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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report of

Test on Bells
Contract NOs-37951
Manufactured and Submitted by
Chas. J. Henschel and Co., Inc.
Amesbury, Mass.

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ANACOSTIA STATION
WASHINGTON, D. C.

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Case cover and plunger removed, showing assembly of
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AUTHORIZATION

1. This test was authorized by reference (a) and other additional references pertinent to this problem are listed as references (b) to (e) inclusive.

- Reference:
- (a) BuEng.ltr. EN8/508(8-13-Ds) of 21 August 1934.
 - (b) Navy Department Specifications SGS (65) - 102 of 2 January 1935.
 - (c) Contract NOs-37951 - Requisition Bureau 508 NIRA. Chas. J. Henschel and Co., Inc., Amesbury, Mass., Contractor.
 - (d) Manufacturer's Drwg. 20-114, 12 inch, 115 V. a.c., 60 Cycle, Plunger Type Bell.
 - (e) Manufacturer's Drwg. 20-115, 12 inch, 115 V. d.c., Plunger Type Bell.

OBJECT OF TEST

2. The main objective in conducting this test was to determine whether or not the submitted plunger type bells, were practical for Naval use and whether they had a greater sound output than the present single stroke bells used in the Naval Service. It was also necessary to test the material for compliance with specifications, reference (b), and Contract, reference (c).

ABSTRACT OF TEST

3. Both bells were first tested for their sound output, while operating at the normal 90 strokes per minute, at rated voltages. They were then tested for conformance with the specifications, reference (b), and carefully examined to ascertain whether they were in strict accordance with the specifications in the matter of materials, design and workmanship.

CONCLUSIONS

(a) These bells, manufactured and submitted for test by Chas. J. Henschel and Company, under Contract NOs-37951, will be suitable for the Naval Service provided the manufacturer corrects the defects, noted under "Comments", paragraphs 24 to 29 inclusive and 33.

(b) The subject bells are considered superior to those now used in the service, and due to their simplicity, it is believed that they will require but little attention for maintenance.

RECOMMENDATIONS

(a) In view of the bells complying with the major requirements of the specifications and possessing simplicity in design, it is recommended that they be given type approval subject to modification in accordance with "Comments" of this report.

(b) Inasmuch as, including the results of this report, the Bureau has data on the decibel output of all bells and buzzers manufactured under this contract, it is recommended that in future specifications, the Bureau consider expressing the required sound output in decibels instead of yards of audibility range. As the equipment developed under this contract possesses greater decibel output than equipment previously tested, it is suggested that the subject bells and buzzers be used as standards, and that no equipment possessing less sound output, or having greater power consumption, be accepted for Naval use. All noise measurements were made in a sound-proofed room using the General Radio Noise Meter Type 559-A with microphone located 18 feet from and on the axis of the bell under test.

DESCRIPTION OF MATERIAL UNDER TEST

4. The material tested was developed by the Chas. J. Henschel and Company, Inc., and submitted under Contract NOs-37951.
5. The equipment submitted was as follows:
 - Item 1 - One 12 inch plunger type bell designed for 115 V. a.c., 60 cycles; Drawing 20-114.
 - Item 2 - One 12 inch plunger type bell designed for 115 V. d.c.; Drawing 20-115.
6. These bells are solenoid operated, and are identical in design except for the values of their windings.
7. The solenoid is enclosed in a cast aluminum alloy case, provided with a removable cover, two bosses, one tapped for 3/4" standard Navy terminal tube, and three mounting lugs.
8. The coil is wound on a slotted brass spool which is mounted in a rectangular laminated core. A bakelite tube passes through the coil, laminated core, and the watertight case. A packing gland is provided on the top and bottom of the case to prevent water from entering around the tube.
9. A soft steel armature of hexagonal cross section, provided with duraluminum extension, is suspended in the bakelite tube and normally closes the top of it with a felt pad, fitted under the steel striker head.
10. The case is provided with steel inserts for the cover securing screws, but no inserts are provided for the core or terminal strip securing screws.
11. The gong is stamped stainless steel, 12 inches in diameter and is mounted on a cast BE case cover in such a manner that only the gong is visible from the front, the entire bell occupying a space, 12 inches in diameter. The hole in the center of the gong is square and the gong is secured with a 1/2" brass cap screw, nickel plated and provided with a cadmium plated steel washer.
12. The case cover is provided with two steel dowel pins and the usual 1/4" square rubber gasket, recessed.
13. The case was first coated with aluminum paint and then finished outside in gray and inside with black insulating varnish.
14. When energized, the solenoid winding produces a strong magnetic field; the armature is attracted and attempts to center itself with the winding. However, it exceeds this position and strikes the gong sharply, after which it rebounds and assumes a position where it does not contact the gong.

METHOD OF TEST

15. First, each bell was supplied with its rated voltage, tested for sound output and compared with representative samples of single stroke bells now used in the Naval Service.

16. After completion of this test, the bells were installed in a compartment having an ambient temperature of 65°C. and tested for endurance by operating them one minute every alternate minute for 24 hours.

17. They were then tested at an ambient temperature of 40°C. by operating them one minute every alternate minute for an additional 24 hours. The resistance method was used to determine the temperature rise of the windings during these tests.

18. The a.c. bell was tested for operation at over and under voltage and frequency when inclined 30° from the vertical plane in all directions. The d.c. bell was given the same test except that it was supplied with over and under voltage.

19. The bells were then tested for current consumption, insulation resistance and dielectric strength. The power factor of the a.c. bell was also obtained.

20. Both bells were then tested for shock integrity on a Bureau of Engineering shock stand, in accordance with the specifications, reference (b).

21. Following, the watertight integrity of the bells was determined by submerging each in a tank of salt water to a depth of 3 feet for a period of 12 hours.

22. The test was concluded by inspecting each bell to determine whether the materials, design and workmanship were in accordance with the specifications, reference (b).

RESULTS OF TEST

23.

<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>	
		<u>A.C. Bell</u>	<u>D.C. Bell</u>
Voltage	115 Volts.	115 V.	115 V.
Frequency	60 Cycles.	60 cycles	- -
Amperes	- -	0.292	0.262
Watts	- -	23.6	30.13
Power Factor	Not less than 30%	70.28%	- -
Endurance	One minute of operation every alternate minute for 24 hours at 65°C. ambient, and 24 hours at 40°C ambient, at the rate of 90 strokes per min.	Satisfactory	Satisfactory

<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>	
		<u>A.C. Bell</u>	<u>D.C. Bell</u>
Temperature rise	Observable temperature shall not exceed 100°C. at an ambient temperature of 65°C during first part of endurance test.	85.9°C	79.9°C
	Not over 30°C rise at ambient of 40°C during latter part of endurance test.	23.6°C	24.2°C
Inclination	Satisfactory operation when inclined 30° from vertical in all directions at 10% over voltage and at 10% under voltage, also at 10% over and 10% under frequency where applicable.	Satisfactory	Satisfactory
Shock Integrity	Satisfactory operation under shocks required by specifications, par. F-5C.	Unsatisfactory *See comments, par. 24.	Not tested
Audibility range	Shall be heard in still air in the open not less than 150 yards.	Both bells could be heard at a distance of approximately 405 yards.	
Sound intensity in db. measured in sound proof room, microphone located 18 feet from and on the axis of the equipment under test.	Not specified	53 db.	54 db.
Insulation resistance before and after immersion.	Before - not less than 5 megohms.	200 megohms	200 megohms
	After - not less than 1 megohm. (By 1000 V. Megger)	100 "	75 "
Watertight Integrity	Shall not leak when submerged in salt water to a depth of 3 feet for a period of 12 hours.	Both cases were watertight.	
Resistance by bridge at ambient of 40°C.	- - -	44.3 ohms	458.0 ohms
Case material	Aluminum alloy	Aluminum alloy	Aluminum alloy
Cover material	Aluminum alloy or approved equivalent.	Comp. M.	Comp. M.

<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>	
		<u>A.C. Bell</u>	<u>D.C. Bell</u>
Gong material	Cast bell metal, pressed brass bronze, or stainless steel.	Both made of pressed, stainless steel, polished on convex face.	
Weights (Total)	Not specified	13.0 lbs.	13 lbs.4 oz.
Gong Weight	" "	5.0 "	5.0 lbs.
Dielectric Strength before and after immersion.	Before - 1230 V. a.c. 60 cycle. After - 500 V. a.c. 60 cycle.	Satisfactory	Unsatisfactory *See comments, par.25.
Dimensions	Gong, 12 inches in diameter, others not specified.	Gong diameter and overall diameter - 12"0 Overall depth 4"75	

*Denotes non-compliance with specifications.

COMMENTS ON RESULTS OF TEST

24. One of the bells failed to withstand the required shock test, reference (b), par. F5c. The bakelite tube, passing through the case and supporting the solenoid winding, fractured. This could be prevented by supporting the winding independently of the tube, possibly by securing it to the core.

25. The winding on the d.c. bell failed to withstand the required dielectric test of 1230 V. a.c., 60 cycles, applied for one minute between it and the case. The manufacturer should use greater care in insulating the winding from the brass spool.

26. The six tapped holes inside of the case for securing the laminated core and terminal strip should be provided with steel inserts.

27. The laminations of the core do not appear to have been painted with insulating varnish as required by SGS (65)-102, par. D-6j.

28. The terminal strip is of laminated bakelite, but should be of molded insulating material as required by SGS(65)-102, par. D-6b.

29. The brass spool for supporting the winding should be nickel plated, as are other brass parts.

30. These bells have a sound output of 53 and 54 decibels respectively. The single stroke bells at present used in the Naval Service have a sound output of approximately 47 decibels when tested under the same conditions.

31. No tests could be made at minus 30°C. as test equipment for this purpose has not been received to date. Due to the simplicity of their design, it is believed that they will be unaffected by low temperatures.

32. One of the manufacturer's bells of identical material has been given the required 100 hour salt spray test and proved satisfactory.

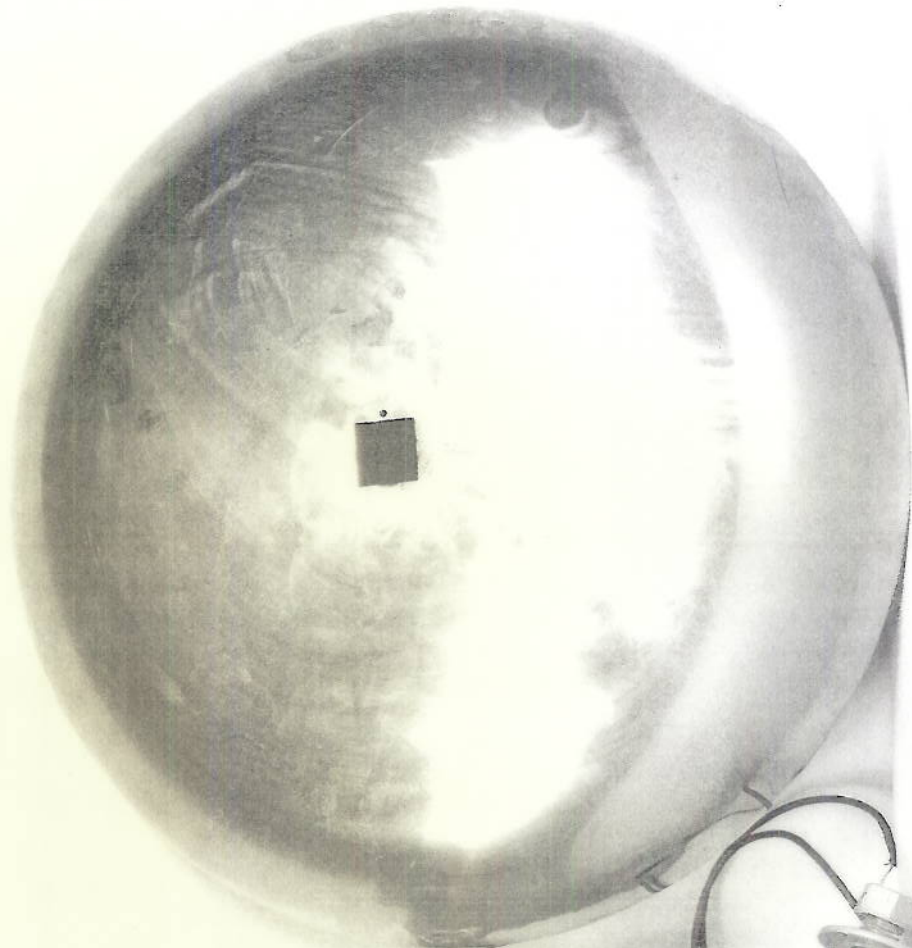
33. It appears that the only possible trouble that may develop will be that the bakelite tube, passing through the case may absorb enough moisture to cause trouble. It is believed that its non-hydroscopic properties can be improved by treating it with bakelite or similar varnish, using a tubing with hard internal and external finishes, or possibly by incorporating a molded tube.

34. It was observed during the test that the A.C. bell was consistent in operation while being energized 90 times per minute. The bell was never observed to miss a stroke as frequently occurs with single stroke a.c. bells of the type now used in the Naval Service.

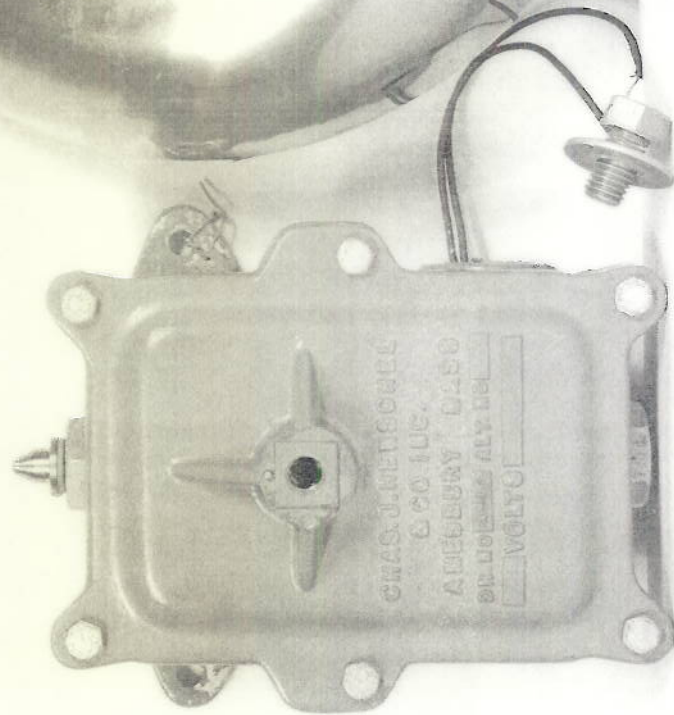
CONCLUSIONS

35. These bells, manufactured and submitted for test by Chas. J. Henschel and Company, under Contract NOs-37951, will be suitable for the Naval Service provided the manufacturer corrects the defects, noted under "Comments", paragraphs 24 to 29 inclusive and 33.

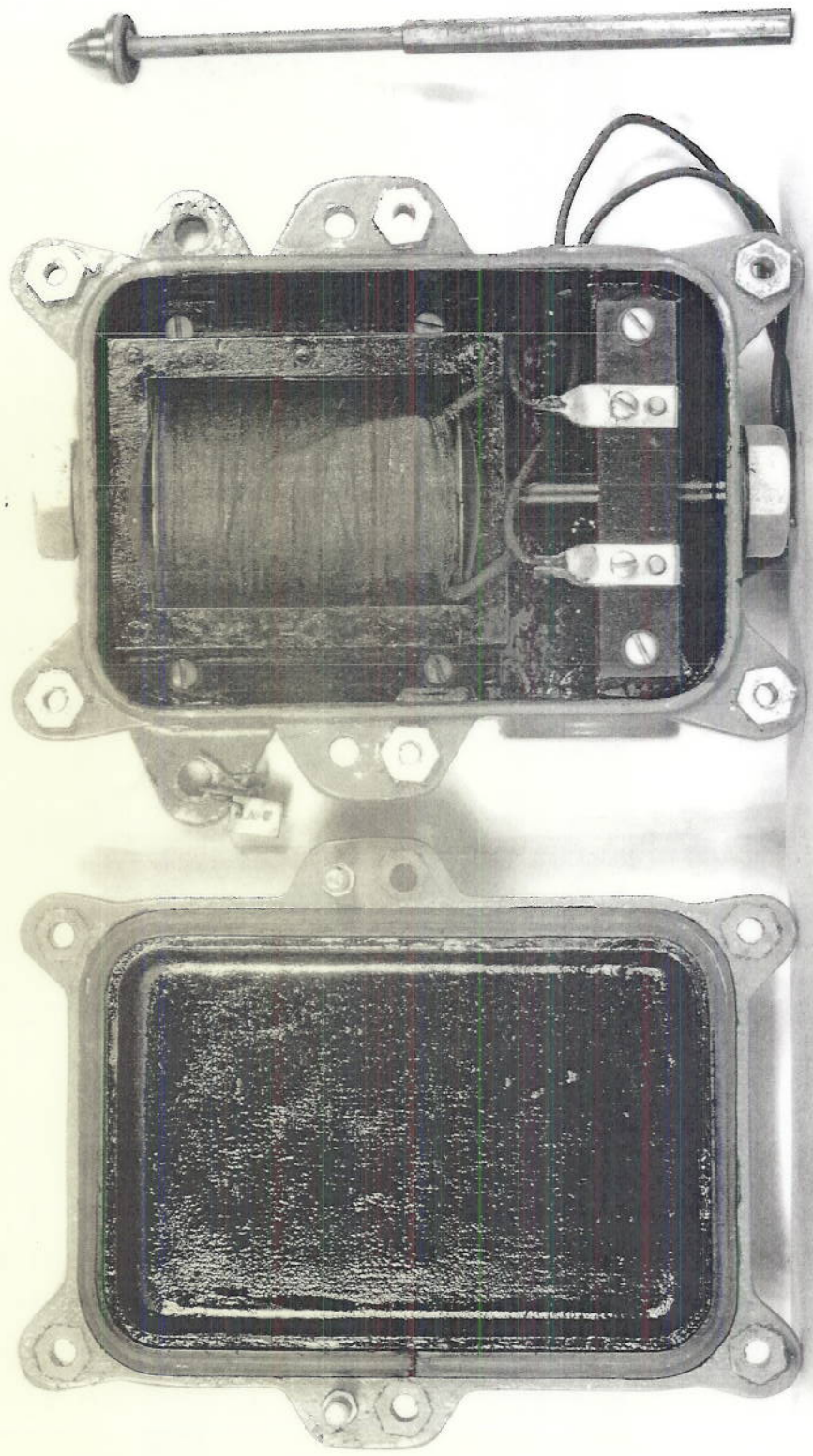
36. The subject bells are considered superior to those now used in the service, and due to their simplicity, it is believed that they will require but little attention for maintenance.



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& CO. INC.
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