed that the use of six - 1/4-28 screws to assemble the base plate, pc. 51, to front plate, pc. 31, is not justified in view of the 6 screws, pc. 37, which assemble both these parts to front cover, pc. 6.

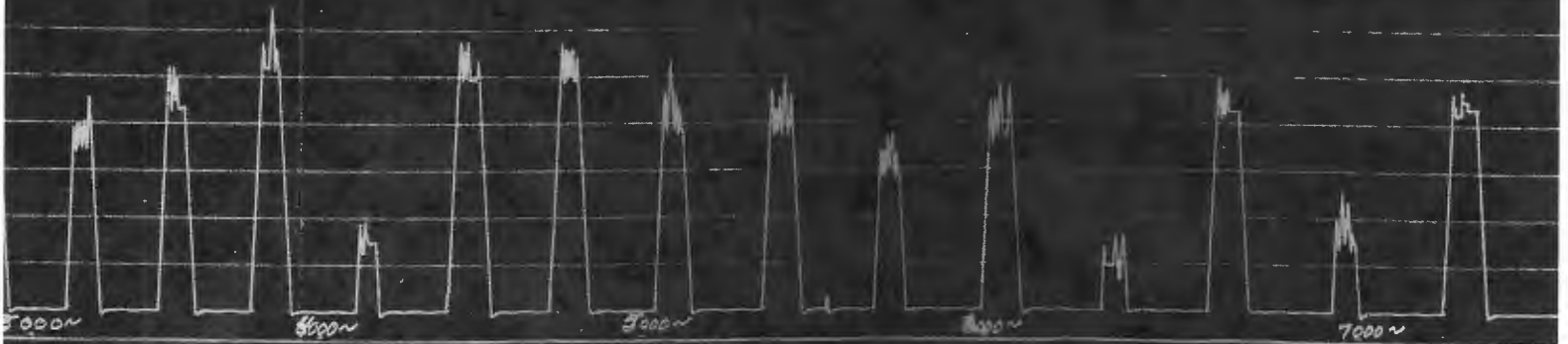
18. The results of the HI shock test indicate that the strength of the sample horns is not adequate to withstand high impact shock. It is believed that some form of resilient mounting plate would provide the desired shock integrity. It is also possible that the use of a resilient mounting plate will improve the stability of the operation of the H-3 horn. Laboratory experience indicates that this type is sensitive to the flexibility of its mounting.



TYPE 4-3 HORN
TEST NO 8-1993



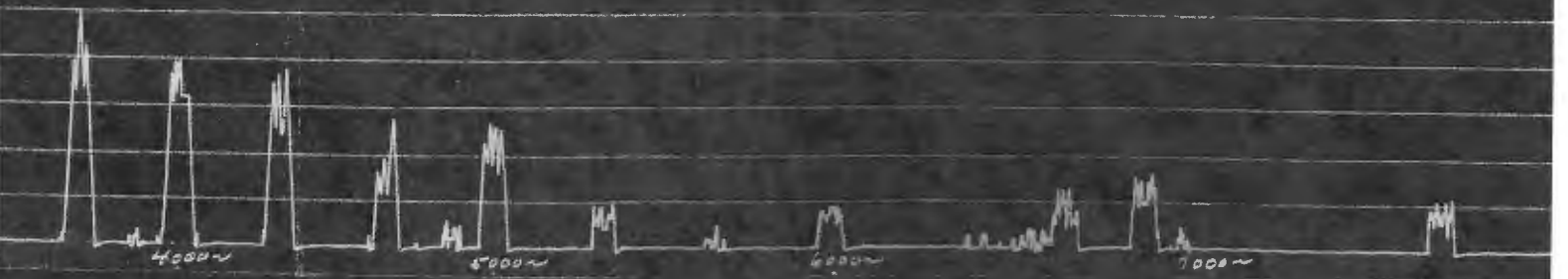
TYPE 4-3 HORN



TYPE H-4 HORN



TYPE H-4 HORN



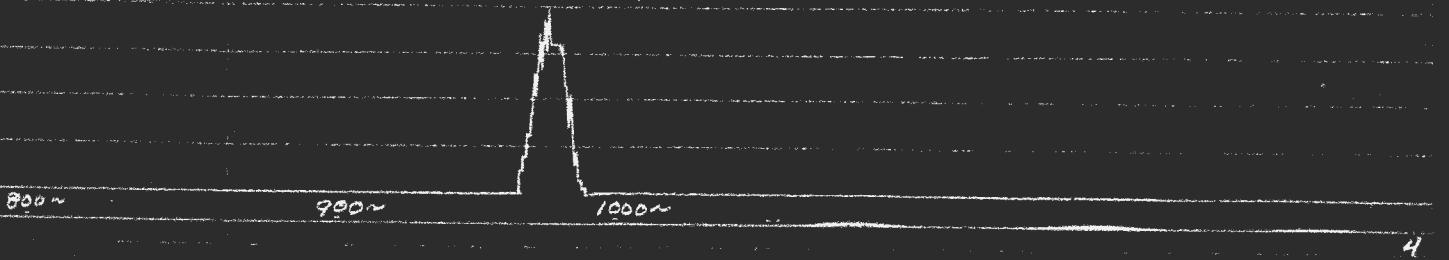
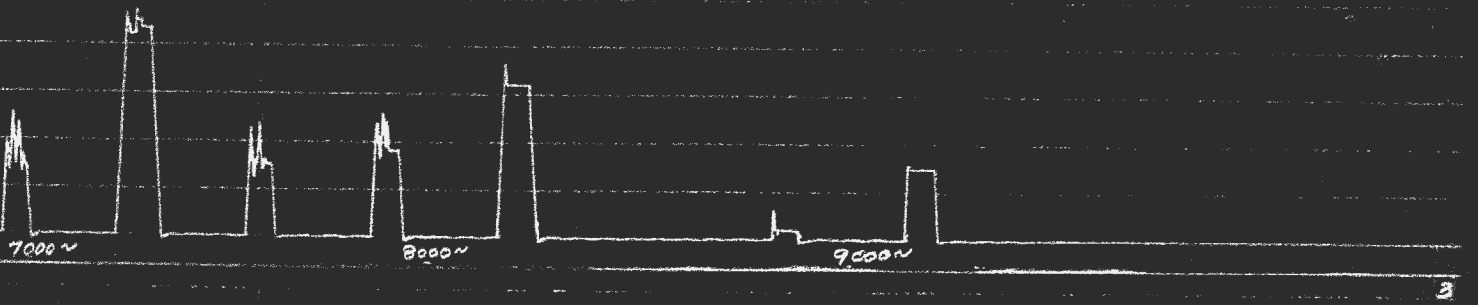
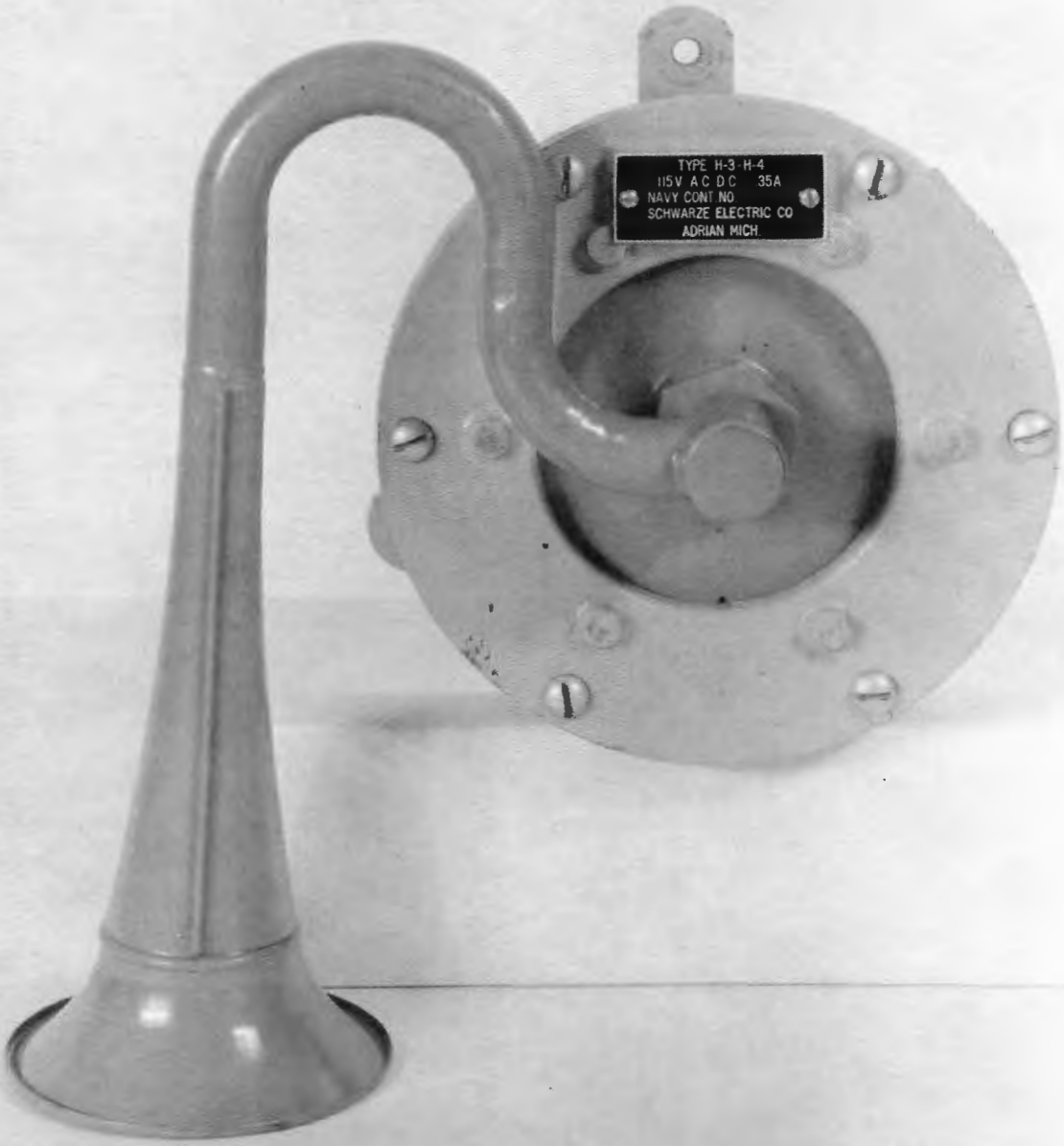


PLATE I





TYPE H-3 H-4
115V A.C. D.C. 35A
NAVY CONT. NO.
SCHWARZE ELECTRIC CO.
ADRIAN MICH.

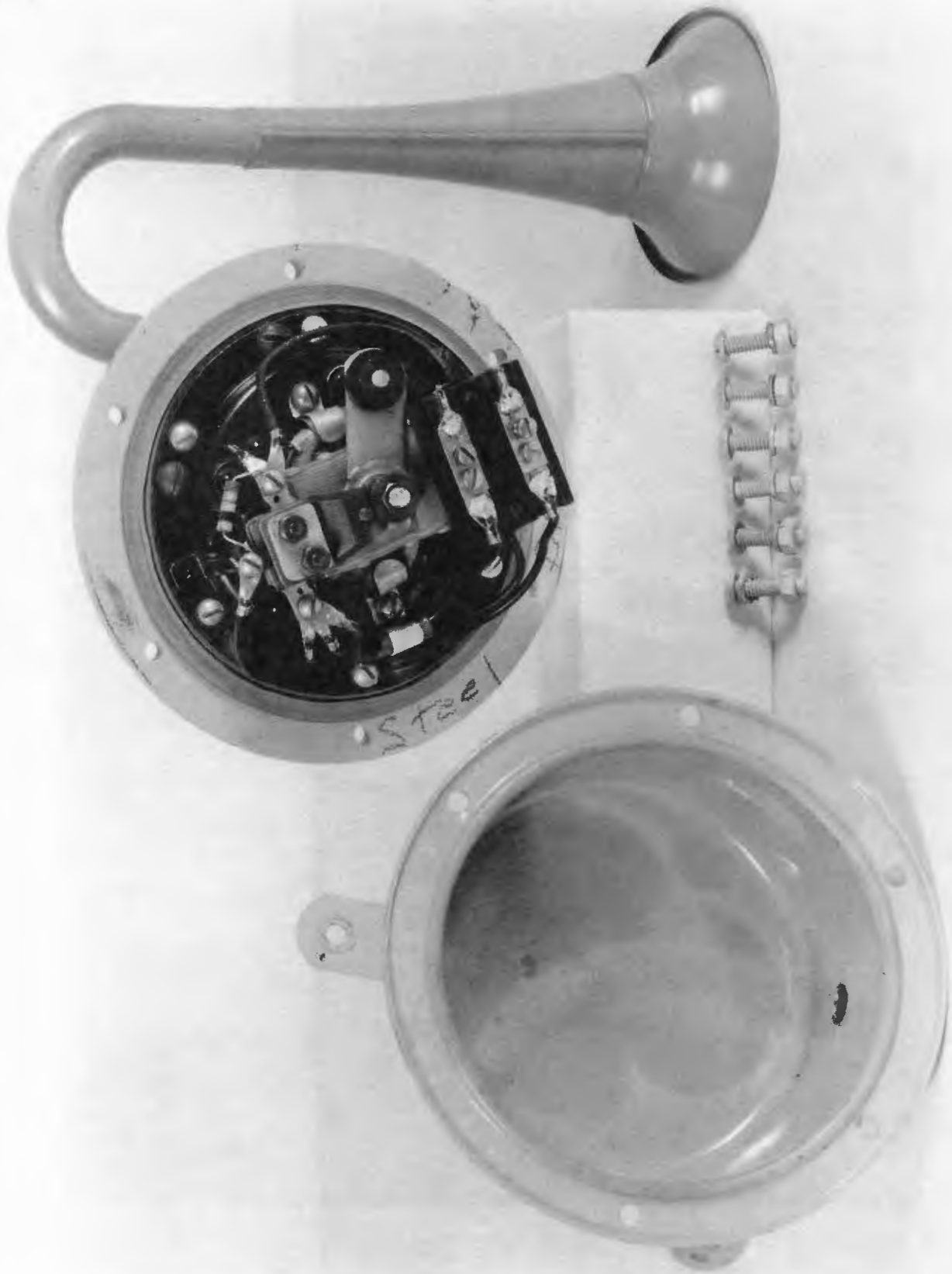
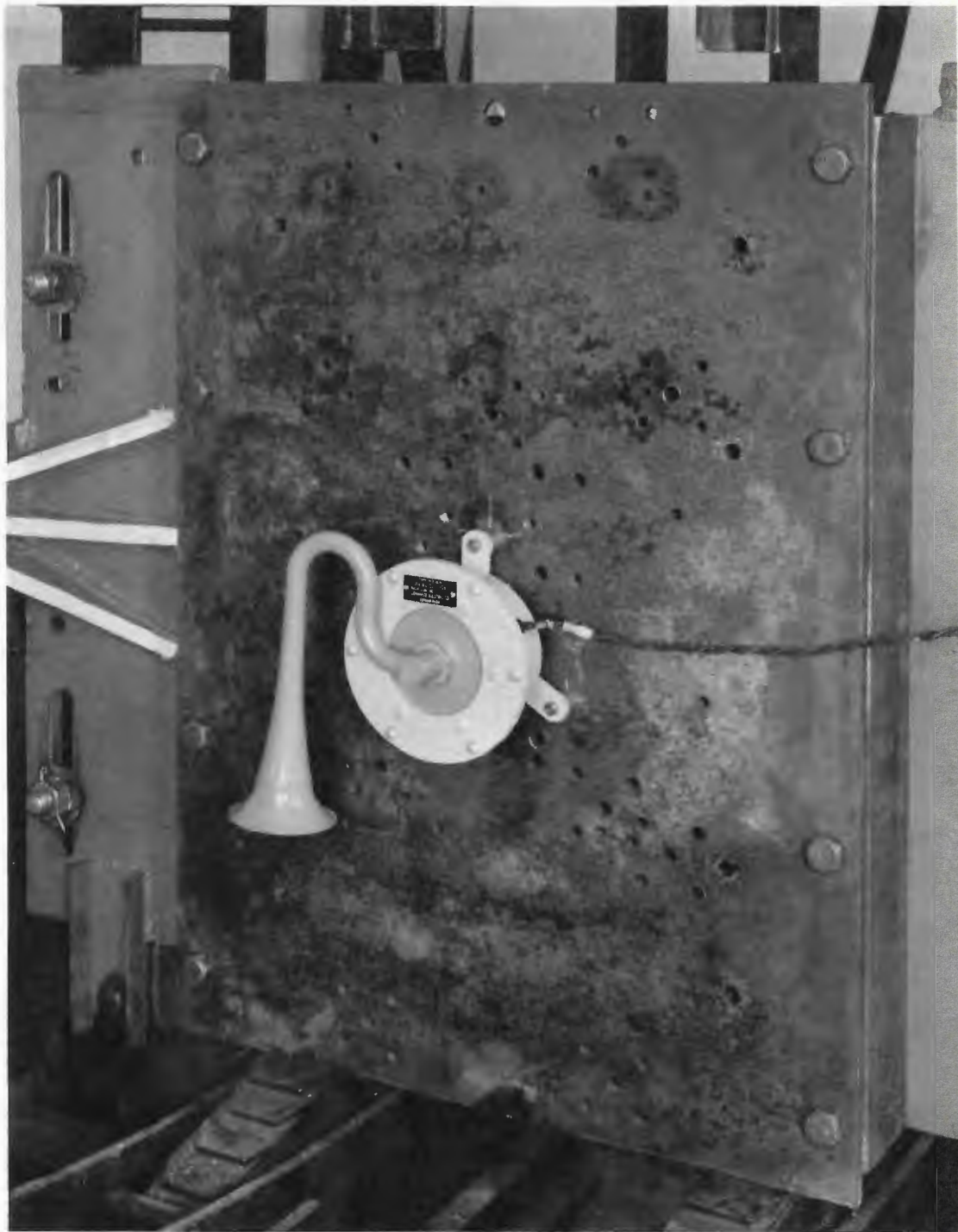


PLATE 3



METHOD OF TEST (Cont'd)

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

RESULTS OF TEST

14. The results of test were as follows:

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type H-3</u>	<u>Type H-4</u>
Voltage: Type H-3, 115 volts, d.c. Type H-4, 115 volts, a.c.	Tested at 115 volts, d.c.	Tested at 115 volts, a.c.
Amperes: Not specified.	0.238 ampere.	0.368 ampere.
Watts: Para. E-1.	27.3 watts.	27 watts.
Sound pressure output: Para. E-1. (a) Before endurance (b) After endurance	Complied. (a) 102 db. (b) 104 db.	Complied. (a) 99 db. (b) 98 db.
Pitch of note: Para. E-1.	Complied. See Plate 1.	Complied. See Plate 1.
Inclination: Para. D-11h.	Complied.	Complied.
Endurance test: Para. F-2m(1).	*Pitch of note changed 80 times during the test, at which time current consump- tion increased from 0.23 ampere to 0.52 ampere.	Complied.
Temperature rise: Para. F-2m(4).	Complied. 55° C. above 60° C. ambient temperature.	Complied. 43.3° C. above 60° C. ambient tem- perature.
Shock test: Para. F-2g.	Complied.	Complied.
Vibration test: Para. F-2h.	*Resistor connec- tions were bro- ken.	Complied.
Dielectric test: Para. D-4a.	*Broke down at 600 volts in contact assembly.	*Complied, ex- cept that it was necessary to remove the condensers from the

RESULTS OF TEST (Cont'd)

Requirements

Test Values

<u>Type H-3</u>	<u>Type H-4</u>	
		circuit before this test because it was grounded on one side.

Insulation resistance:
Para. D-4b.

*Insulation resistance was zero. Contact assembly was grounded.

Complied (with the condenser out of the circuit).

Splashproof test: Para. D-12d.

Complied.

Complied.

Salt spray test: Para. F-2p.

Not conducted due to similarity of samples.

Satisfactory. Slight corrosion of projector thread at lock-nut, piece 7.

Weight: Para. E-1.

Complied.
7 lbs., 2 oz.

Complied.
7 lbs., 2 oz.

Nameplate: Para. D-13c.

Complied.

Complied.

Diaphragm: Para. E-4d(2).

Complied.

*Steel diaphragm was furnished.

Protection of exterior surfaces: Para. C-5d.

Complied.

Complied.

Clearances: Para. D-5.

Complied.

Complied.

Wiring: Para. D-6a.

Complied.

Complied.

Coil windings: Para. D-6b.

*"Formex" used in lieu of silk or cotton insulation.

*"Formex" used in lieu of silk or cotton insulation.

Protective covering for coils: Para. D-9a.

Complied.

Complied.

Waterproofing of coils: Para. D-9e.

Complied.

Complied.

Magnetic circuit: Para. D-9c.

Complied.

Complied.

Terminal block: Para. D-10a.

Complied.

Complied.

Terminal lugs: Para. D-10b.

Complied.

Complied.