

August 26, 1940

NRL Report No. B-1645

NAVY DEPARTMENT

Report of Test

on

Horns, Types H-8 and H-9

Submitted by Clark Cooper Company,

Philadelphia, Pa.

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Authorization: BuShips Ltr. S65-4(7-10-SS) of 22 July 1940
Date of Test : August 1940.

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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) and (c).

Reference: (a) BuShips ltr. S65-4(7-10-SS) of 22 July 1940.
(b) Specifications 17S11c of 1 May 1940
(c) Clark Cooper Co. Plan E-356.

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) The subject horns failed to meet the specifications as follows:
- (1) The power consumption of the type H-8 horn was 81.1 watts. That allowed is 75 watts.
 - (2) After 3 hours of operation, during the latter half of the endurance test at 0° C. (28 hours total), the type H-8 horn failed. The diaphragm was found cracked and the end of the armature shaft, to which the ratchet wheel (pc. 4) is secured, was found broken.
 - (3) The type H-9 horn failed after 4 hours of operation at 0° C (28 hours total). The motor's stalling was apparently due to the receding of the steel ball in the end of the armature shaft, allowing spring (pc. 8) to press against the ratchet wheel (pc. 4) and produce considerable friction.
 - (4) Both samples failed under the dielectric test; the breakdown occurring at the brush holders, due to insufficient creepage distance. The insulation resistance, following this test, was 10,000 ohms by a 500 volt megger.
 - (5) Raised lettering is used on the connection box cover in lieu of the nickel-copper alloy nameplate, shown on drawing, reference (c).
- (b) It is considered that the adjusting screw and locknut (pcs. 18 and 19) should be of steel.

RECOMMENDATIONS

- (a) In view of the unsatisfactory tests and non-compliance with the specifications, the subject horns are not recommended for Naval use.
- (b) As these sample horns now incorporate a type of motor which has a satisfactory temperature rise, it is also recommended that the manufacturer be invited to make the necessary modifications to correct the defects noted herein and submit samples for test.
- (c) It is further recommended that the manufacturer be requested to omit all paint from that part of the inside of the case which is in contact with the motor and that portion of the motor which is in contact with the case. Painting of these surfaces makes it difficult to remove the motor from the case.

DESCRIPTION OF MATERIAL UNDER TEST.

4. The two sample horns, manufactured by Clark Cooper Company, were submitted as Navy types H-8 (115 v.d.c.) and H-9 (115 v.a.c.) motor driven horns. They are identical in design, employing universal motors which operate on either a.c. or d.c., at a potential of 115 volts. For part numbers, refer to drawing, reference (c).

5. The motor is housed in a cast bronze case (pc. 14) 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. 21) of phenolic material is located in the connection box and is reached by removing a cast bronze cover (pc. 27). Raised lettering on this cover also serves as a nameplate.

7. The motor is equipped with sleeve bearings (pcs. 5 and 15) each of which may be oiled by removing a plug (pc. 31), in the housing, covering the oilers (pc. 10).

8. The noise is produced when a heat treated tool steel ratchet wheel (pc.4), secured to the end of the armature shaft, strikes a heat treated tool steel anvil (pc. 3) riveted to the diaphragm (pc. 2).

9. The spring steel diaphragm (pc. 2), protected by gray lacquer over zinc chromate paint, is located between two (2) flat rubber gaskets (pc. 25), and is secured between the case and projector (pc. 1) by eight (8) fillister headed brass machine screws (pc. 12) passing through the projector ring and threaded into the case.

10. Threaded into the bottom of the case is a hexagon-headed brass adjusting screw (pc. 18) having a freely rotating steel ball retained in its end. A brass locknut (pc. 19) is provided on the adjusting screw. The ball presses against the end of the armature shaft and, when the screw is properly adjusted, the shaft is forced forward, causing the ratchet wheel to strike the diaphragm anvil. Forward movement of the shaft is resisted by a flat phosphor bronze spring having a steel insert (pc. 8). This spring is so mounted that the insert presses against a steel ball (pc. 20) recessed in the ratchet end of the armature shaft.

11. Further details are shown by photographs, Plates 3, 4, and 5, and drawing, reference (c).

METHOD OF TEST

12. The sample horns were first tested for power consumption and acoustical characteristics at their rated voltage and frequency.

13. They were next subjected to the required endurance test of 1500 cycles of operation of "one minute on" and "one minute off", the first 750 cycles at 60° C. and the second at 0° C. ambient temperatures.

14. Following tests for dielectric strength and insulation resistance, the horns were examined to determine the causes of failure during the endurance test and compliance with the specifications in the matter of design, quality of workmanship and materials.

15. Due to the failure of the horns during the endurance test, the other tests required by the specifications could not be made.

RESULTS OF TEST

16. The results of the tests were as follows:

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type H-8</u>	<u>Type H-9</u>
Voltage: 115 volts	115 volts	115 volts
Current:	Direct	Alternating
Amperes: Not specified	0.74 amperes	0.72 amperes.
Watts: Shall not exceed 75	*81.1 watts	60 watts
Power factor: Not specified	- -	72.4%
Weight: Shall not exceed 15 pounds	Complied 10 pounds, 13 ounces	Complied 10 pounds, 13 ounces.
Sound pressure output: Shall be not less than 90 decibels at 18 feet in a soundproof room under the following conditions:		
At rated voltage and frequency:	100 db (total noise)	102 db (total noise)
After endurance test	Could not be tested due to failure during the endurance test.	
Pitch of note: 100 to 600 CPS.	Complied (See Plate 1)	Complied. (See Plate 2.)

<u>Requirements</u>	<u>Test Values</u>	
	<u>Type H-8</u>	<u>Type H-9</u>
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.	*Unsatisfactory (See "Conclusions")	*Unsatisfactory (See "Conclusions")
Temperature rise: Maximum temperature shall not exceed 115° C. during the endurance test. (55° C rise at 60° C.)	Complied 44.4° C above 60° C. ambient	Complied 32.3° C. above 60° C. ambient
Dielectric test: Shall withstand twice the rated voltage plus 1250 volts, 60 cycles, for 1 minute between electrical circuit and ground.	*Unsatisfactory (See "Conclusions")	*Unsatisfactory (See "Conclusions")
Insulation resistance: Shall be not less than 5 megohms at not less than 500 volts d.c.	*Unsatisfactory 10,000 ohms by 500 volt megger	*Unsatisfactory 10,000 ohms by 500 volt megger
Nameplate: Shall be in accordance with N.D. Specification 42N2.	*Unsatisfactory (See "Conclusions")	*Unsatisfactory (See "Conclusions")
Diaphragm: Shall be given one coat of zinc chromate paint primer and one coat of approved paint.	Complied	Complied
Terminal block: Shall be of phenolic material equipped with 9-S-1841-I terminals.	Complied	Complied
Terminal wiring: Shall be lead in through a boss tapped for Navy standard terminal tube.	Complied	Complied.

* Denotes non-compliance with the specifications.

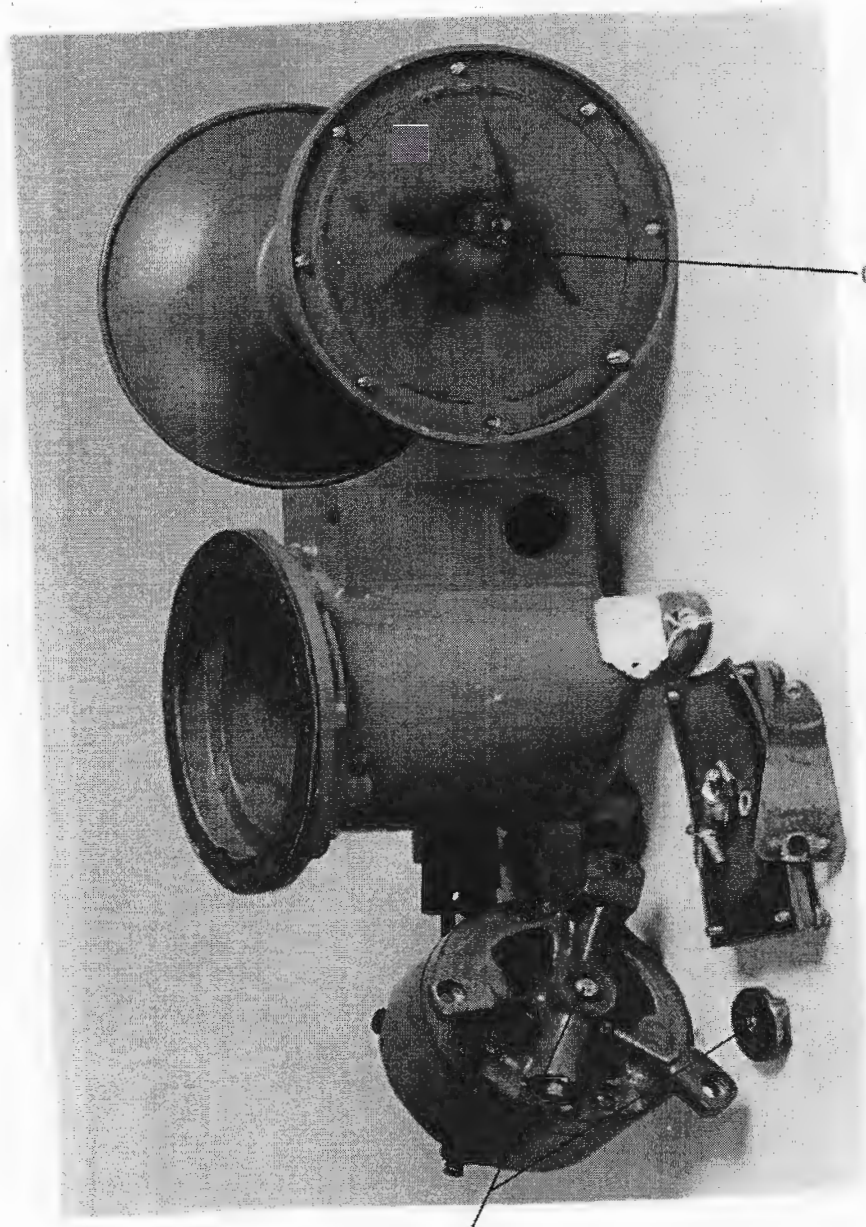
17. The salt spray test was omitted because of satisfactory tests on similar horns previously submitted by this manufacturer.

CONCLUSIONS

18. (a) The subject horns failed to meet the specifications as follows:
- (1) The power consumption of the type H-8 horn was 81.1 watts. That allowed is 75 watts.
 - (2) After 3 hours of operation, during the latter half of the endurance test at 0° C (28 hours total), the type H-8 horn failed. The diaphragm was found cracked and the end of the armature shaft, to which the ratchet wheel (pc. 4) is secured, was found broken.
 - (3) The type H-9 horn failed after 4 hours of operation at 0° C. (28 hours total). The motor's stalling was apparently due to the receding of the steel ball in the end of the armature shaft, allowing spring (pc. 8) to press against the ratchet wheel (pc. 4) and produce considerable friction.
 - (4) Both samples failed under the dielectric test, the breakdown occurring at the brush-holders, due to insufficient creepage distance. The insulation resistance, following this test, was 10,000 ohms by a 500 volt megger.
 - (5) Raised lettering is used on the connection box cover in lieu of the nickel-copper alloy nameplate, shown on drawing, reference (c).
- (b) It is considered that the adjusting screw and locknut (pcs. 18 and 19) should be of steel.

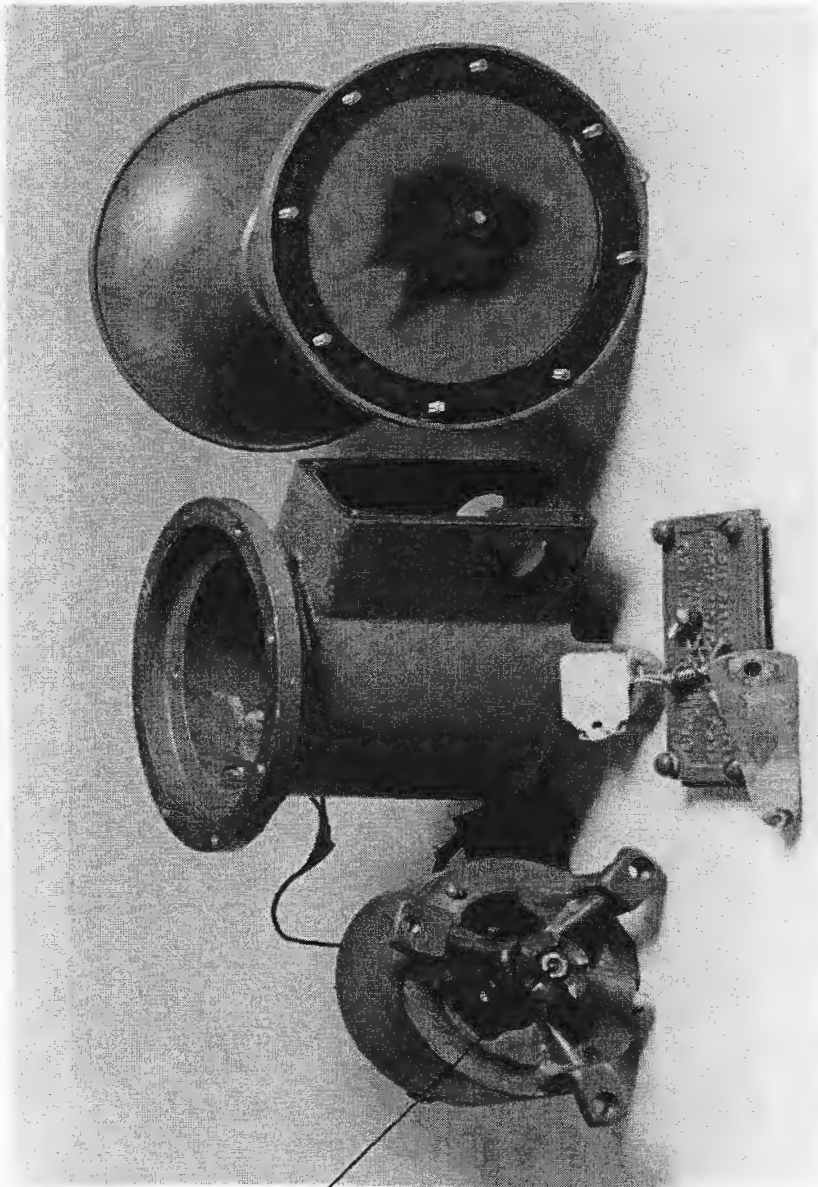


Types H8 and H9 Horns.



Cracked diaphragm

Broken Shaft



Steel ball recessed
too deeply in armature shaft

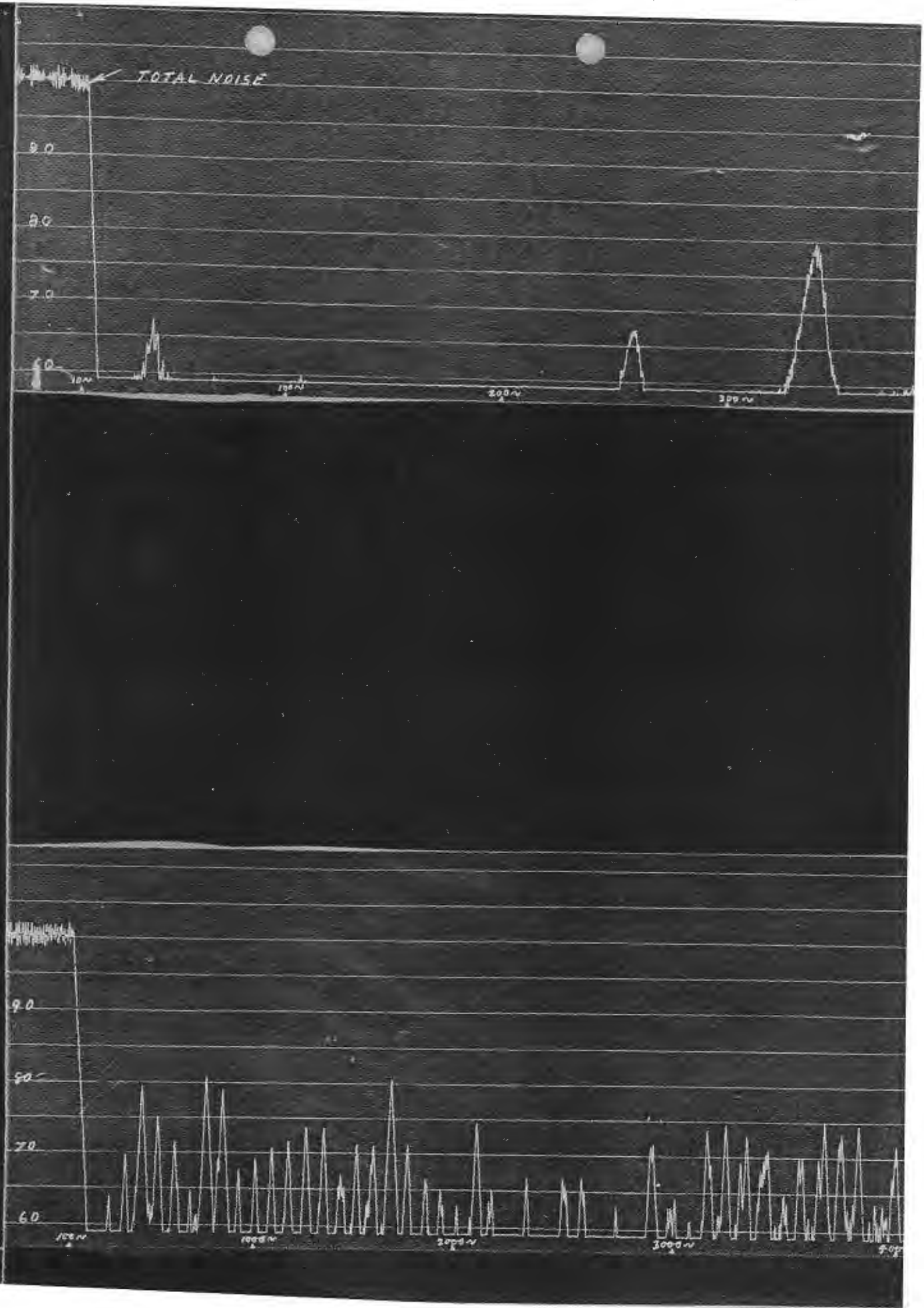
TOTAL NOISE

90
80
70
60

100 v 100 v 200 v 300 v

90
80
70
60

100 v 1000 v 2000 v 10000 v 20000 v

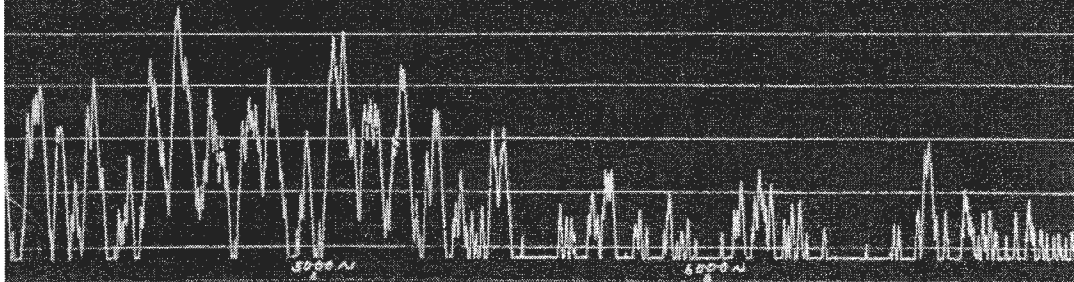
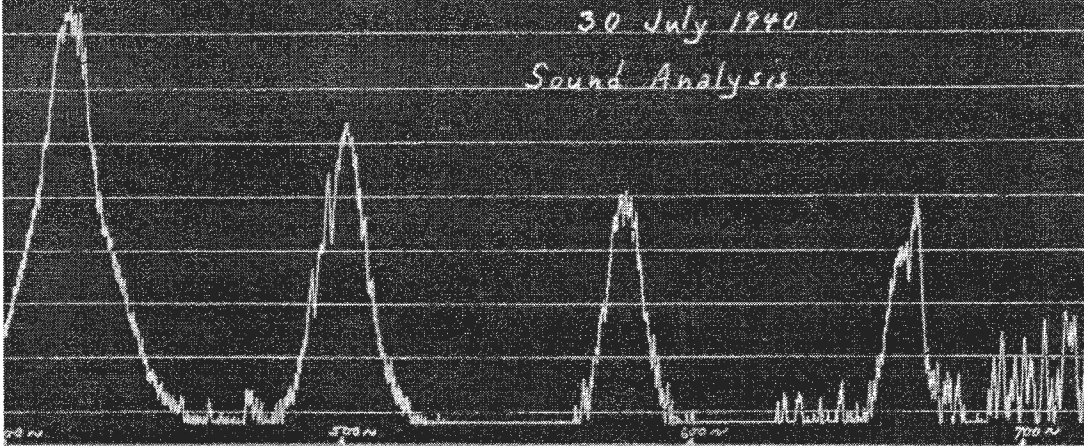


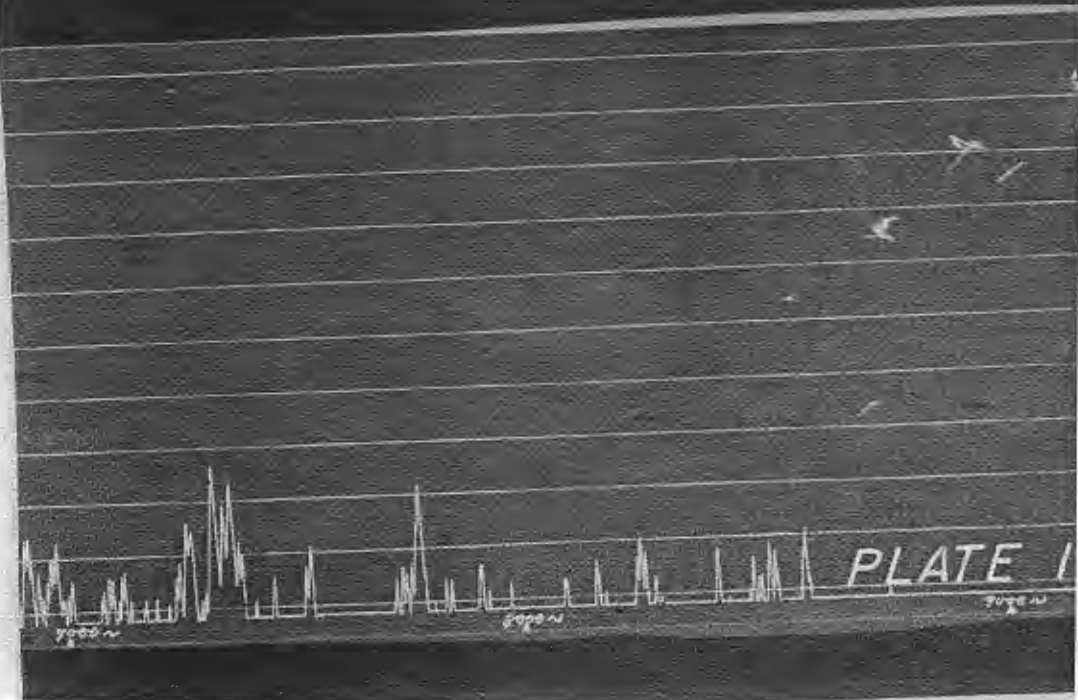
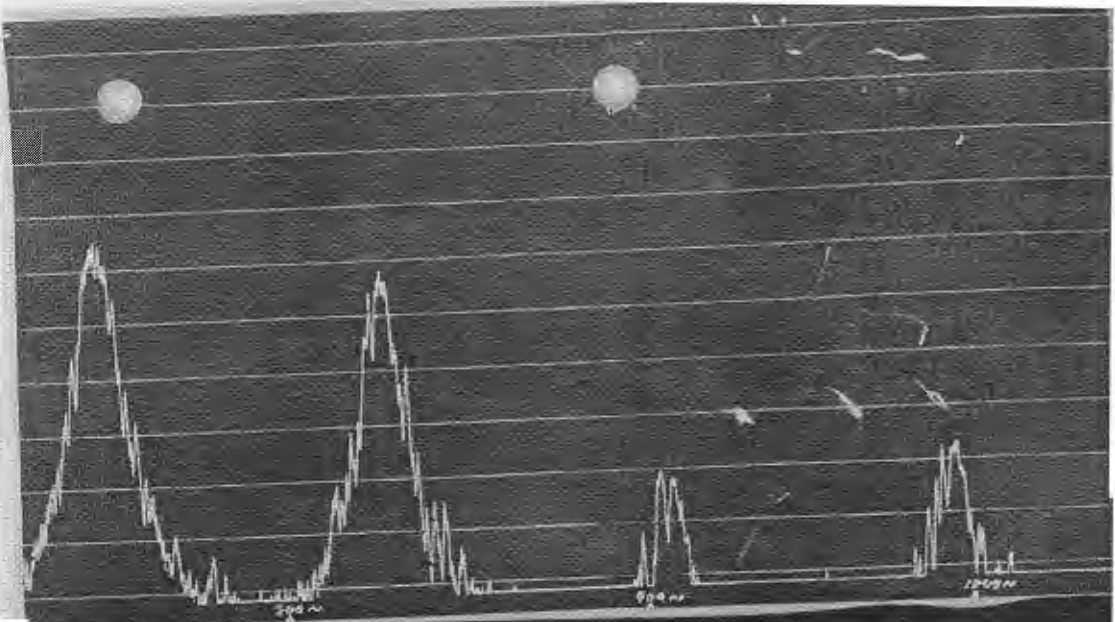
CLARK COOPER COMPANY

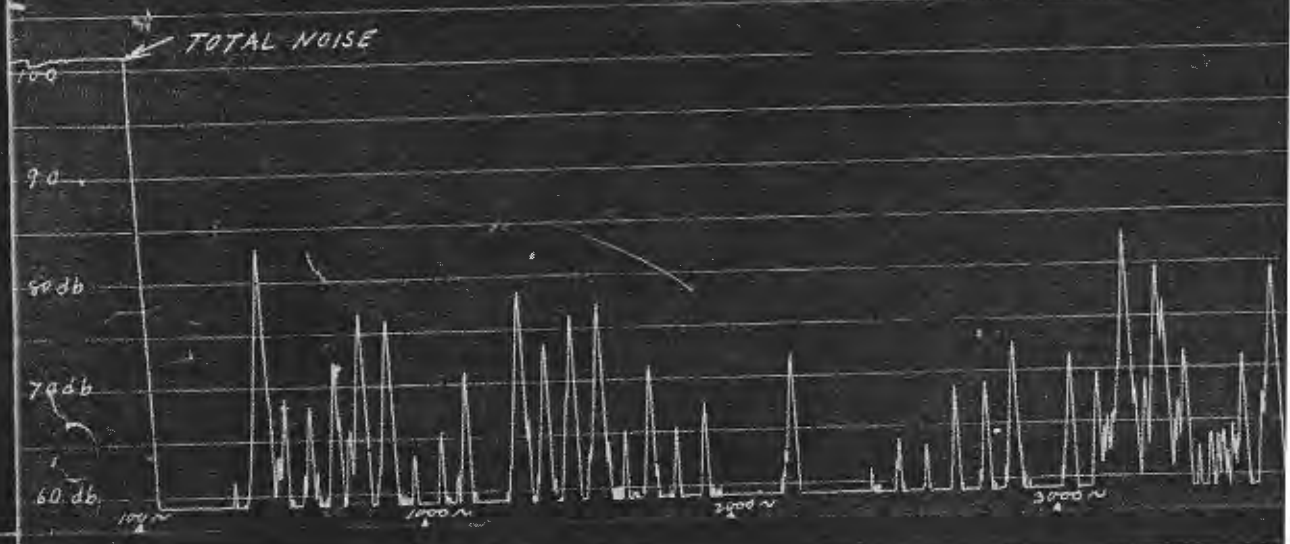
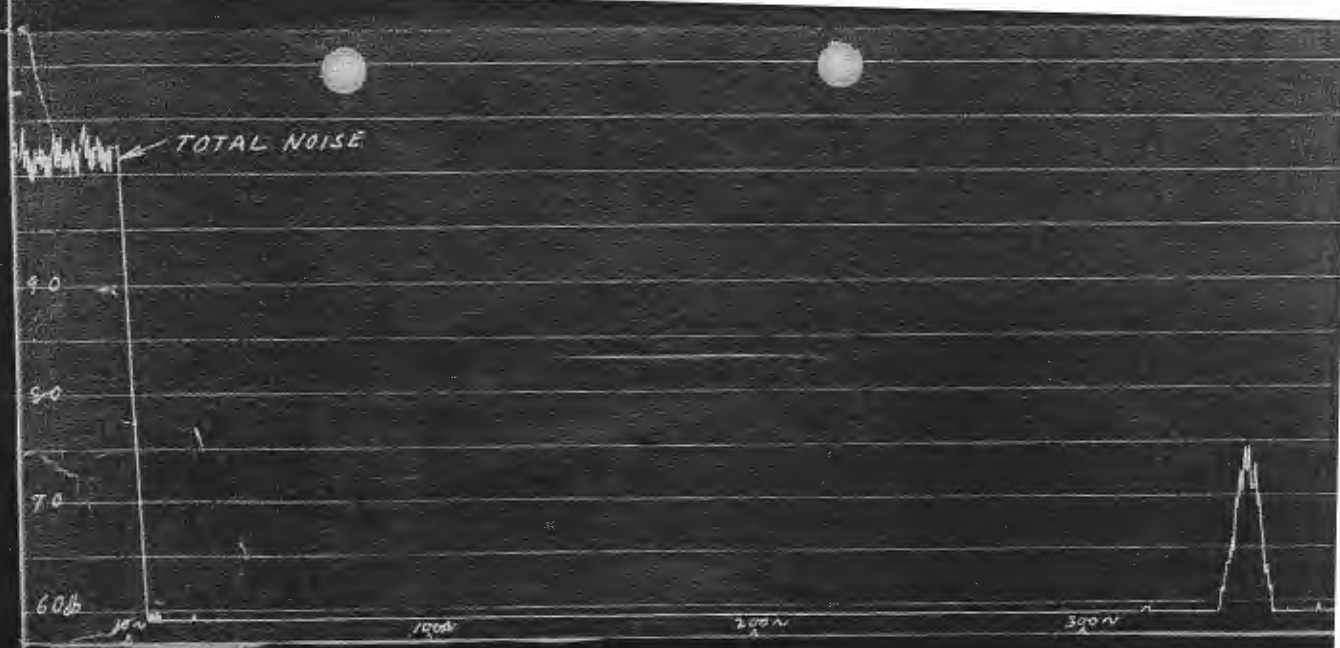
TYPE H-8 115 V. 1T, D.C. HORN

30 July 1940

Sound Analysis





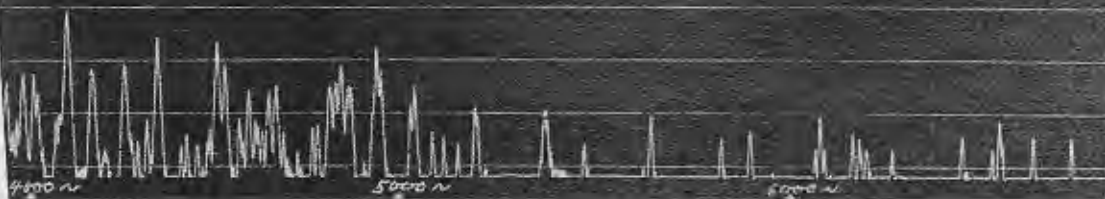


CLARK COOPER COMPANY

TYPE H-9 115 Volt A.C. HORN

30 July 1940

Sound Analysis



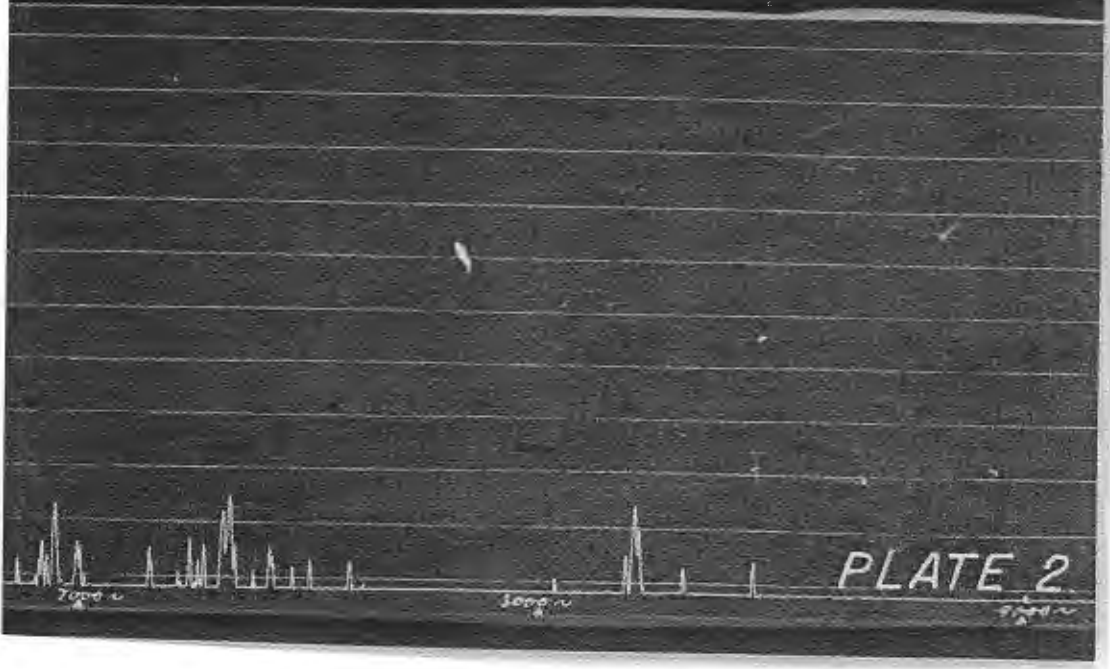
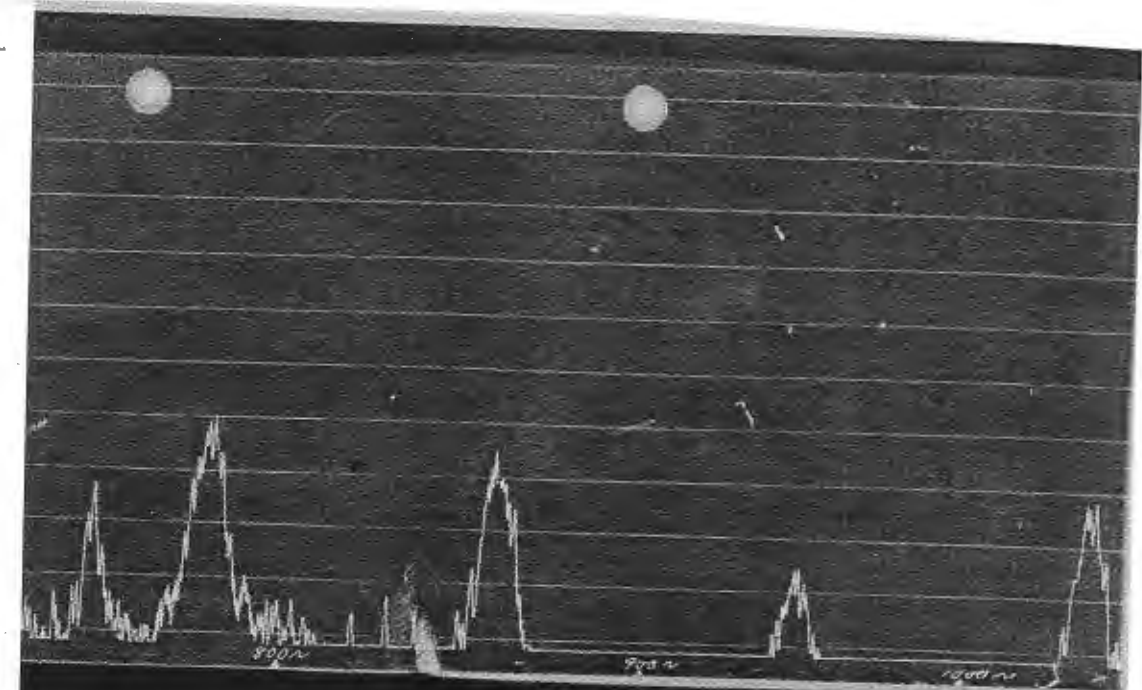


PLATE 2