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NAVY DEPARTMENT

BUREAU OF ENGINEERING

Report of

Test of Static Electricity Dissipation in Submarine Storage Battery Ventilation Ducts

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Appendix

High Voltage Circuit for Test of Submarine Battery Ventilation Ducts. . . . . Plate 1.

AUTHORIZATION

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

Reference: (a) Bu.Eng.let.SS/S62(7-30-D1) of 7 August 1935.
(b) Requisition 194, Order N173s-2382 of 30 April 1935.
(c) INM, Phila., let.L4-3/194 of 19 September 1935.

OBJECT OF TEST

2. The object of this test was to determine the ability of the submarine main battery ventilation ducts supplied by the Electric Storage Battery Company under the order reference (b) to dissipate static electric charges which might be generated during the operation of a submarine battery ventilation system.

ABSTRACT OF TEST

3. The duct samples were tested, first, by connecting one end of the duct to a high potential source simulating a source of static electricity, with the other end grounded, and measuring the current flowing, and, second, by determining the electrical resistance of the duct with a Wheatstone bridge.

CONCLUSIONS

(a) The duct compositions under test have a sufficiently low electrical resistance to dissipate static charges.

(b) Their electrical resistance is, in fact, probably 1000-fold lower than necessary.

RECOMMENDATIONS

(a) It is recommended that the "brittleness" and other pertinent physical properties of the duct material be tested before deciding on its suitability for use in submarines.

(b) The effect of the use of such low resistance ducts on the ground detector system should be considered.

DESCRIPTION OF MATERIAL UNDER TEST

4. For the subject tests, two samples of submarine main storage battery ventilation ducts were provided. These are molded hard rubber composition ducts 46 inches by 4 inches with 1/4-inch walls. The two samples differ in composition and appearance. It was the Bureau's intention that soft rubber connecting sleeves of high electrical conductivity were also to be provided for test, but in enclosure (A) of reference (c) the contractor stated his inability to obtain such material.

METHOD OF TEST

5. To simulate the generation of static electricity in the duct, the high potential system diagrammed in Plate 1 was set up. Measurements of the voltage showed that the resistance of the duct samples was far lower than anticipated so that the 1000 volts used was needlessly high. Hence, the resistances of the ducts were next determined by use of a Wheatstone bridge. To do this, a band of tin foil was secured around each end of the duct and used as the collector conductor to connect to the Wheatstone bridge.

DATA RECORDED DURING TEST

6. The resistance of the two samples was found to be 1000 and 5000 ohms respectively.

PROBABLE ERRORS IN RESULTS

7. A principal source of error in the measurement of the resistance of insulating materials is in making electrical connection from the measuring instrument to the sample under test. It is considered that the method used reduces this source of error to a minimum. The instrumental errors in the present test are small in comparison with that error.

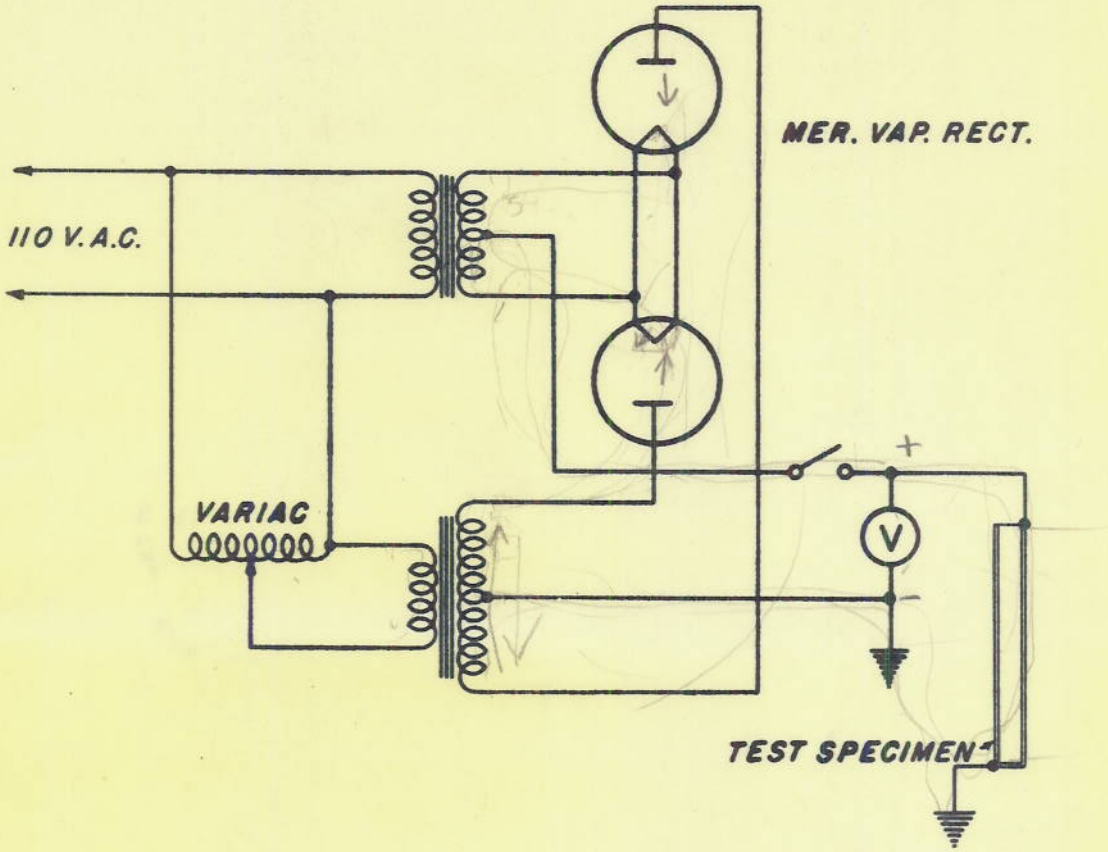
RESULTS OF TEST

8. The electrical measurements thus show that the electrical resistivity of the hard rubber composition from which these ducts were fabricated is of the order of 10^2 ohms as compared with the 10^{15} ohms of ordinary hard rubber. The new duct would therefore dissipate static electricity 10^{13} times as fast as ordinary hard rubber. This is a 1000 times greater than is considered absolutely necessary.

CONCLUSIONS

9. The duct compositions under test have a sufficiently low electrical resistance to dissipate static charges.

10. Their electrical resistance is, in fact, probably 1000-fold lower than necessary.



HIGH VOLTAGE CIRCUIT FOR TEST OF SUBMARINE BATTERY VENTILATION DUCTS.

PLATE I