

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>PAGE</u>
Authorization for Test	1
Object of Test	1
Abstract of Test	1
(a) Conclusions	1a
(b) Recommendations	1b
Description of Material	2
Method of Test	3
Results of Test	3
Conclusions	6

Appendices

Photostat of Acoustical Analysis of Sample Type H-8 Horn, Before and After the Endur- ance Test - - - - -	Plate 1
Photostat of Acoustical Analysis of Sample Type H-9 Horn, Before and After the Endur- ance Test - - - - -	Plate 2
Photograph of Sample Types H-8 and H-9 Horns	Plate 3
Photograph of Sample Type H-8 Horn, Dis- assembled - - - - -	Plate 4

AUTHORIZATION FOR TEST

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

Reference: (a) BuEng. and BuC&R Ltr. S65-4(4-30-SS) of 10 May 1940.

(b) Specifications 17S11c of 1 May 1940.

(c) Benjamin Electric Co. Plans 192511 and 192511-A.

OBJECT OF TEST

2. The object of this test was to determine conformance of the sample horns with the specifications, 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 (AC and DC) where their performance was carefully observed for compliance with the requirements of the specifications. An inspection of the samples to determine compliance in the matter of materials, design, and workmanship, concluded the test.

Conclusions

(a) Under the endurance test, the diaphragm installed in the type H-8 horn fractured after 3 hours. The diaphragm of the type H-9 horn fractured after 6 hours.

Two replacement diaphragms were furnished by the manufacturer and were installed and new tests were begun by direction of the Bureau. The diaphragm of the type H-8 horn fractured after 1-1/2 hours while the diaphragm of the type H-9 horn survived the 50 hour endurance test. However, it was necessary to readjust the horn on 3 occasions; after 19, 44, and 49 hours respectively. Ratchet (pc. 5) and diaphragm button (pc. 2) were found to be badly worn in this horn at the end of the test.

Following receipt of 6 additional ratchets and diaphragms, one of each was installed in each horn and new tests were begun. During the course of these tests, a deliberate attempt was made to adjust the horns so that the amplitude of diaphragm motion would be reduced in order to observe the effect on diaphragm life. The diaphragm of the type H-8 horn fractured after 2 hours. Another diaphragm was then installed and survived the 50 hour test. However, it was found that each horn required six adjustments during the 50 hour test, including an immediate adjustment when the ambient temperature was reduced from 60° C. to 0° C. This increase in the number of necessary adjustments is attributed to the reduced amplitude chosen for this part of the test.

(b) These horns complied with the specifications in all particulars, except for the adjustments and diaphragm replacements. At the conclusion of all tests, the motor of the type H-8 horn had operated a total of 56-1/2 hours of one minute on each alternate minute. The motor of the type H-9 horn had operated 106 hours under the same conditions. Both motors were in good condition at the conclusion of all tests. Of seven diaphragms tested four failed to withstand a complete test.

(c) The sample horns and fractured diaphragms are being returned to the manufacturer.

Recommendations

(a) It is recommended that the subject horns be approved for Naval use subject to correction of the unsatisfactory features noted under "Conclusions" and check tests of production samples.

DESCRIPTION OF MATERIAL UNDER TEST

4. The two sample horns, manufactured by Benjamin Electric Manufacturing Company, were submitted as Navy types H-8 (115 v. d.c.) and H-8 (115 v. a.c.) motor-driven horns. They are identical in design, except for the winding data of the motors. For part numbers, refer to drawings, reference (c).
5. The motor is housed in a cast bronze case (pc. 15) having three (3) mounting lugs and a connection box cast integral with the case. The connection box is tapped for two (2) 3/4-inch (IPS) terminal tubes.
6. A terminal block (pc. 31) of phenolic material is located in the connection box and is reached by removing a cast bronze cover (pc. 22). An engraved nameplate of nickel-copper alloy is secured to the outside of the connection box by two (2) zinc plated steel drive screws.
7. The motor is equipped with sleeve bearings each of which is oiled by a wick type oiler (pc. 33) which is accessible by removing the connection box cover.
8. The noise is produced when a forged steel ratchet (pc. 5), secured to the end of the armature shaft, strikes a steel anvil riveted to the diaphragm (pc. 2).
9. The spring steel diaphragm, protected by gray glyptal paint over zinc chromate paint, is located between two (2) flat rubber gaskets (pc. 3), and is secured between the case and projector (pc. 1) by eight (8) fillister head brass machine screws (pc. 4) passing through the projector ring and threaded into the case.
10. Threaded into the bottom of the case and secured by a brass locknut (pc. 12), is a hexagon head brass adjusting screw (pc. 13) having a steel insert in its end. The insert presses against a steel ball (pc. 11) recessed in the end of the armature shaft and, when the screw is properly adjusted, the shaft is forced forward, causing the ratchet to strike the diaphragm anvil. Forward movement of the armature shaft is resisted by a flat bronze spring (pc. 14), mounted inside the motor endbell (pc. 16), and pressing against a bronze washer (pc. 9) located against a shoulder on the shaft.
11. Further details are shown by photographs, Plates 3 and 4, and drawings, reference (c).

METHOD OF TEST

12. The sample horns, following tests to determine their electrical and acoustical characteristics at rated voltage and frequency, were subjected to tests in the following order:

- (a) Inclination.
- (b) Endurance and temperature rise.
- (c) Sound analysis following endurance test.
- (d) Shock test.
- (e) Vibration test.
- (f) Dielectric test.
- (g) Insulation resistance.

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 test results obtained were as follows:

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type H-8</u>	<u>Type H-9</u>
Volts: 115 volts.	115 volts.	115 volts.
Current: Type H-8 direct; H-9 a.c. 60 cycles.	Direct.	Alternating.
Amperes: Not specified.	0.52 amperes.	0.62 amperes.
Watts: Shall not exceed 75.	59.8 watts.	61.4 watts.
Power Factor: Not specified.	--	86.0%.
Weight: Shall not exceed 15 lbs.	Complied, 12 lbs, 6 oz.	Complied, 12 lbs, 6 oz.
Sound Pressure Output: Shall be not less than 90 decibels at 18 feet in a soundproof room under the following conditions:		
(a) At rated voltage and frequency before the endurance test.	Complied, 105 db total noise.	Complied, 109 db total noise.
(b) At rated voltage and frequency following the endurance test.	107 db total noise.	105 db total noise.

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type H-8</u>	<u>Type H-9</u>
Pitch of note: 100 to 600 C.P.S.	Complied. (See Plate 1)	Complied. (See Plate 2)
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.	Complied following 3 diaphragm replacements due to fractures. (See Conclusions)	Complied following 1 diaphragm replacement due to fracture. (See Conclusions)
Temperature rise: Maximum temperature shall not exceed 115°C. during the endurance test. (55°C. rise at 60°C.)	Complied, 30.9°C. above 60°C. ambient.	Complied, 26.5°C. above 60°C. ambient.
Shock integrity: 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 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 circuit and ground.	Complied.	Complied.
Insulation resistance: Shall be not less than 5 megohms at not less than 500 volts d.c.	Complied. 200 megohms by 1000 volt megger on both samples.	Complied.
Watertight integrity: Shall be submerged under 3 feet of standard sea water for 3 hours without the entry of water into the case.	Complied.	Complied.

Requirements

Test Values

	<u>Type H-8</u>	<u>Type H-9</u>
Nameplate: Shall be in accordance with N.D. Specification 42N2.	Complied. Nickel-copper alloy.	Complied. Nickel-copper alloy.
Diaphragm: Shall be protected with one coat of zinc chromate primer and one coat of approved paint.	Complied. Zinc chromate primer and glyptal paint.	Complied.
Terminal block: Shall be of phenolic material equipped with 9-S-1841-L terminals.	Complied.	Complied.
Coil windings: Shall be of single or double silk or cotton covered enameled copper wire.	Complied. Double silk covered enameled copper wire.	Complied.

Note: The salt spray test was not conducted due to previous satisfactory tests.

CONCLUSIONS

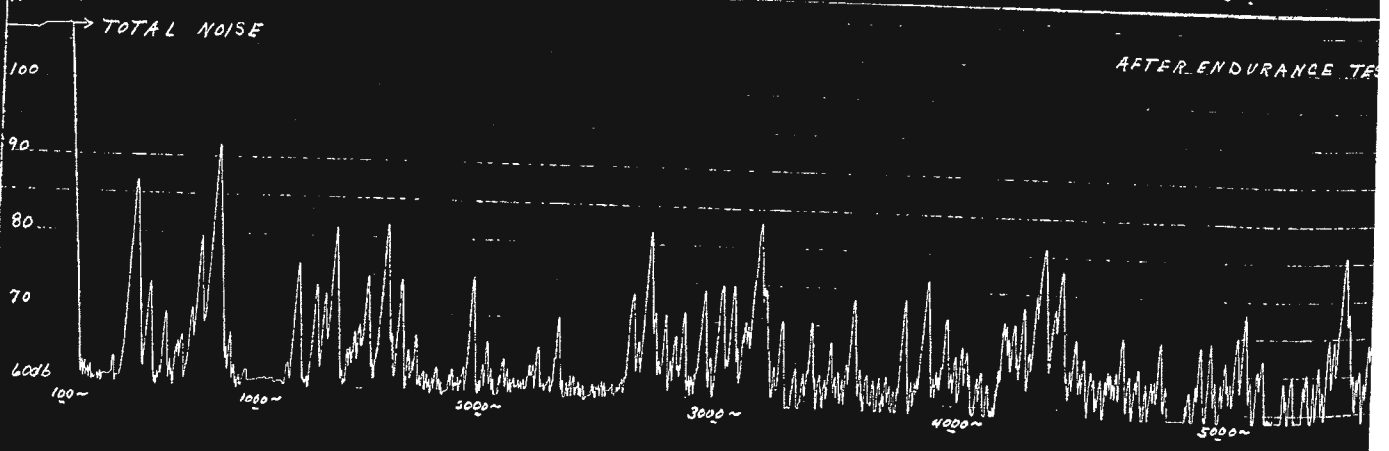
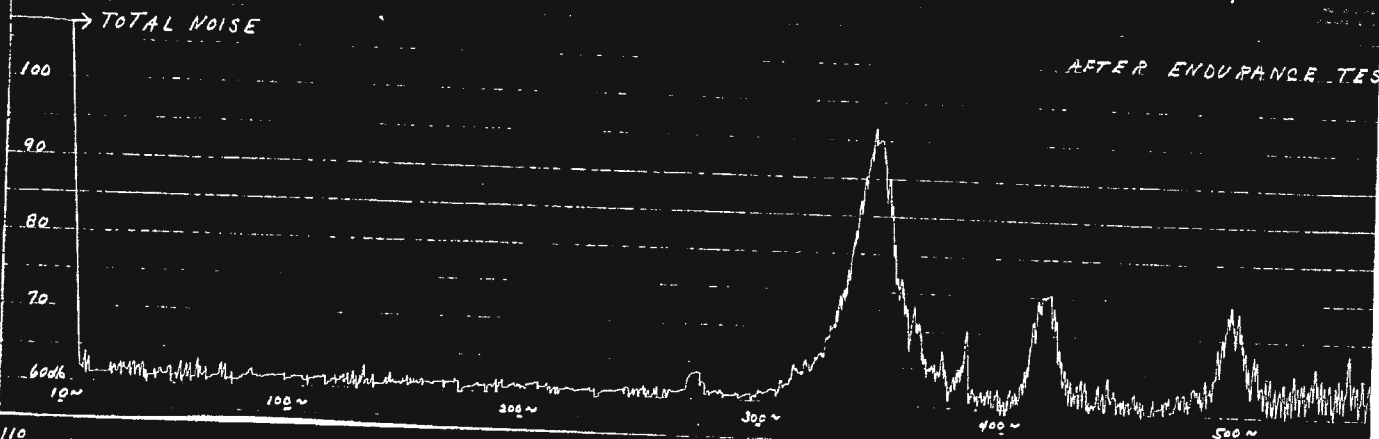
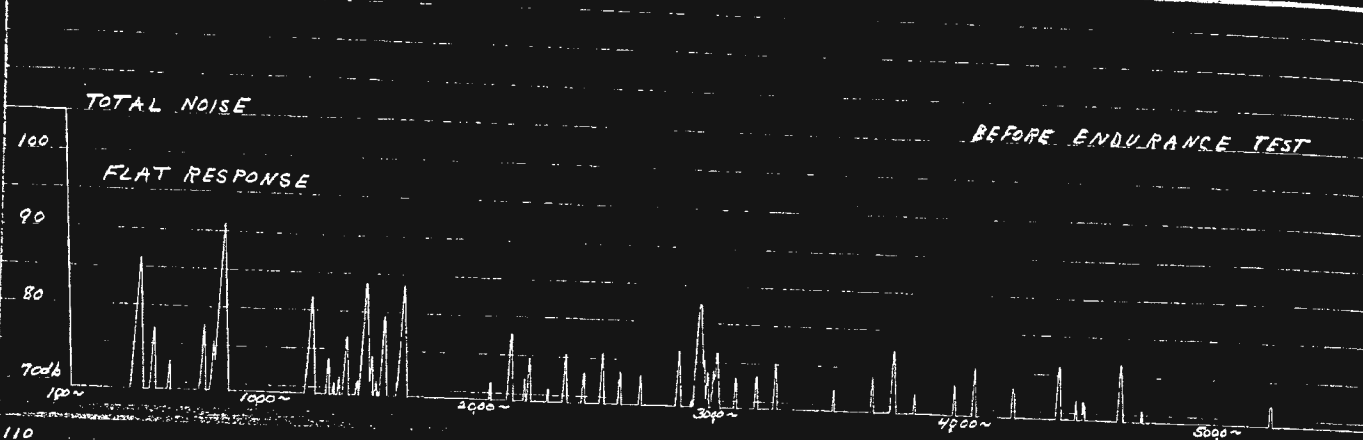
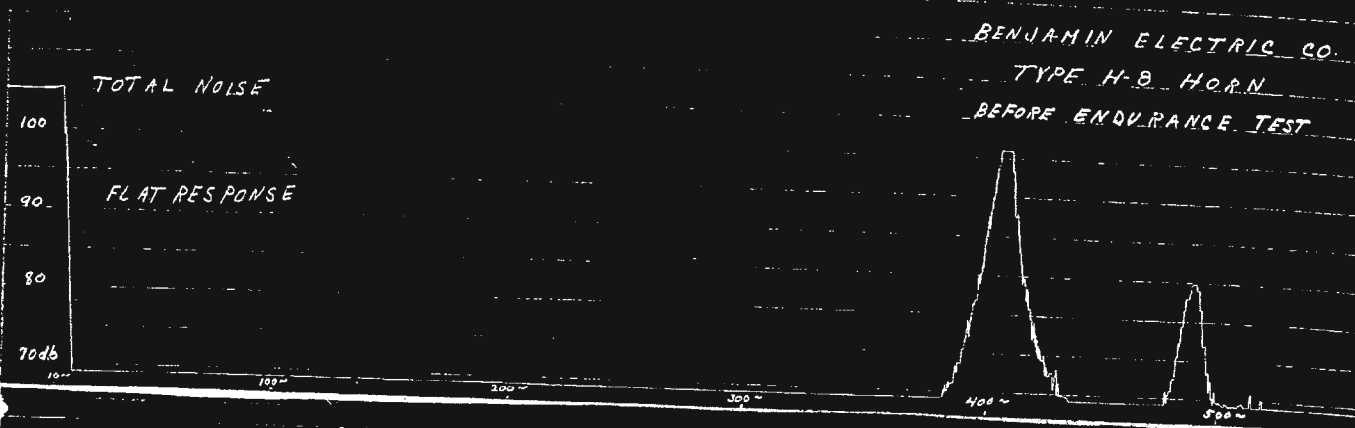
15. Under the endurance test, the diaphragm installed in the type H-8 horn fractured after 3 hours. The diaphragm of the type H-9 horn fractured after 6 hours.

16. Two replacement diaphragms were furnished by the manufacturer and were installed and new tests were begun by direction of the Bureau. The diaphragm of the type H-8 horn fractured after 1-1/2 hours while the diaphragm of the type H-9 horn survived the 50 hour endurance test. However, it was necessary to readjust the horn on 3 occasions; after 19, 44, and 49 hours respectively. Ratchet (pc. 5) and diaphragm button (pc. 2) were found to be badly worn in this horn at the end of the test.

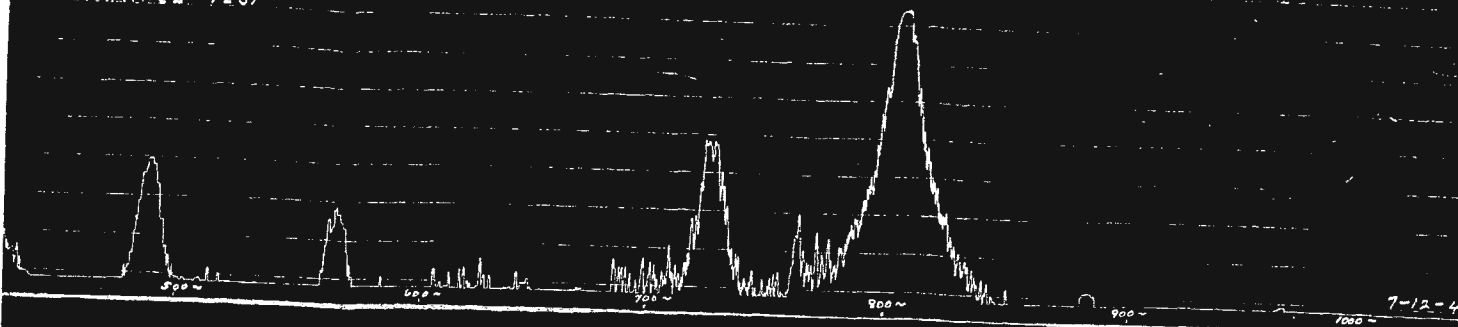
17. Following receipt of 6 additional ratchets and diaphragms, one of each was installed in each horn and new tests were begun. During the course of these tests, a deliberate attempt was made to adjust the horns so that the amplitude of diaphragm motion would be reduced in order to observe the effect on diaphragm life. The diaphragm of the type H-8 horn fractured after 2 hours. Another diaphragm was then installed and survived the 50 hour test. The diaphragm of the type H-9 horn also survived the 50 hour test. However, it was found that each horn required six adjustments during the 50 hour test, including an immediate adjustment when the ambient temperature was reduced from 60°C. to 0°C. This increase in the number of necessary adjustments is attributed to the reduced amplitude chosen for this part of the test.

18. These horns complied with the specifications in all particulars, except for the adjustments and diaphragm replacements. At the conclusion of all tests, the motor of the type H-8 horn had operated a total of 56-1/2 hours of one minute on each alternate minute. The motor of the type H-9 horn had operated 106 hours under the same conditions. Both motors were in good condition at the conclusion of all tests. Of seven diaphragms tested, four failed to withstand a complete test.

19. The sample horns and fractured diaphragms are being returned to the manufacturer.

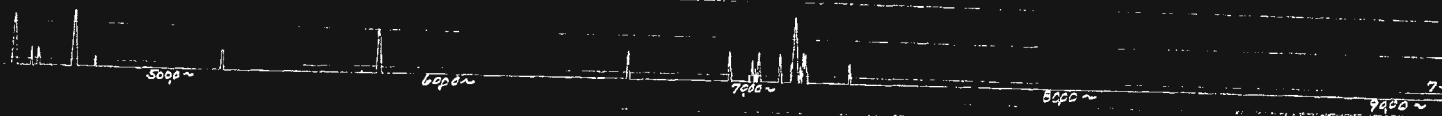


MIN ELECTRIC CO.
PE H-B HORN
ENDURANCE TEST



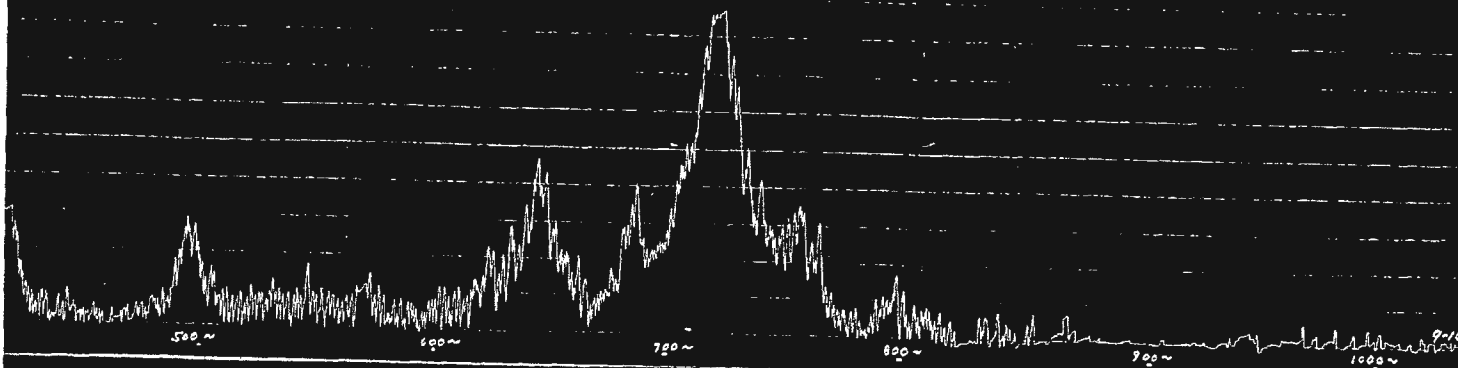
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ENDURANCE TEST



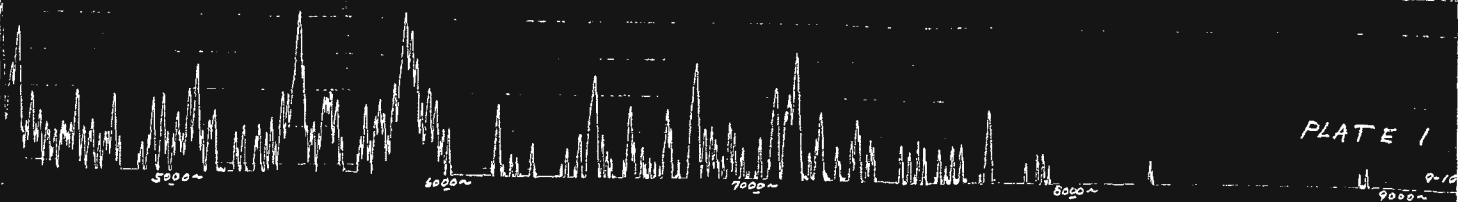
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AFTER ENDURANCE TEST



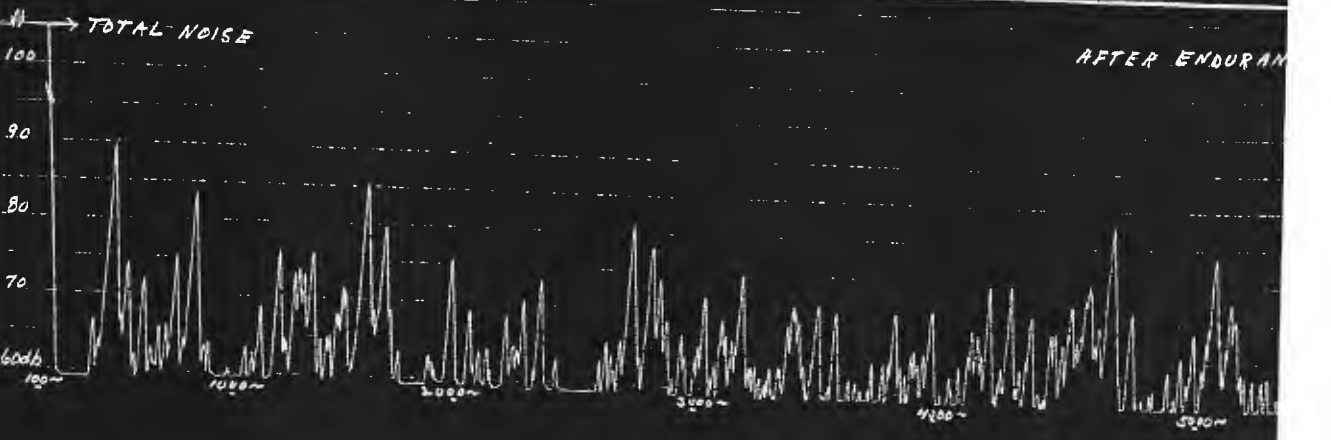
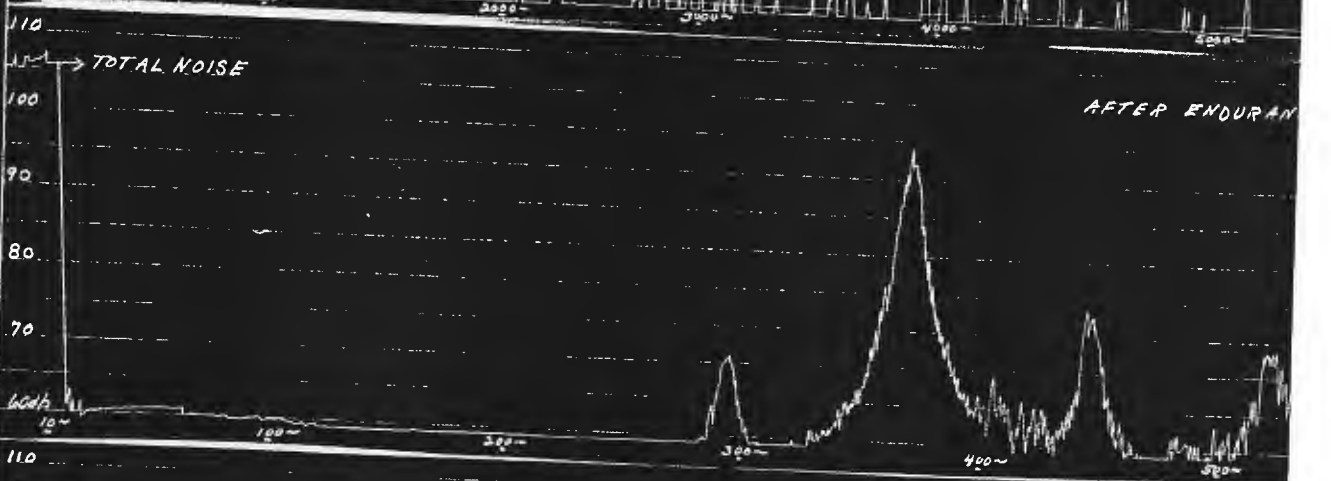
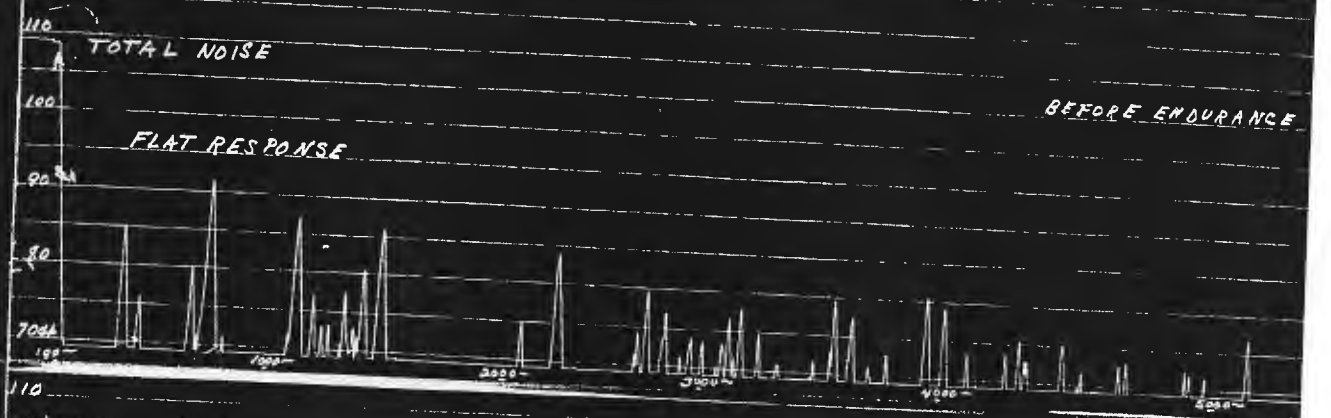
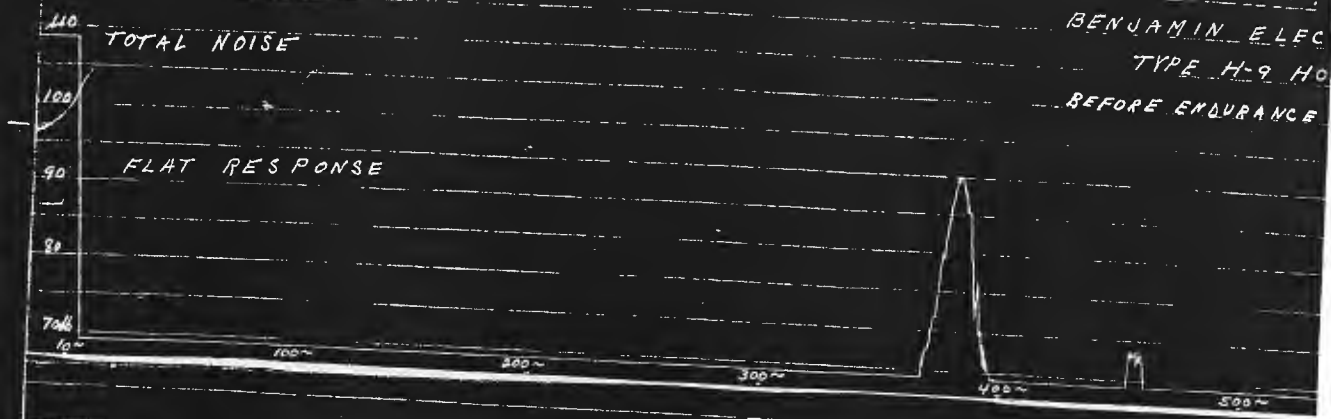
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AFTER ENDURANCE TEST



9-16

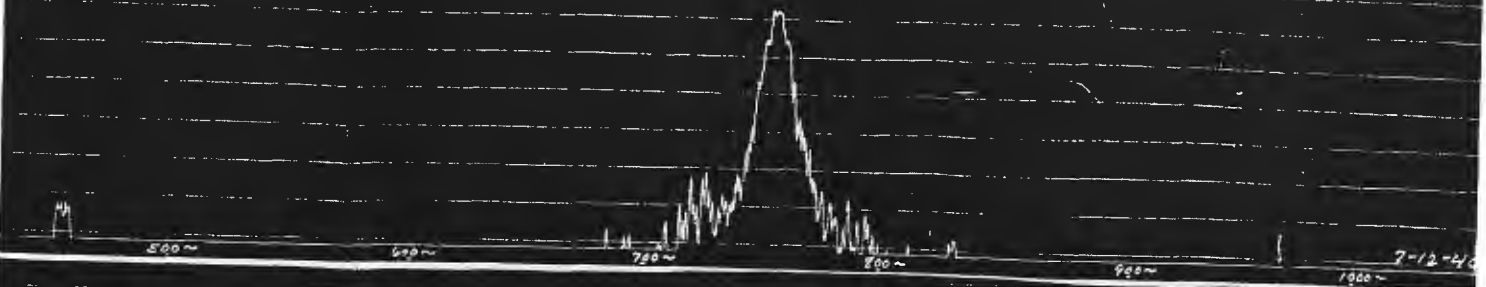
PLATE 1



ENJAMIN ELECTRIC CO.

TYPE H-9 HORN

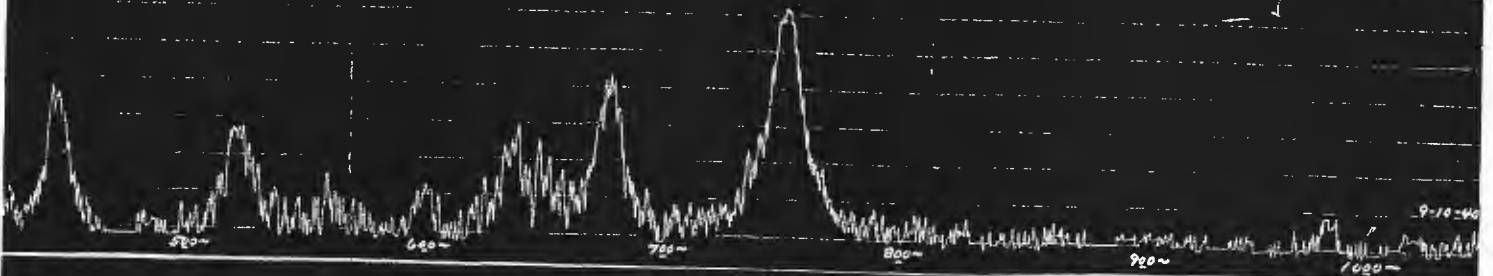
BEFORE ENDURANCE TEST



BEFORE ENDURANCE TEST



AFTER ENDURANCE TEST



AFTER ENDURANCE TEST

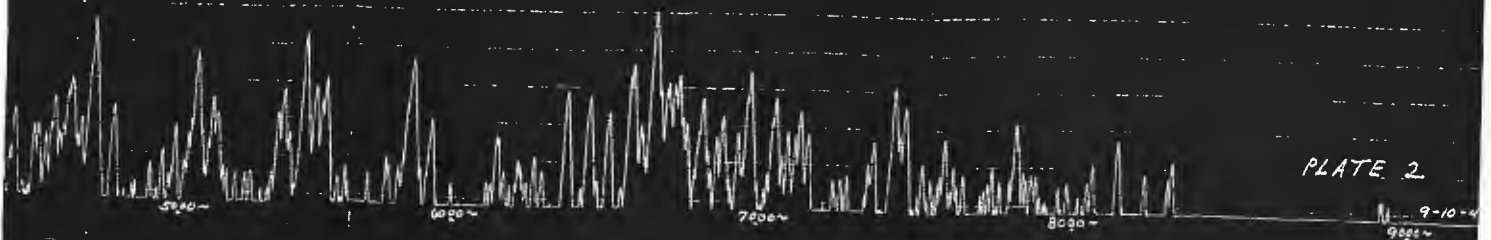


PLATE 2

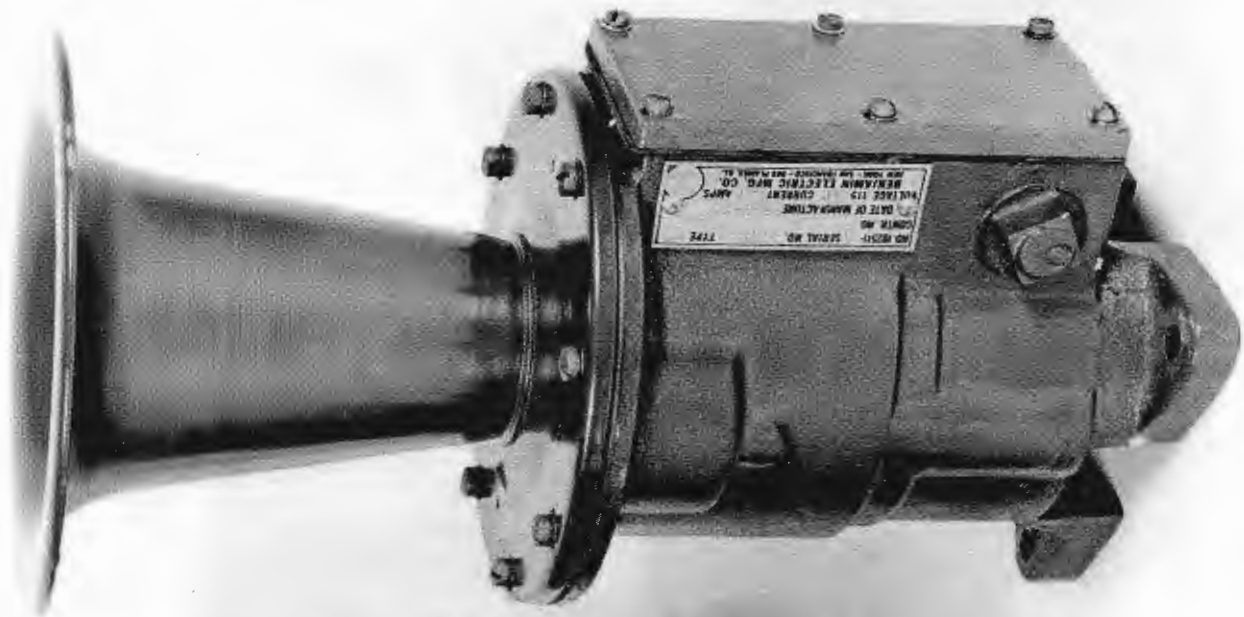


Plate 3



Plate 4