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NAVY DEPARTMENT

Report of Test

on

Switches, Multipole Rotary

Submitted by _____

Arrow-Hart and Hegeman Electric Company

Hartford, Connecticut

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ANACOSTIA STATION
WASHINGTON, D. C.

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Authorization: BuShips Ltr. NXs-12243(350) of 11 February 1943.

Date of Test: April and May 1943

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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) to (d).

References: (a) BuShips Ltr. NXs-12243(350) of 11 February 1943.
(b) Contract NXs-12243 of 1 September 1943.
(c) Bureau Standard Plan No. 9-S-4474-I-Alt, 27.
(d) Specification 17E13(INT) of 1 March 1942.

OBJECT OF TEST

2. The object of this test was to determine conformance of the sample switches with the requirements of notes 15-a,b,c, and d of plan, reference (c), and with specification, reference (d).

ABSTRACT OF TEST

3. The sample switches were set up in connection with suitable test equipment where their performances were carefully observed for compliance with the applicable requirements of references (c) and (d). An inspection, to determine compliance in the matter of materials, design, and workmanship, concluded the test.

CONCLUSIONS

(a) The subject switches complied with the applicable requirements of plan, reference (c), except in the following details of construction:

- (1) Design and construction of the detent wheel.
- (2) Marking of back plate.
- (3) Marking of phenolic barriers.
- (4) Mounting screws
- (5) Material and design of the handle.

(b) The results of the HI shock test indicate that the strength of the switches is adequate to withstand high impact shock except that in the switch having a removable shaft, a better method of securing the collars to the shaft should be provided.

RECOMMENDATIONS

(a) That the subject switches be APPROVED for Naval use subject to the desires of the Bureau relative to the departures from plan, reference (c), in regard to design and construction.

(b) That the switch having a non-removable shaft be considered to have satisfactory HI shock resistance.

(c) That the switch having a removable shaft be considered to have satisfactory HI shock resistance subject to the adequate securing of the shaft collars.

DESCRIPTION OF MATERIAL

4. The subject switches, submitted by Arrow-Hart and Hegeman Electric Company, Hartford, Connecticut, are of the multipole, rotary type, and are generally of the design covered by Bureau of Ships Standard plan 9-S-4474-I-Alt.27.

5. Two types were submitted. In one type, a removable square steel shaft extends through the phenolic rotary contact holders and the steel end plates. The stationary contact holders are clamped between the end plates by four No. 10-32 steel machine screws used as through bolts. One end of the shaft is provided with a phenolic handle secured to a steel rotary nameplate. Two steel collars, each provided with two No. 6-32 fillister headed steel machine screws, used as set screws, are located externally and contact the front and back plates to hold the shaft in place.

6. Four steel balls, each actuated by a coiled spring in combination with a steel star wheel located on the shaft, serve as an indexing device for the shaft and as a means of accelerating the rotation of the contacts when the switch is hand operated. This assembly is recessed in a phenolic holder located under the lower contact holder.

7. An internal steel stop, located in the shaft, contacts removable steel pins extending from two of sixteen holes in a round phenolic block located under the front plate, to limit the travel of the contacts as desired. The fixed contacts are provided with terminal lugs and each layer is separated by flat phenolic rings of 1/16" thickness.

8. The other type is similar with the principal exceptions that the rear of the shaft is rounded to fit a bearing hole in the back plate and is retained by a "U" shaped steel washer inserted in a groove in the shaft above the star wheel, but behind the front plate. The four mounting studs are riveted to the back plate. Further details in the design and construction of the samples are shown by photographs, Plates 1 and 2.

METHOD OF TEST

9. Following an examination of the samples for compliance with plan, reference (c), they were subjected to tests for dielectric strength and insulation resistance.

10. One switch was operated by a mechanical drive at the rate of 10 operations per minute when carrying a load of 10 amperes, 125 volts, 60 cycles, 0.5 power factor. The rate of transfer (44° rotation of the switch handle) was approximately 6 seconds. Under this test setup, the contacts were badly burned after an average of 2800 operations. A compressed air mechanism was then constructed and three of the samples were operated by this means at 10 operations per minute while carrying rated load. The rate of transfer was 44° in 0.41 second. This is believed to more nearly simulate hand operation. The driving mechanism is shown by Plate 3. The millivolt drop across the contacts when carrying rated load was measured before and after the test by a Ballentine Laboratories, Inc., Model 300 electronic voltmeter.

11. The tests were concluded by subjecting the remaining two samples to the HI shock test when mounted on a panel as shown by figure 6c of reference (d). Plate 4 shows the switches mounted on the shock machine. The millivolt drop across the contacts when carrying rated load was measured before and after this test.

RESULTS OF TEST

12. The test results obtained were as follows:

Requirements

Test Values

Compliance with plan: Note 15a of reference (c).

*The samples do not agree in the following respects:

- (a) Design and construction of the detent wheel.
- (b) Marking of the back plate.
- (c) Marking of the barriers.
- (d) Mounting screws.
- (e) Material and design of handle.

Dielectric test: Note 15b of reference (c).

Complied.

Insulation resistance: Note 15c of reference (c).

Greater than 200 megohms by 1000 volt Megger.

Operation: Note 15d of reference (c).

Satisfactory when operated as shown by Plate 3.

Millivolt drop across contacts: (Not specified).

The average drop across the fixed contact terminals before the test was 48 millivolts and after the test was 61 millivolts.

(Max. Before: 80 MV. After 80 MV.)

(Min. Before: 10 MV. After 10 MV.)

*Denotes failure to comply with plan, reference (c).

13. The HI shock test resulted in no apparent damage to the switches except that in the switch having a removable shaft the collar securing the shaft extending through the back plate came off, allowing the shaft to be partially ejected. The average drop across the fixed contact terminals when the switches were carrying rated load, was 52 millivolts before and 56 millivolts following the test.

CONCLUSIONS

14. The subject switches complied with the applicable requirements or plan, reference (c), except in the following details of construction:

- (1) Design and construction of the detent wheel.
- (2) Marking of back plate.
- (3) Marking of phenolic barriers.
- (4) Mounting screws
- (5) Material and design of the handle.

15. The results of the HI shock test indicate that the strength of the switches is adequate to withstand high impact shock except that in the switch having a removable shaft, a better method of securing the collars to the shaft should be provided.

CLUSIONS

14. The subject switches complied with the applicable requirements plan, reference (c), except in the following details of construction:

- (1) Design and construction of the detent wheel.
- (2) Marking of back plate.
- (3) Marking of phenolic barriers.
- (4) Mounting screws
- (5) Material and design of the handle.

15. The results of the HI shock test indicate that the strength of the latches is adequate to withstand high impact shock except that in the switch having a removable shaft, a better method of securing the collars to the shaft could be provided.



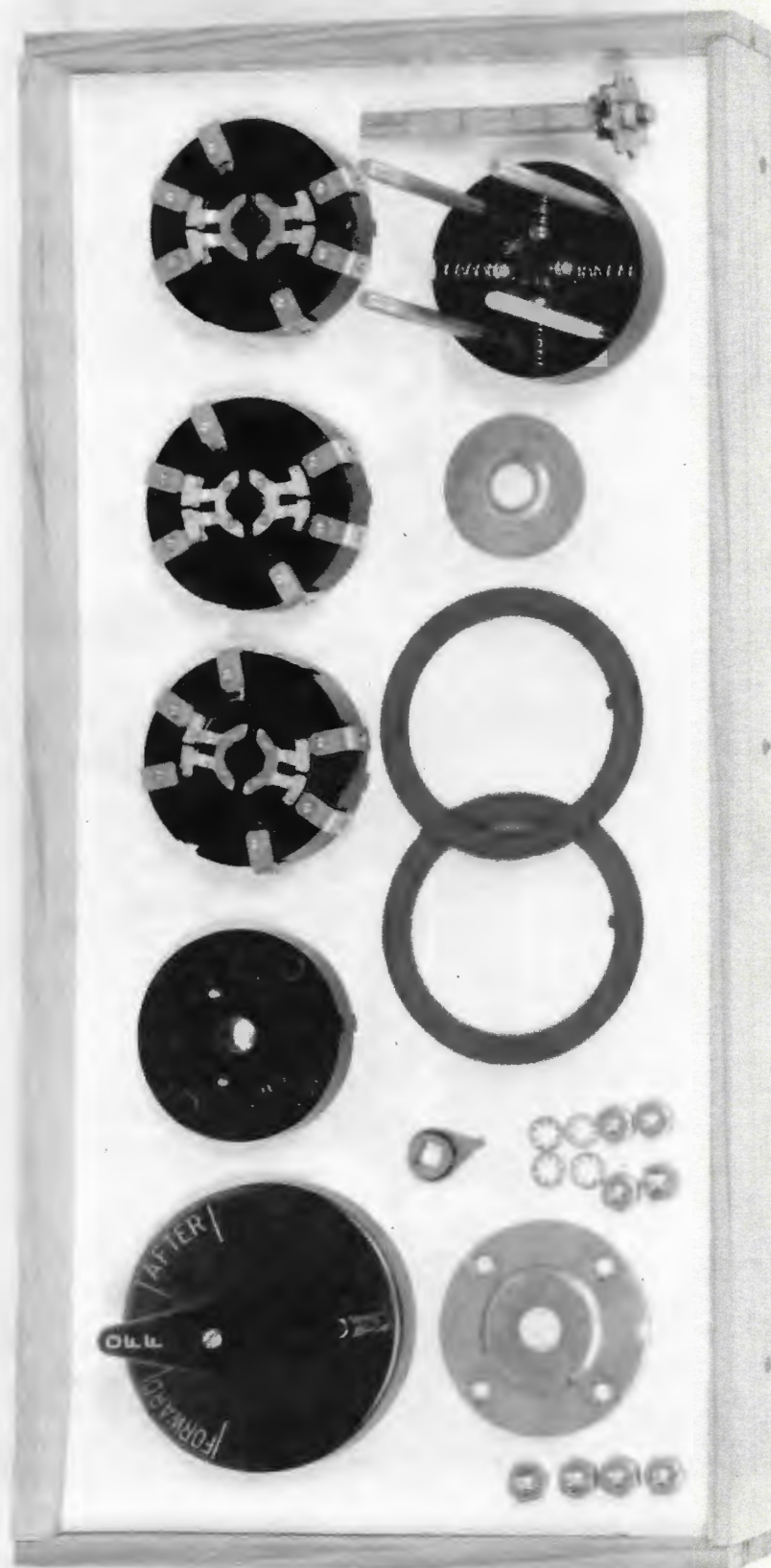


PLATE 2

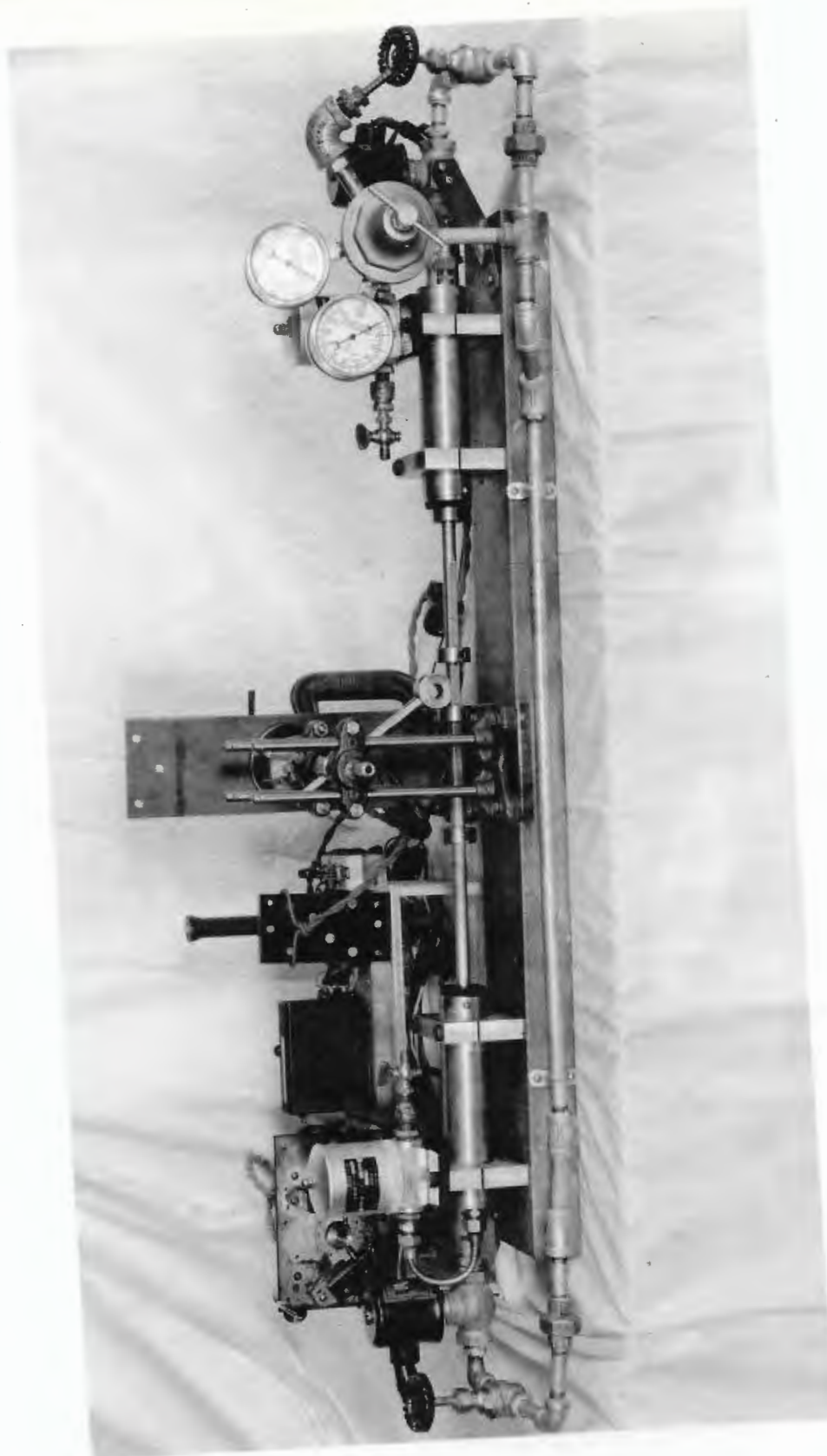


PLATE 3

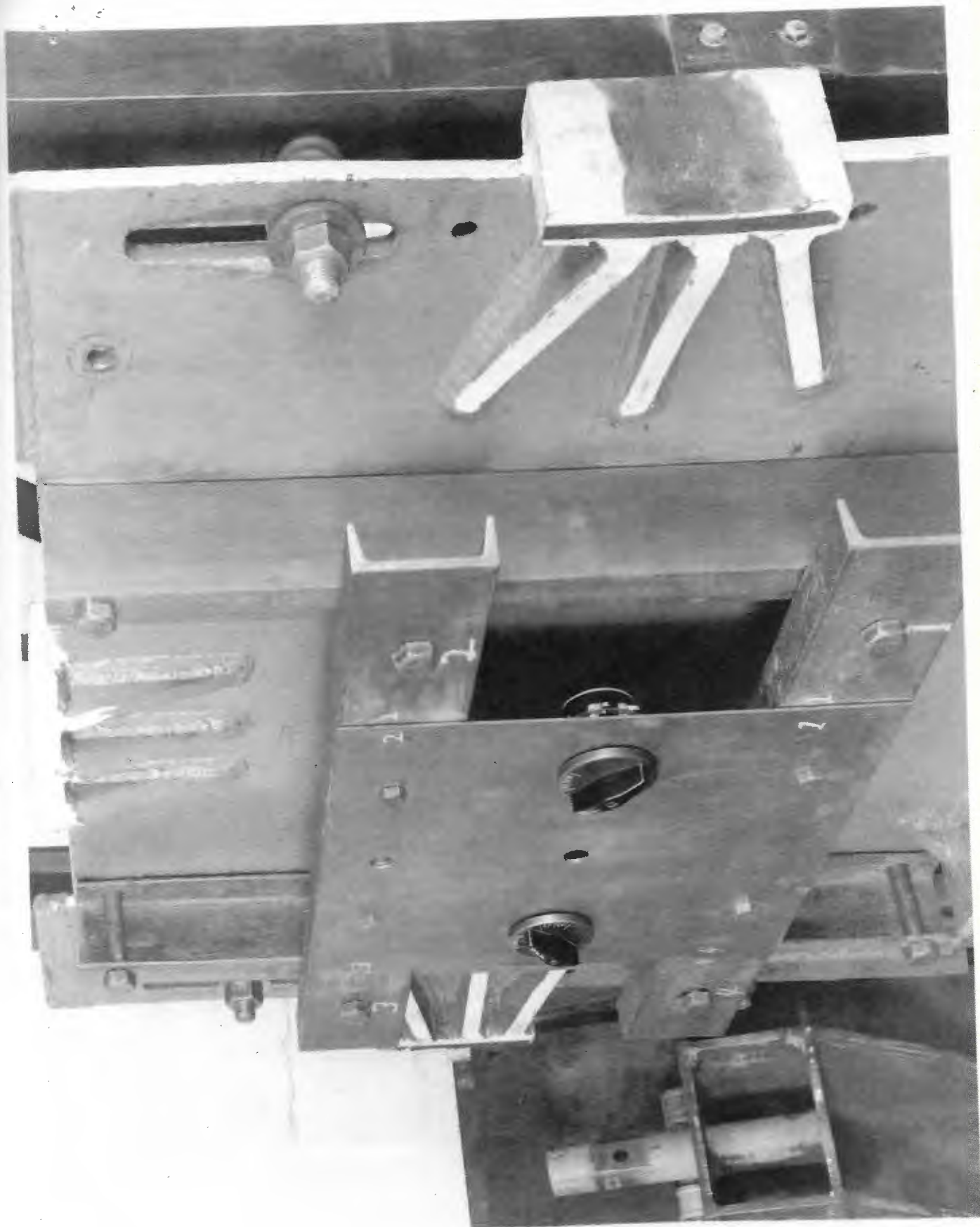


PLATE 4