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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report of

Test on Buzzers, 115 Volt, AC and DC Types

Manufactured and Submitted by
Benjamin Electric Company, Des
Plaines, Illinois.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON DC

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Prepared by: W.B. Roberts, Pr.Eng.Aide, Chief of Section.

Reviewed by: W.M. Haynsworth, Jr., Lieut., USN

Approved by: H.M. Cooley, Capt., USN, Director.

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AUTHORIZATION FOR TEST

1. This test was authorized by reference (a) and another reference pertinent to this problem is listed as reference (b).

Reference: (a) Bu.Eng.ltr.S65-4/L5 (5-22-Ds) of 25 May 1936.
(b) Specifications SGS(65)-103a.

OBJECT OF TEST

2. The object of this test was to determine how closely the buzzers complied with the specifications, reference (b), and their suitability for the Naval service.

ABSTRACT OF TEST

3. The subject buzzers, shown by Plates 1 to 6 inclusive, were set up in standard test circuits and carefully checked for compliance with the specifications, reference (b). The usual inspection of the buzzers relative to materials, design and workmanship concluded the test.

CONCLUSIONS

(a) The a.c. buzzer complied with the major requirements of the specifications and, if provided with a case cover and projector cast in one piece to insure watertightness and with minor changes, should prove satisfactory for use in the Naval service.

(b) The d.c. buzzers are unsuitable for Naval use as they failed to withstand the endurance test, the major requirement. In addition, these buzzers possess several features of poor design, namely (1) poor contacts and contact mountings, (2) condensers which leak at ambient temperature of 70°C, (3) unsatisfactory terminal strips, (4) cast iron cases. The comments of paragraph 25 also apply.

RECOMMENDATIONS

(a) In view of the a.c. buzzer complying with the major requirements of the specifications and of its excellent performance while under test for endurance, it is recommended that it be approved for Naval use, provided that the manufacturer makes the buzzer with a projector and case cover cast in one piece and secures the chassis and diaphragm from the inside with machine screws tapped into but not penetrating the case cover. A proposed mounting is shown by sketch, Plate 7. The defects given under paragraph 25 must also be corrected.

(b) It is further recommended that the Bureau consider requiring a cast aluminum alloy case and case cover for buzzers of the subject types, using threaded steel inserts where necessary.

(c) In the event that the Bureau approves the a.c. buzzer, it is suggested that a sample, embodying all modifications, be sent to this Laboratory for inspection.

(d) It is also recommended that neither of the d.c. buzzers be approved for the Naval service in view of their failure to comply with the specifications.

DESCRIPTION OF MATERIAL UNDER TEST

4. The a.c., 60 cycle, 115 volt buzzer, shown by Plates 1 and 2, is of the contactless vibratory type. The magnetic circuit is made up of "U" shaped iron laminations, supported by an aluminum alloy chassis. Attached to the chassis is a terminal block of phenolic material.
5. Located on each pole piece is a form wound coil, the coils being connected in series.
6. The flat steel armature secured to the aluminum chassis is provided with a steel button which strikes a steel diaphragm. When the buzzer is energized, it produces a note of 120 CPS.
7. The entire assembly is mounted on the base of the brass horn projector, part of the chassis serving as a clamping ring for the diaphragm and diaphragm gasket.
8. The projector base is provided with a flat rubber gasket and contains four (4) 1/8" drain holes. It is secured to a cast BE case with six (6) round head brass machine screws, provided with nuts and washers and used as through bolts.
9. The case is provided with two (2) mounting lugs and two (2) tapped bosses for 3/4" terminal tubes.
10. The d.c. type buzzers, shown by Plates 3, 4, 5 and 6, are designed for 115 volts, d.c. operation, containing contacts for interrupting the current and having condensers of 0.2 MFD connected across the contacts. Buzzer, shown by Plates 3 and 4, has a heavy corrugated diaphragm, while buzzer, Plates 5 and 6, has a thinner flat steel diaphragm.
11. The chassis and the magnetic circuit are similar to that of the a.c. type, but the armature is mounted on two flat steel springs.
12. Two adjustments are provided: one, a screw threaded into a split sleeve secured to the center of the diaphragm, which is struck by the armature when it vibrates; the other, a screw which adjusts the contacts. Both adjustments are accessible from the outside of the case.
13. The cast iron cases furnished with the d.c. buzzers are of a different style than the a.c. buzzer case. They have two mounting lugs, one boss, tapped for 3/4" terminal tube, and six tapped holes for securing the projector base with round head machine screws.
14. All three cases are finished in black on the inside and gray on the outside.

METHOD OF TEST

15. Each sample buzzer was first tested for power consumption, power factor where applicable, sound output in decibels and frequency of note at rated voltage.

16. It was necessary to adjust the d.c. buzzers and connect their respective condensers across the contacts instead of across the windings as received.

17. Each buzzer was then placed in a temperature controlled compartment and tested for endurance by operating it one minute, every alternate minute, for 700 cycles at ambient temperature of 70°C and 700 cycles at 0°C. During this test, the temperature rises of the windings were measured by the resistance method. Due to the unsatisfactory operation of the d.c. buzzers during the endurance test, no further tests were conducted.

18. The a.c. buzzer was then tested for operation when inclined 45° from the vertical in all planes and energized at 10% over and 20% under normal voltage.

19. Following this, the buzzer was placed on a Bureau of Engineering shock stand and tested for shock integrity in accordance with the specifications, par. F-2g(3), of reference (b).

20. The insulation resistance was next determined with the use of a 1,000 volt megger and the buzzer was given a dielectric strength test of 1500 volts a.c., 60 cycles, applied for one minute between the windings and ground.

21. Its watertight integrity was ascertained by placing it in a tank of water to a depth of three feet for a period of twelve hours.

22. Upon completion of these tests, the buzzers were carefully examined in regard to quality of workmanship and suitability of materials.

RESULTS OF TEST

23. Test results on the a.c. buzzer, shown by Plates 1 and 2, follow:

Requirements

Voltage: 115 volts
Current: Alternating
Frequency: 60 cycles
Watts: Not over 15 watts
Power Factor: Not less than 30%.
Amperes: Not specified
Temperature Rise: Not over 30°C at ambient of 70°C by resistance method.
Sound-Output: Shall be not less than 75 decibels, under conditions specified in par. E-5.

Test Values

115 volts
Alternating
60 cycles
12.4 watts
57.67%
0.187 amperes
26.64°C rise by resistance method
75 decibels measured 18 ft. from the buzzer and on the axis thereof, in a soundproof room, using General Radio noise meter, Type 559-A, having a reference level of 0.4 - 0.5 millibars.

RequirementsTest Values

Pitch of Note; 60 to 500 CPS.

120 CPS at 60 cycle input.

Inclination: Shall operate satisfactorily in any plane 45° from vertical at 10% over or 10% under normal voltage.

Buzzer operated satisfactorily under conditions specified.

Voltage and frequency variations, specified under par. F-2h(2).

*Buzzer operated satisfactorily under conditions specified, except that it would not produce a note at a potential lower than 110 volts, at 65 cycles.

Endurance: Shall operate 700 cycles of one minute on, every alternate minute, at an ambient temperature of 70°C and 700 cycles at 0°C .

Buzzer operated satisfactorily throughout this test, no adjustments or repairs being necessary.

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

Buzzer withstood this test under conditions specified.

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

*Case leaked 10 cc of water. Leak occurred around the case gasket, due to case cover having insufficient rigidity.

Dielectric Strength: Shall withstand 1500 V. A.C., 60 cycles, applied between any electrical point and ground for a period of 1 minute, and 500 V. a.c. 60 cycles following the immersion test.

Satisfactory, no breakdowns occurring. No test conducted after immersion, due to water entering the case.

Insulation Resistance: Shall be not less than 10 megohms between any electrical point and ground following the dielectric test and 1 megohm following the immersion test.

After dielectric - 200 megohms. No test conducted after immersion, due to water entering the case.

Total weight: Shall not exceed 5 lbs. 4 lbs. 14 oz.

24. Test results on the d.c. buzzers, shown by Plates 3, 4, 5 and 6, follow:

Requirements:Test Values

No. 1
(Flat Diaphragm)

No. 2
(Corrugated Diaphragm)

Voltage: 115 volts
Watts: Not over 15.0

115 volts
*20.46 watts

115 volts
*36.85 watts

<u>Requirements</u>	<u>Test Values</u>	
	No. 1 (Flat Diaphragm)	No. 2 (Corrugated Diaphragm)
Sound-Output: Shall be not less than 75 decibels, under conditions specified under par. E-5.	*72 decibels	*69 decibels
Pitch of Note: 60 to 500 CPS.	300 CPS	350 CPS
Endurance: Shall operate 700 cycles of one minute on, every alternate minute, at ambient temperature of 70°C and 700 cycles at 0°C.	*NOTE: Test discontinued after 700 cycles at ambient temperature of 70°C due to poor quality of note produced and the necessity of frequent adjustments.	

*Denotes failure to comply with the specifications.

25. The results of the inspection test of the buzzers relative to materials, design and workmanship, in conformance with the specifications, follow:

(a) The case cover on all buzzers is now of formed brass and should have been of cast BE metal, specifications 46 B 24.

(b) Brass screws are threaded into the aluminum alloy chassis, contrary to the specifications.

(c) The lead wires from the windings should be longer and heavier to avoid breaking in handling. The spaghetti covering these wires should be replaced with insulating cotton sleeving.

(d) The connection between the two windings should be insulated.

(e) Additional terminal lugs should be furnished for line connections.

(f) The gray paint on the projector and projector base does not adhere to the surface properly. When drying with compressed air after the watertight test, most of the paint came off.

(g) The diaphragm should be better protected against corrosion by the use of "Glyptal" lacquer or its equal.

CONCLUSIONS

26. The a.c. buzzer complied with the major requirements of the specifications and, if provided with a case cover and projector cast in one piece to insure watertightness and with minor changes, should prove satisfactory for use in the Naval service.

27. The d.c. buzzers are unsuitable for Naval use as they failed to withstand the endurance test, the major requirement. In addition, these

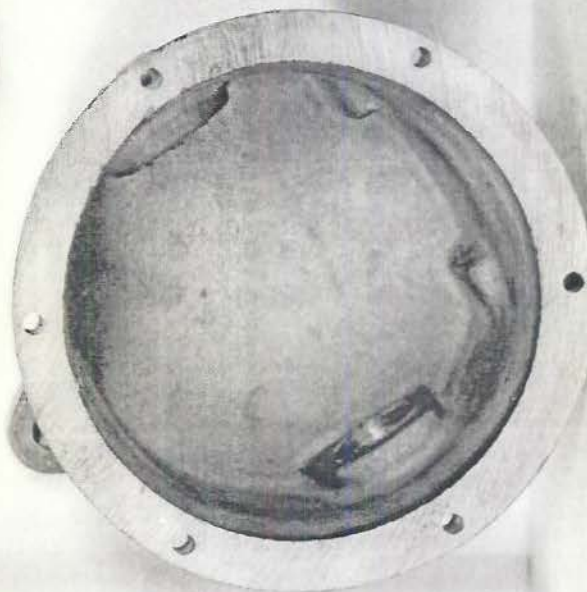
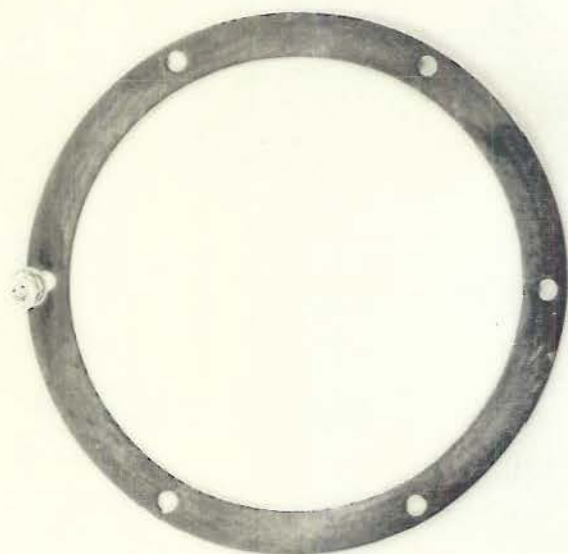
buzzers possess several features of poor design, namely (1) poor contacts and contact mountings, (2) condensers which leak at ambient temperature of 70°C, (3) unsatisfactory terminal strips, (4) cast iron cases. The comments of paragraph 25 also apply.

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Navy Type B-2

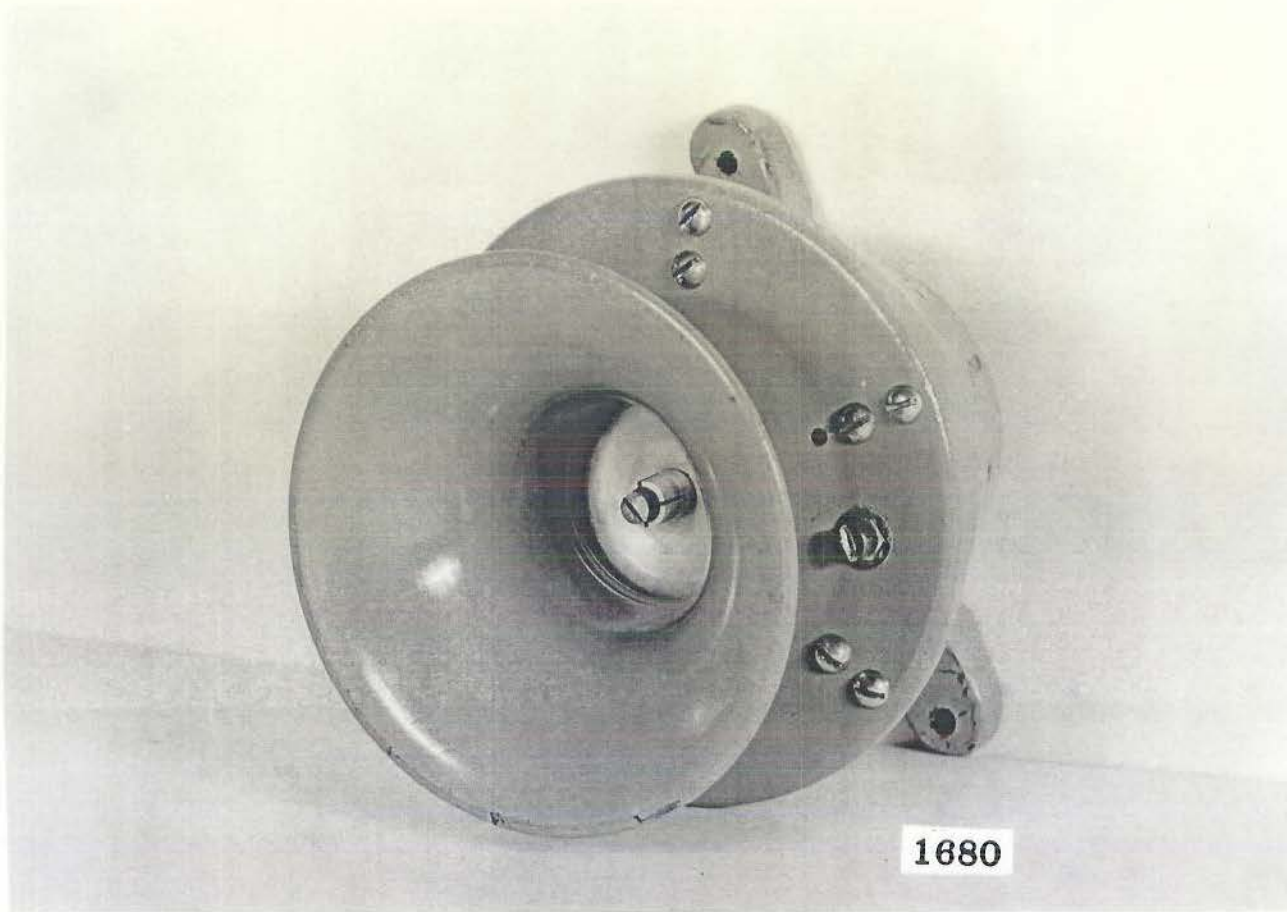
Plate 1



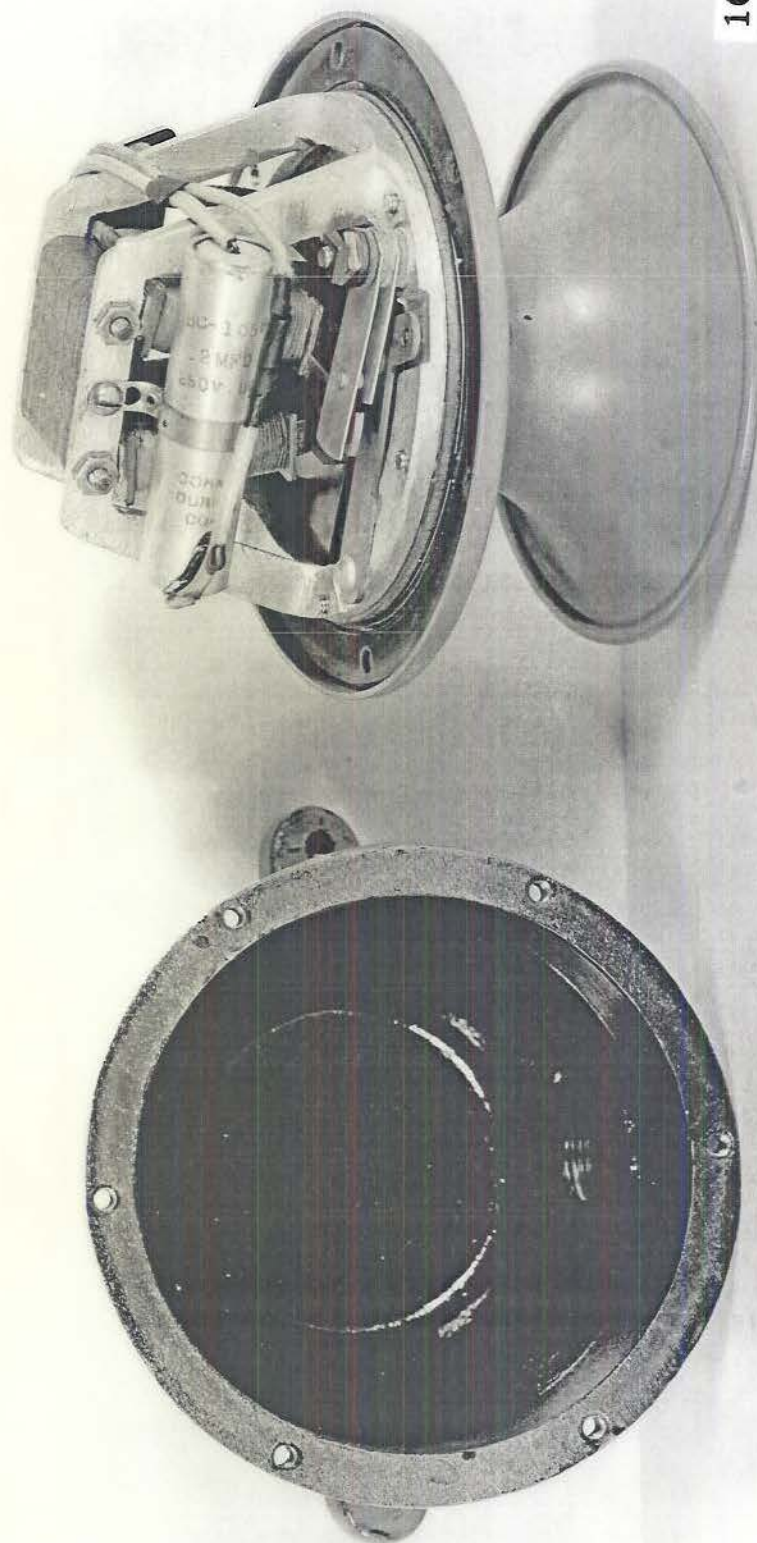
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Navy Type B-1

Plate 5



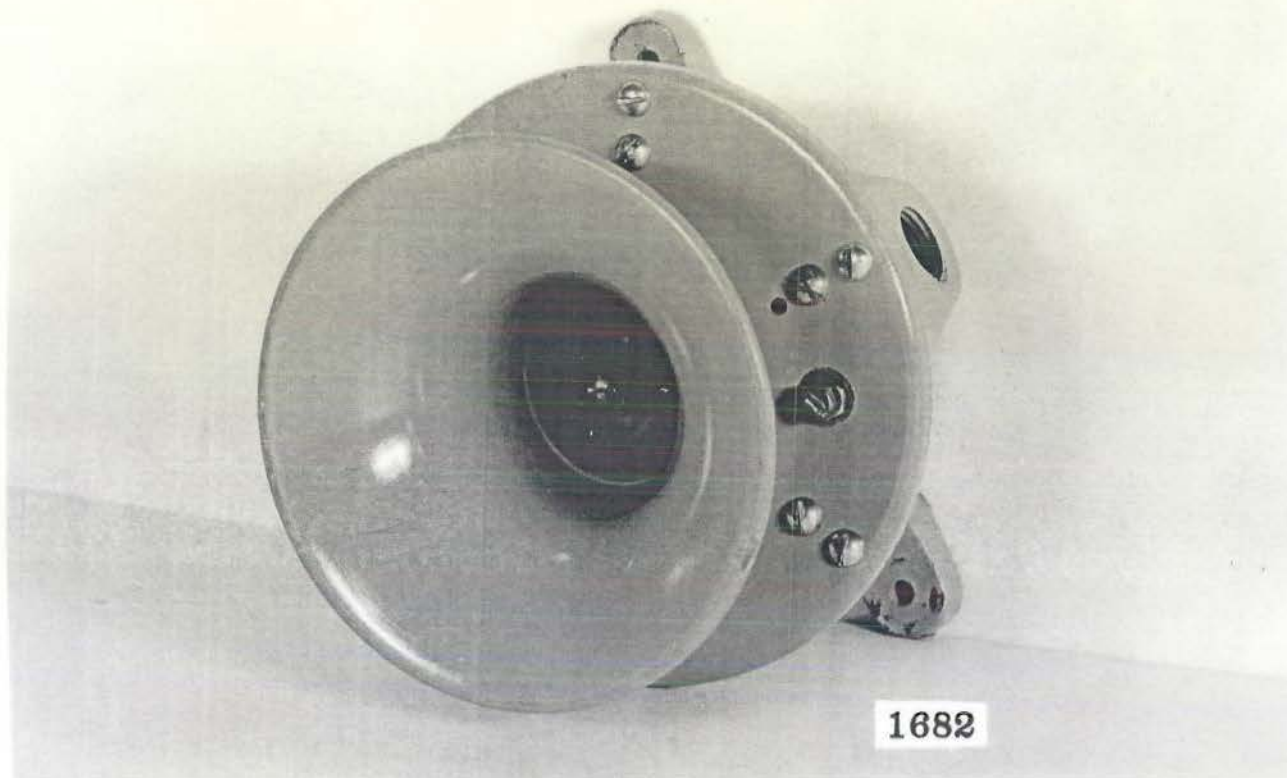
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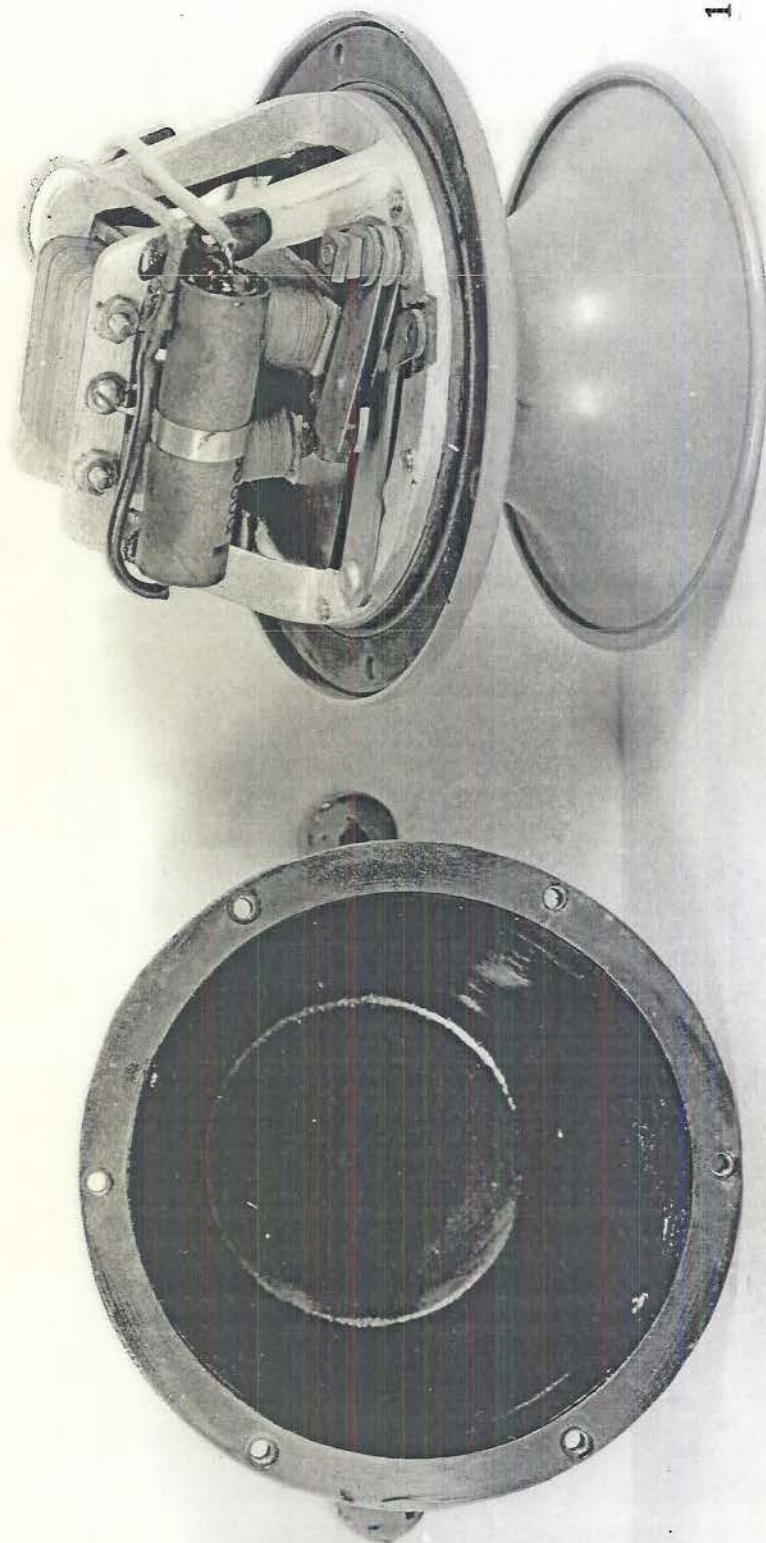


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Navy Type B-1 Plate 5





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