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NAVY DEPARTMENT  
BUREAU OF ENGINEERING

Report

of

Test on Bells, Vibrating,  
4-inch and 8-inch

FR-1369

Submitted by  
Bendix Marine Products Company,  
Brooklyn, New York.

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON, D.C.

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Date of Test: March and April, 1937.  
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Note: Photographs made following the salt spray test.

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) BuEng.ltr. S65-4/L5(2-1-Ds) of 4 Feb. 1937.  
(b) Specifications SGS(65)-102a, Bells, Interior Communication, of 1 June 1936.

OBJECT OF TEST

2. The object of this test was to determine how closely the subject bells complied with the specifications, reference (b), relative to tests for type approval.

ABSTRACT OF TEST

3. The subject bells as received, without making any adjustments, were tested for power consumption and sound output at rated voltage and frequency. All tests were made in the order outlined under the specifications for type approval. The usual inspection for suitability in design and quality of workmanship and materials concluded the test.

## Conclusions

(a) The subject bells manufactured and submitted by Bendix Marine Products Company, Brooklyn, New York, under test for conformance with the specifications, reference (b), for type approval, failed to comply with the following requirements:

- (1) During the second period of the endurance test (at the 14th hour) the striker rod on the 8-inch bell broke at the point where the rod is clamped to the armature. This break was due to the lack of sufficient material where the rod is cut away to allow for clamping. In order to complete the test, a new rod was installed.
- (2) The movable tungsten contact on the 4-inch bell loosened and required re-riveting during the latter part of the endurance test.
- (3) Under the salt spray test, the paint on both of the bells was badly deteriorated and the lockwashers used under the heads of the bolts securing the gongs were corroded. The lockwashers had no protective plating.
- (4) The priming coat of zinc chromate paint has been omitted on both of the bell cases. The gongs are finished in black instead of a heavy coating of approved grey lacquer.
- (5) The weight of the 4-inch bell exceeds that allowable by 14 ounces.
- (6) Plain enameled copper wire is used on the windings of both bells instead of double silk or cotton covered enamel.
- (7) No nameplates have been provided on the sample bells as required under Specifications 17N1.
- (8) The case covers of both bells are of cast aluminum alloy, while that required when the internal mechanism is located thereon is composition BE.
- (9) It is noted that resistors are used across the contacts of each bell. Paragraph D-7w requires suitable condensers to prevent radiation of radio frequency energy. However, as these resistors reduce contact arcing, they may be considered a satisfactory substitute.

Recommendations

(a) In view of the subject bells having complied with the major requirements of the specifications, it is recommended that tentative approval be considered pending the correction of the deficiencies noted herein under "Conclusions."

#### DESCRIPTION OF MATERIAL UNDER TEST

4. Two bells, one 4-inch and one 8-inch, shown by Plates 1 to 4 respectively, were submitted for test.
5. Each bell is of the vibrating type and is designed for 115 volts, a.c., 60 cycles.
6. The magnetic circuit consists of a "U"-shaped laminated core and a solid armature of rectangular cross section.
7. The laminated core supports two (2) windings connected in series, each being held on its respective pole piece by the bending over of the outside laminations. The coils on the 4-inch bell are form wound and bound with cotton tape. The coils on the 8-inch bell are formed with inter-wound cotton thread and impregnated.
8. The armature of each bell is provided with two (2) locking adjustments; one a contact which limits the stroke away from the poles, the other a spring to return the armature to its normal position.
9. Each unit is equipped with a terminal block of molded phenolic material having 9-S-1841-L terminals and a bracket for supporting a flat contact spring. The spring is slotted at the unsupported end to fit an insulating bushing riveted to the armature. A clearance is provided in the bushing so that the armature may move further toward and away from the poles than the contact carrying spring. The contact carrying spring on the 8-inch bell unit has a longitudinal slot approximately 0".75, presumably to weaken the spring tension without decreasing the thickness.
10. All contacts are made of tungsten and are shunted by two (2) fixed resistors connected in series and having a total resistance of approximately 1250 ohms.
11. The striker arm is a bent piece of steel rod threaded to fit the steel striker ball. Where the arm enters the case cover, a watertight packing gland of cadmium-plated steel is provided. The striker ball, which may be adjusted by turning, is provided with a locknut and forms the only external adjustment of the bell. The 4-inch and 8-inch units are mounted on their respective aluminum alloy case covers.
12. Located on each of the case covers is a cast steel bracket secured to a boss by a tapered steel pin, threaded at one end to accommodate a locknut. The other end of the bracket is provided with a square boss, fitting a hole in the bell gong and preventing its turning. A pin also is located in this boss to engage a hole in the bell.

13. The pressed steel gongs are clamped to their respective brackets by brass cap screws, nickel plated, having cadmium plated steel washers.

14. All internal metallic parts, with the exception of the laminated core in the 8-inch bell, are protected against corrosion by nickel or cadmium plating.

15. Each case is of cast aluminum alloy, having four (4) mounting lugs and two (2) external bosses, one tapped for a 3/4-inch standard terminal tube. The case covers are secured with six (6) 1/4"-20 oval fillister head cadmium-plated steel machine screws equipped with cadmium-plated steel washers and locknuts.

16. Both units are made watertight by the incorporation of four (4) circular "V"-shaped edges, cut in the case covers, which imbed themselves in the rubber gasket, recessed in the case, when the cover is bolted down.

#### METHOD OF TEST

17. The sample bells as received from the manufacturer were first tested for current consumption and power factor and then subjected to the shock tests, conducted as specified under paragraph F-2h.

18. They were next subjected to an endurance test consisting of operating them one minute every alternate minute for 24 hours at an ambient temperature of 65° C., and one minute every alternate minute for 24 hours at ambient temperature of 10°C. During these tests, the temperature rises of the windings were obtained, using the resistance method.

19. During the last four (4) hours of each half of the endurance test, both bells were tested for operation at over and under voltage and frequency. Tests were also made with the bells inclined 30° from the vertical in all planes.

20. Next followed tests for insulation resistance, dielectric strength, sound output, and watertight integrity.

21. The test was concluded with an examination of the design and quality of workmanship and materials.

#### RESULTS OF TEST

22. The test results obtained were as follows:

<u>Requirements</u>	<u>Test Values</u>	
	<u>4-inch Bell</u>	<u>8-inch Bell</u>
Voltage: 115 volts	115 volts	115 volts
Current: Alternating	Alternating	Alternating
Frequency: 60 cycles	60 cycles	60 cycles
Amperes: Not specified	0.20 amperes	0.21 amperes
Watts: Not over 15 watts for 4-inch bell and 25 watts for 8-inch.	12.0 watts	13.0 watts
Power factor: Not less than 50%.	52.2%	53.3%
Sound output: Not less than 47 db. for 4-inch bell and 55 db. for 8-inch bell.	63 db.	64 db.
Endurance: Shall operate one minute every alternate minute for 24 hours at ambient temperature of 65°C. and 24 hours at 10°C.	See comments under "Conclusions."	See comments under "Conclusions."
Sound output: Shall not decrease more than 3 db. during the period of type approval tests.	2 db.	2.5 db.
Temperature rise: Shall not exceed 35°C. above an ambient temperature of 65°C., during period of endurance test.	13.1°C.	11.9°C.
Shockproof qualities and inclination operation: Par. F-2h.	Complied	Complied
Dielectric test: Shall withstand 1500 volts a.c., 60 cycles, for a period of one minute applied before immersion and 500 volts a.c., 60 cycles, applied after immersion.	Complied	Complied

<u>Requirements</u>	<u>Test Values</u>	
	<u>4-inch Bell</u>	<u>8-inch Bell</u>
Insulation resistance: Shall be not less than 10 megohms following dielectric test and 1 megohm succeeding immersion test.	200 megohms 100 megohms	200 megohms 100 megohms
Waterproof test: No leaks shall occur when submerged in salt water to a depth of 3 feet for a period of one hour.	Complied	Complied
Salt spray test: Par. F-2f.	See comments under "Conclusions."	See comments under "Conclusions."
Case material: Shall be of aluminum alloy and cover made of composition BE when supporting the internal mechanism.	Case - aluminum *Cover - "	Case - aluminum *Cover - "
Bell material: Stainless steel or approved equivalent.	Formed stainless steel.	Formed stainless steel.
Contact material: Shall be made of tungsten.	Complied	Complied
Assembly screws and bolts: Steel, cadmium plated.	Complied	Complied
Painting: One priming coat of zinc chromate paint prior to two coats of aluminum paint. Gongs to be finished with a coating of grey lacquer.	*Priming coat omitted on case. *Omitted Black substituted.	*Priming coat omitted on case. *Omitted. Black substituted.
Weight: Shall be not more than 4 pounds for 4-inch bell and 9-1/2 pounds for 8-inch bell.	*4 lbs. 14 oz.	6 lbs. 15 oz.
Dimensions: Not specified.	Depth - 5"0 Height - 6"75	6"625 10"5

Requirements

Test Values

	<u>4-inch Bell</u>	<u>8-inch Bell</u>
Amplitude of contact motion: Shall be not less than 0.093 for 4-inch and 8-inch bells.	*0.018 (approximately)	*0.020 (approximately)
Windings: Shall be of double silk or cotton covered enameled copper wire.	*Plain enameled copper wire.	*Plain enameled copper wire.
Nameplates: Shall be in accordance with Specifica- tions 17N1.	*No nameplate provided, raised lettering used.	*No nameplate provided, raised lettering used.

\* Denotes failure to comply with the specifications.

## CONCLUSIONS

23. The subject bells, manufactured and submitted by Bendix Marine Products Company, Brooklyn, New York, under test for conformance with the specifications, reference (b), for type approval, failed to comply with the following requirements:

- (a) During the second period of the endurance test (at the 14th hour) the striker rod on the 8-inch bell broke at the point where the rod is clamped to the armature. This break was due to the lack of sufficient material where the rod is cut away to allow for clamping. In order to complete the test, a new rod was installed.
- (b) The movable tungsten contact on the 4-inch bell loosened and required re-riveting during the latter part of the endurance test.
- (c) Under the salt spray test, the paint on both of the bells was badly deteriorated and the lockwashers used under the heads of the bolts securing the gongs were corroded. The lockwashers had no protective plating.
- (d) The priming coat of zinc chromate paint has been omitted on both of the bell cases. The gongs are finished in black instead of a heavy coating of approved grey lacquer.
- (e) The weight of the 4-inch bell exceeds that allowable by 14 ounces.
- (f) Plain enameled copper wire is used on the windings of both bells instead of double silk or cotton covered enamel.
- (g) No nameplates have been provided on the sample bells as required under Specifications 17N1.
- (h) The case covers of both bells are of cast aluminum alloy, while that required when the internal mechanism is located thereon is composition BE.
- (i) It is noted that resistors are used across the contacts of each bell. Paragraph D-7w requires suitable condensers to prevent radiation of radio frequency energy. However, as these resistors reduce contact arcing, they may be considered a satisfactory substitute.

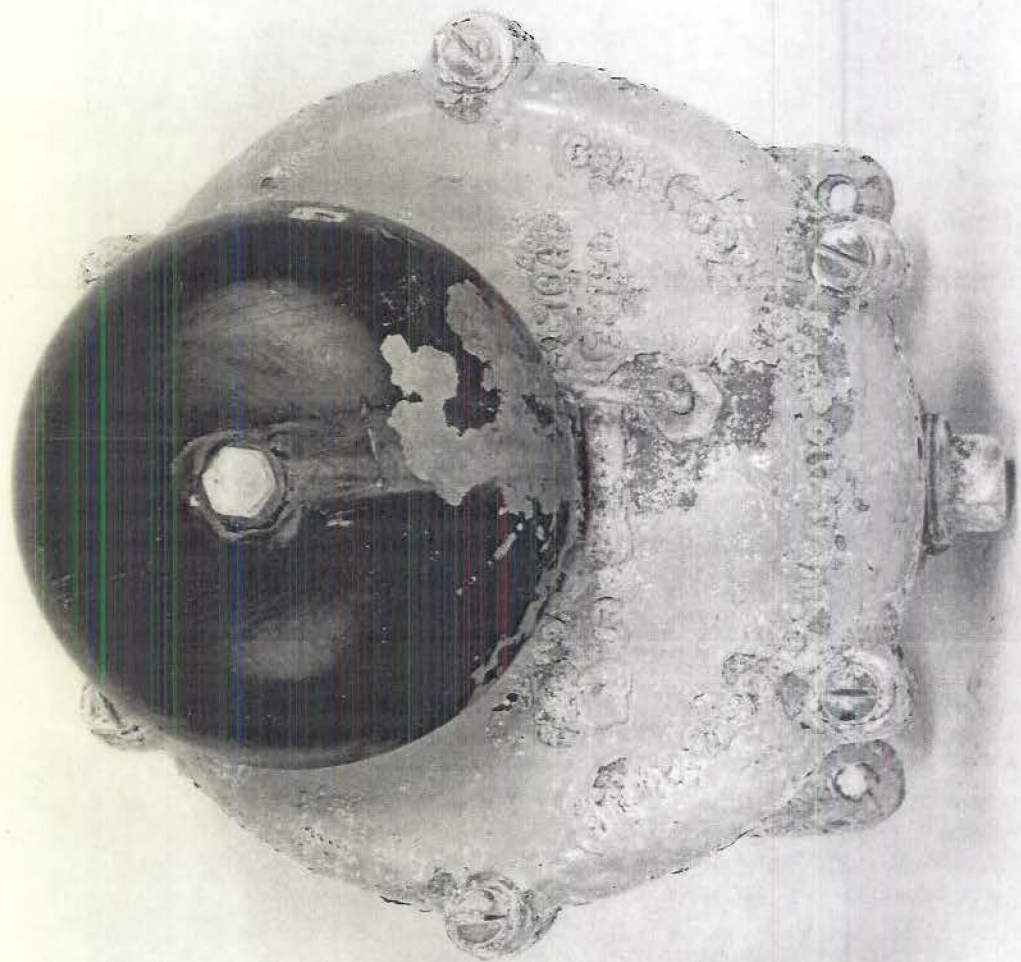
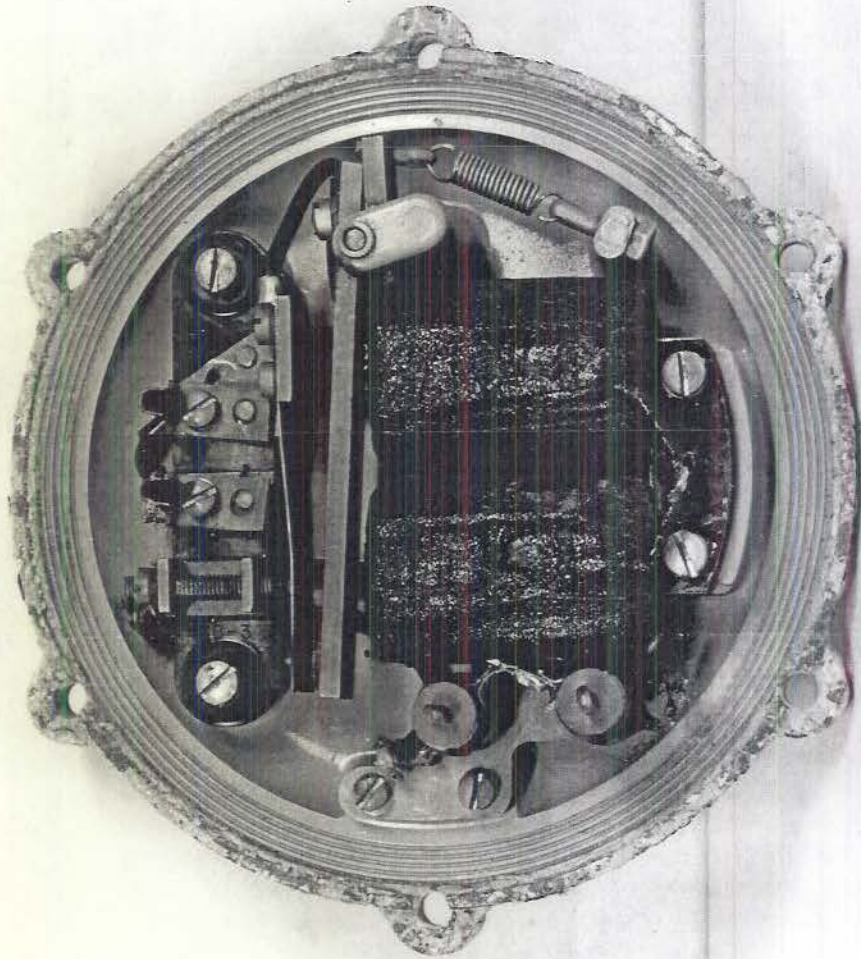
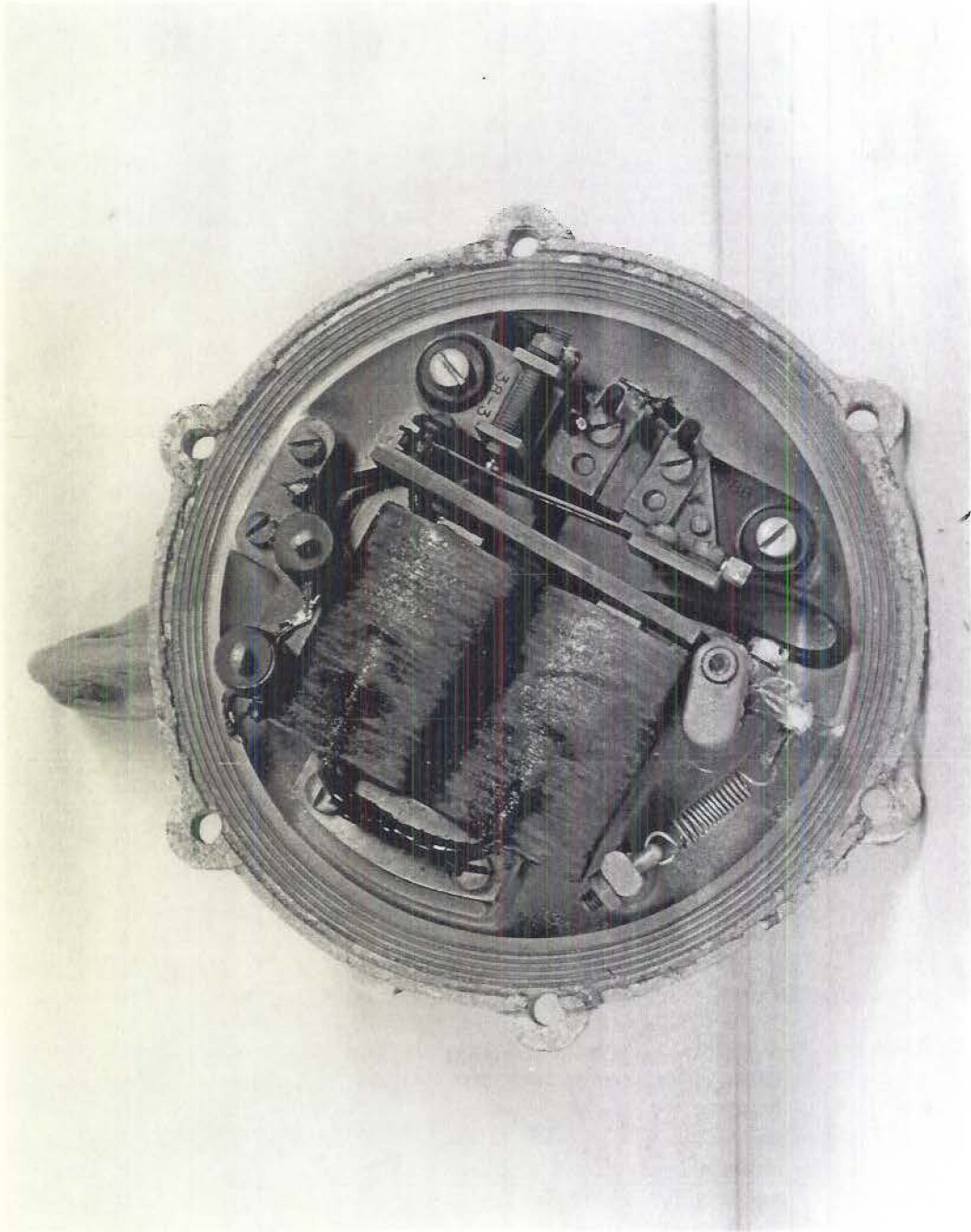
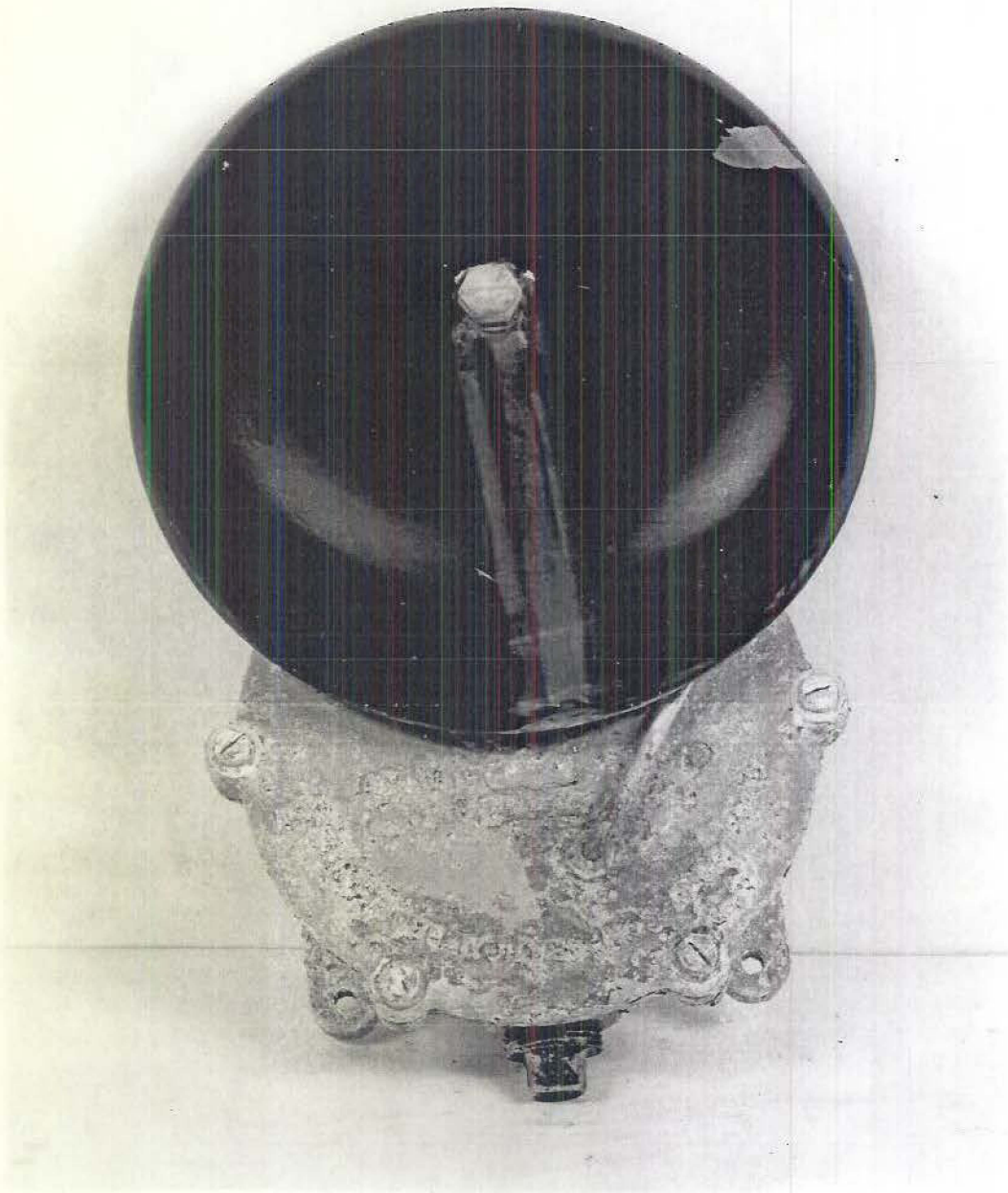


Plate 1











A U T H O R   I N D E X

Bryant, J. S...B-1363, B-1365, B-1369  
Coomes, J. R.....B-1363  
Greenleaf, S. A.....R-1366  
Hulburt, E. O.....H-1367, H-1362  
Miller, H. R.....R-1364  
Owens, R. B.....P-1361  
Rehbein, C. A.....P-1360  
Roberts, W. B..B-1369,B-1368,B-1365,B-1363  
Wallace, J. D.....R-1364  
Whybrew, W. E.....P-1360