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S NAVAL PROVING GROUND
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REPORT NO 896
ROTATING BAND STUDY

2nd Partial Report
TEST OF 3"/70 AA PROJECTILES WITH
ARMCO IRON ROTATING BANDS

1st Partial Report Task Assignment NPG-Re3b-225-1-52
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UNCLASSIFIED
Second Partial Report

on

Rotating Band Study

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First Partial Report

on

Test of 3"/70 AA Projectiles with

Armco Iron Rotating Bands

Project No.: NPG-Re3b-225-1-52
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Test of 3"/70 AA Projectiles with Armco Iron Rotating Bands

PART A

SYNOPSIS

1. 3"/70 projectiles of various types, fitted with gilding metal rotating bands, have been observed to exhibit serious band wear; that is, partial or complete obliteration of the engraving of the bands recovered after firing. It was desired to investigate the effect of replacing the gilding metal with soft iron, in order to determine the results of using a material with a considerably increased melting point, and if this change would produce a band which did not fail, to determine the effect upon gun performance.

2. It is possible to fit a 3"/70 projectile with a soft iron band using precisely the same method of manufacture as for a gilding metal or copper band. The hardness of such a band is approximately the same as that of a gilding metal band.

3. Armco ingot iron bands of the standard 3"/70 Ex 24-2 contour, fired from the 3"/70 gun Type G-3, showed no band wear. Similar gilding metal bands were almost completely worn away. As a consequence, the iron bands showed considerably less tendency to fringe.

4. Barrel strain values are little if any higher for iron bands than for gilding metal bands.

5. On the basis of a range test in the G-3 gun of twenty projectiles of each type, the iron banded projectiles gave an average D/R of .45% and the gilding metal banded projectiles gave 2.20%.

6. Since the major uncertainty about the iron band is its effect upon gun wear, it is recommended that the Bureau of Ordnance take steps to obtain a sufficient number of iron banded 3"/70 projectiles to perform a life test on at least two barrels. These projectiles should be similar to the Type Ex 24-7, except for band material.
Test of 3"/70 AA Projectiles with Armco Iron Rotating Bands

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PART B

INTRODUCTION

1. AUTHORITY:

This program was authorized by reference (a).

2. REFERENCES:

a. BUORD Conf 1tr NP9 Re3b-RS:mt Ser 24422 of 15 August 1951
b. NPG Report No. 626 of 18 August 1950
c. NPG Report No. 750 of 20 March 1951
d. NPG Report No. 787 of 2 June 1951
e. NPG Report No. 860 of 13 October 1951
f. NPG Range Sheets Nos. 130 and 131

c. BACKGROUND:

It has been suspected for some time that the poor accuracy results obtained with the 3"/70 gun were at least partially to be attributed to the failure of the gilding metal rotating bands, as might also be attributed the body engraving of the projectiles and the spiral wear of the gun. The observed phenomena were described in references (b), (c), (d), and (e), and reference (b) suggested that the band wear (partial or complete obliteration of engraving) might be caused by "loss of copper on the driving edges by abrasion, or by local frictional heating to the point of loss of strength or actual melting". Reference (b) recommended "that a few 3"/70 projectiles be fitted with soft iron bands of contours similar to those in current use, and fired for recovery to determine whether the higher melting point of the iron will produce improvement in the performance".
PART C

DETAILS OF TEST

4. PROCEDURE AND RESULTS:

The Proving Ground found that it was possible to apply a soft iron band (Armco ingot iron) in exactly the same manner that copper or gilding metal bands are applied, that is, by swaging on a ring of the material in a standard banding press. The swaging was done on a West Tire Setter #2 at a gauge pressure of 900 p.s.i., on material at room temperature, and the bands were then machined to finished dimensions. No excessive work hardening was caused by the process. Chemical analysis and tensile test results for the Armco iron used, which was in the form of bar stock, as well as comparative hardness readings for the iron bands and for standard 3"/70 gilding metal bands are given in Table III, Appendix (B). It is seen that the iron bands fall within the hardness range of the gilding metal bands.

Three 3"/70 projectiles Ex 24-2, furnished to the Proving Ground for experimental work without band or band score, were fitted out with two 1" Armco iron bands, diameter 3"09, in accordance with Figure 14, and were fired for recovery from the 3"/70 gun Type G-3 along with three projectiles with gilding metal bands of the same contour and applied in the same manner, for comparison. Detailed results are given in Table I, Appendix (A), and typical photographs of the recovered projectiles are shown in Figures 3 and 4, Appendix (E).

Since the muzzle strain results and the hardness values showed not much difference between iron and gilding metal, it was decided that it would probably be safe to fire iron banded projectiles with the standard 3"/70 band contour. Accordingly, six iron banded projectiles were made up, three with the standard Ex 24-2 after band contour, and three with the same contour modified by a relief groove aft of the forward lip (Figure 15, Appendix (E)), to reduce barrel strain. These were fired for recovery along with three gilding metal banded Ex 24-2 projectiles, with the forward band turned down to body diameter, as is necessary for firing in the G-3 gun. Detailed results are given in Table II, Appendix (A), and photographs of the recovered projectiles are shown in Figures 5 through 12, Appendix (E). Barrel strain results and star gauge readings are shown in Table V, Appendix (D).
Test of 3"/70 AA Projectiles with Armco Iron Rotating Bands

In view of the absence of band wear and fringing of the recovered bands and the favorable barrel strain results a ranging program was arranged to determine whether a non-failing band would give improved range performance in the G-3 gun, which had never performed with satisfactory accuracy using gilding metal bands. Twenty iron banded projectiles (Ex 24-2 contour) and twenty standard Ex 24-2 gilding metal banded projectiles, with the front band turned down, were fired alternately in this program, the detailed results of which are given in reference (f), and a summary in Table IV, Appendix (C). Briefly, the D/R for the iron banded projectiles averaged 1.45%, and for the gilding metal banded projectiles 2.20%. The average ranges were 14098 yards and 14036 yards, respectively.

5. DISCUSSION:

On the basis of the results described, it would appear that the only objection to the use of the ingot iron band would be its possibly deleterious effect upon gun life. This should certainly be investigated, and more information on range results simultaneously obtained. Furthermore, it would be most interesting to determine whether a gun fired with non-failing bands would develop the spiral wear observed hitherto in the 3"/70 guns.

The range results obtained so far are surprisingly good, as regards dispersion. It is not easy to see why there is not a greater range differential between projectiles with the two types of bands. Possibly this is to be attributed to the greater roughness of the iron band. The recovery results lend support to the belief that the band wear observed with gilding metal is caused by local frictional heating of the band to a temperature near the melting point, with consequent loss of strength, rather than any effect of abrasion or gas erosion.

It is planned to conduct firings with iron banded projectiles in other 3"/70 guns with disappearing and with trurred-depth rifling. No non-failing band has yet been fired in these guns, and it is conceivable that with such a band, muzzle strains may reach undesirably high values. If not, range data will be obtained for these guns also.
Test of 3"/70 AA Projectiles with Armco Iron Rotating Bands

PART D

CONCLUSIONS

6. a. It is possible to fit a 3"/70 projectile with a soft iron band using precisely the same method of manufacture as for a gilding metal or copper band. The hardness of such a band is approximately the same as that of a gilding metal band.

b. Armco ingot iron bands of the standard 3"/70 Ex 24-2 contour, fired from the 3"/70 gun Type G-3, showed no band wear. Similar gilding metal bands were almost completely worn away. As a consequence, the iron bands showed considerably less tendency to fringe.

c. Barrel strain values are little if any higher for iron bands than for gilding metal bands.

d. On the basis of a range test in the G-3 gun of twenty projectiles of each type, the iron banded projectiles gave an average D/R of .45% and the gilding metal banded projectiles gave 2.20%.

PART E

RECOMMENDATIONS

7. Since the major uncertainty about the iron band is its effect upon gun wear, it is recommended that the Bureau of Ordnance take steps to obtain a sufficient number of iron banded 3"/70 projectiles to perform a life test on at least two barrels. These projectiles should be similar to the Type Ex 24-7, except for band material.
Test of 3"/70 AA Projectiles with Armco Iron Rotating Bands

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Captain, USN
Ordnance Officer
By direction

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### Table I
**COMPLETE BEFORE AND AFTER FIRING DATA**

**3"/70 AA Projectiles Fired in Gun Type G Pod 3 No. 24493**

<table>
<thead>
<tr>
<th>Projectile Number</th>
<th>Type &amp; Mod.</th>
<th>Band Type</th>
<th>Order of Firing 3/9/51</th>
<th>Powder Charge (lbs.)</th>
<th>Avg. Pressure (t.s.i.)</th>
<th>Muzzle Velocity (ft./sec.)</th>
<th>Wt. (lbs.)</th>
<th>Max. Opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>560</td>
<td>Ex 24-4</td>
<td>A</td>
<td>1</td>
<td>10.3</td>
<td>18.6</td>
<td>3308</td>
<td>15.00</td>
<td>3&quot;</td>
</tr>
<tr>
<td>561</td>
<td>Ex 24-4</td>
<td>A</td>
<td>2</td>
<td>10.3</td>
<td>18.3</td>
<td>3360</td>
<td>15.00</td>
<td>3&quot;</td>
</tr>
<tr>
<td>T22-0-1</td>
<td>Ex 24-2</td>
<td>A</td>
<td>3</td>
<td>10.3</td>
<td>18.7</td>
<td>Missed</td>
<td>15.00</td>
<td>3&quot;</td>
</tr>
<tr>
<td>T22-0-2</td>
<td>Ex 24-2</td>
<td>B</td>
<td>4</td>
<td>10.3</td>
<td>19.2</td>
<td>3403</td>
<td>15.00</td>
<td>3&quot;</td>
</tr>
<tr>
<td>T22-0-3</td>
<td>Ex 24-2</td>
<td>A</td>
<td>5</td>
<td>10.3</td>
<td>18.9</td>
<td>3407</td>
<td>15.00</td>
<td>3&quot;</td>
</tr>
<tr>
<td>T22-1-1</td>
<td>Ex 24-2</td>
<td>B</td>
<td>6</td>
<td>10.3</td>
<td>19.6</td>
<td>3428</td>
<td>15.00</td>
<td>3&quot;</td>
</tr>
<tr>
<td>T22-1-2</td>
<td>Ex 24-2</td>
<td>B</td>
<td>7</td>
<td>10.3</td>
<td>18.8</td>
<td>3396</td>
<td>15.00</td>
<td>3-1/2&quot;</td>
</tr>
<tr>
<td>T22-1-3</td>
<td>Ex 24-2</td>
<td>B</td>
<td>8</td>
<td>10.6</td>
<td>19.8</td>
<td>3464</td>
<td>15.00</td>
<td>3-1/2&quot;</td>
</tr>
</tbody>
</table>

* Two Gilding Metal Bands 1" wide.
B Two Armorco Iron Bands 1" wide.

Notes:
- Rounds 1 and 2 were warming rounds.
- Gun Type G Pod 3 No. 24493 had 282 ESR at start of test.
- Wire impressions for determining spin were obliterated.

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APPENDIX A
### TABLE II

**COMPLETE BEFORE AND AFTER FIRING DATA**

3\textquoteleft /70 AA Projectiles Type Ex 24 Mod 2 Fired in Gun Type G Mod 3 No. 24493

<table>
<thead>
<tr>
<th>Projectile Number</th>
<th>Order of Firing 4/20/51</th>
<th>Band Type</th>
<th>Powder Charge (lbs.)</th>
<th>Avg. Pressure (t.s.i.)</th>
<th>Muzzle Velocity (ft./sec.)</th>
<th>% Nominal Spin</th>
<th>Wt. (lbs.)</th>
<th>Yaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>595</td>
<td>3</td>
<td>A</td>
<td>10.3</td>
<td>18.9</td>
<td>3387</td>
<td>99.6</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>596</td>
<td>4</td>
<td>A</td>
<td>10.3</td>
<td>18.7</td>
<td>3394</td>
<td>99.9</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>597</td>
<td>5</td>
<td>A</td>
<td>10.3</td>
<td>18.9</td>
<td>3394</td>
<td>100.1</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>598</td>
<td>6</td>
<td>B</td>
<td>10.3</td>
<td>19.1</td>
<td>3494</td>
<td>99.4</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>599</td>
<td>7</td>
<td>B</td>
<td>10.3</td>
<td>19.8</td>
<td>3408</td>
<td>99.9</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>600</td>
<td>8</td>
<td>B</td>
<td>10.3</td>
<td>19.8</td>
<td>3395</td>
<td>98.9</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>601</td>
<td>1</td>
<td>C</td>
<td>10.3</td>
<td>19.0</td>
<td>3360</td>
<td>98.9</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>602</td>
<td>9</td>
<td>C</td>
<td>10.3</td>
<td>18.7</td>
<td>3369</td>
<td>98.9</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
<tr>
<td>603</td>
<td>2</td>
<td>C</td>
<td>10.3</td>
<td>19.2</td>
<td>3373</td>
<td>98.1</td>
<td>15.00</td>
<td>None Observed</td>
</tr>
</tbody>
</table>

A Armco Iron band with groove machined aft of forward lip in rotating band. Approx. deformation under band after firing was -\textquoteleft .020.

B Armco Iron band with standard Ex 24-2 contour. Approx. deformation under band after firing was -\textquoteleft .040.

C Gilding metal band with standard Ex 24-2 contour. Approx. deformation under band after firing was -\textquoteleft .030.

Notes: Gun Type G Mod 3 No. 24493 had 295 ESR at start of test.

All rounds rubber crimped in case.

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APPENDIX A
**TABLE III**

Tensile Test Results - Armco Iron Used in Test

<table>
<thead>
<tr>
<th>Y. S. (p.s.i.)</th>
<th>T. S. (p.s.i.)</th>
<th>% El.</th>
<th>% R. A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20,000</td>
<td>38,800</td>
<td>49.5</td>
<td>76.2</td>
</tr>
</tbody>
</table>

Chemical Analysis - Armco Iron Used in Test

<table>
<thead>
<tr>
<th>C</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Cu</th>
<th>Al</th>
</tr>
</thead>
<tbody>
<tr>
<td>.025</td>
<td>.06</td>
<td>.011</td>
<td>.024</td>
<td>.10</td>
<td>.006</td>
</tr>
</tbody>
</table>

Hardness Results

Rockwell 15-T Scale

<table>
<thead>
<tr>
<th>Before Firing</th>
<th>After Firing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gilding Metal Bands</td>
<td>81(79-83)</td>
</tr>
<tr>
<td>Armco Iron Bands</td>
<td>83(82-84)</td>
</tr>
</tbody>
</table>

Hardnesses of Gilding Metal Commonly Used for 3"/70 Rotating Bands

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Hardness - Rockwell 15-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelsoy Hayes</td>
<td>84.1</td>
</tr>
<tr>
<td>Bethlehem</td>
<td>81.5</td>
</tr>
<tr>
<td>Lansdowne Co.</td>
<td>83.4 &amp; 82.6</td>
</tr>
<tr>
<td>Midvale</td>
<td>80.8</td>
</tr>
<tr>
<td>Motor Wheel</td>
<td>85.3</td>
</tr>
</tbody>
</table>
## TABLE IV

Charge Determination and Ranging of 3"/70 Ex 24 Mod 2 Projectiles
With Iron and Gilding Metal Bands

<table>
<thead>
<tr>
<th>Date</th>
<th>No. Rounds</th>
<th>Band</th>
<th>K. V. (ft./sec.)</th>
<th>Uncorrected Range (yd.)</th>
<th>Drift (yd.)</th>
<th>D/R (%)</th>
<th>Corrected Range (yd.)</th>
<th>D/R (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Sep 1951</td>
<td>5</td>
<td>Armco Iron</td>
<td>3453±6</td>
<td>14240±44</td>
<td>193±9</td>
<td>0.31</td>
<td>14141±48</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>&quot;</td>
<td>3440±15</td>
<td>14229±45</td>
<td>222±11</td>
<td>0.32</td>
<td>14112±20</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>&quot;</td>
<td>3423±7</td>
<td>14191±106</td>
<td>240±12</td>
<td>0.75</td>
<td>14127±122</td>
<td>0.86</td>
</tr>
<tr>
<td>10 Sep 1951</td>
<td>4</td>
<td>&quot;</td>
<td>3426±4</td>
<td>14014±58</td>
<td>28±20</td>
<td>0.41</td>
<td>13364±58</td>
<td>0.41</td>
</tr>
<tr>
<td>8 Sep 1951</td>
<td>5</td>
<td>Gilding Metal</td>
<td>3416±14</td>
<td>14123±266</td>
<td>184±10</td>
<td>1.86</td>
<td>14077±253</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>&quot;</td>
<td>3424±15</td>
<td>14117±211</td>
<td>228±27</td>
<td>1.49</td>
<td>14029±230</td>
<td>1.64</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>&quot;</td>
<td>3418±11</td>
<td>14106±440</td>
<td>251±14</td>
<td>3.12</td>
<td>14054±379</td>
<td>2.70</td>
</tr>
<tr>
<td>10 Sep 1951</td>
<td>5</td>
<td>&quot;</td>
<td>3409±3</td>
<td>13940±386</td>
<td>52±16</td>
<td>2.77</td>
<td>13970±370</td>
<td>2.65</td>
</tr>
<tr>
<td>Avg.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14098</td>
<td>0.45</td>
</tr>
<tr>
<td>8 Sep 1951</td>
<td>5</td>
<td>Gilding Metal</td>
<td>3416±14</td>
<td>14123±266</td>
<td>184±10</td>
<td>1.86</td>
<td>14077±253</td>
<td>1.80</td>
</tr>
<tr>
<td>10 Sep 1951</td>
<td>5</td>
<td>&quot;</td>
<td>3409±3</td>
<td>13940±386</td>
<td>52±16</td>
<td>2.77</td>
<td>13970±370</td>
<td>2.65</td>
</tr>
<tr>
<td>Avg.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14036</td>
<td>2.20</td>
</tr>
</tbody>
</table>

Notes:
1. Gun Type G Mod 3 No. 24493 had 328.3 ESR at start of test.
3. Ranges corrected to 3400 ft./sec. and 15.00 lbs. weight of projectile.
4. Iron banded projectiles were fired alternately with gilding metal banded projectiles.
5. Average % D/R for Gun Type G Mod 3 No. 24493 with 3"/70 projectiles fired prior to this test was in the range from .91 to 1.88.

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# TABLE V

Barrel Strain Measurements in Gun Type G Mod 3 No. 24493

<table>
<thead>
<tr>
<th>Projectile Number</th>
<th>10&quot; Peak</th>
<th>10&quot; Plateau</th>
<th>81&quot; Peak</th>
<th>81&quot; Plateau</th>
<th>112&quot; Peak</th>
<th>112&quot; Plateau</th>
</tr>
</thead>
<tbody>
<tr>
<td>560</td>
<td>750</td>
<td>720</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>561</td>
<td></td>
<td>650</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T22-0-1</td>
<td>700</td>
<td>670</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T22-0-3</td>
<td>700</td>
<td>650</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T22-1-1</td>
<td>695</td>
<td>660</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>595</td>
<td>1005</td>
<td>590</td>
<td>505</td>
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Gilding-Metal Bands  Armco Iron Bands

Photograph of 3"/70 AA Projectiles Type Ex 24 Mod 2 with two 1" bands, before firing.

Figure 1
Photograph of 3"/70 AA Projectile Type Ex 24 Mod 2, modified, with Armco Iron band before firing.

Figure 2
Photograph of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with two 1" Armco iron bands.

Figure 3
Photograph of recovered 3\"/70 AA Projectile Type Ex 24 Mod 2 with two 1\" gilding-metal bands.

Figure 4
NP9-45531
20 April 1951
CONFIDENTIAL

Three views (120° apart) of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with groove aft of forward lip in Armco iron rotating band. Projectile No. 595.

Figure 5
Three views (120° apart) of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with groove aft of forward lip in Armco iron rotating band. Projectile No. 596.

Figure 6
Three views (120° apart) of recovered 3"/70 AA Projectile
Type Ex 24 Mod 2 with groove aft of forward lip in Armco iron
rotating band. Projectile No. 597.

Figure 7
NP9-45534  20 April 1951  CONFIDENTIAL

Three views (120° apart) of recovered 3"/70 AA Projectile
Type Ex 24 Mod 2 with Armor iron rotating band. Projectile
No. 598.

Figure 8
Three views (120° apart) of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with Armco iron rotating band. Projectile No. 599.

Figure 9
Three views (120° apart) of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with Armco iron rotating band. Projectile No. 600.

Figure 10
Three views (120° apart) of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with gilding-metal band. Projectile No. 601.

Figure 11
Three views (120° apart) of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with gilding-metal band. Projectile No. 602.

Figure 12
Three views (120° apart) of recovered 3"/70 AA Projectile Type Ex 24 Mod 2 with gilding-metal band. Projectile No. 603.

Figure 13
BAND SEAT DETAIL

APPROX 8 SCORES PER INCH

-20° - 20° - 20°
BODY: MAT'L - STEEL
SEE BUORD DWG. NO 239075
MOD.0 HAS GILDING METAL BANDS
MOD.1 HAS ARMCO IRON BANDS

3"/70 AA PROJECTILE
EX 24 MOD 2
MODIFIED TYPE 22
MOD.0 & MOD.1
REF: BUORD SK. NO. 239075 FOR UNMODIFIED BAND AND BODY DIMENSIONS.
NOTE: MOLYKOTE TO BE MIXED WITH PLASTIC PAINT TO WITHSTAND HANDLING.

3"/70 AA PROJECTILE
TYPE EX.24-2
MODIFIED

U.S. NAVAL MANUFACTURING CORPORATIONS

2:1 T-2808/153 APL-207
Test of 3\textsuperscript{rd}/70 AA Projectiles with Armco Iron Rotating Bands

Wire Impression Method of Determining Spin

Two screens are set up 41.5 apart, each screen consisting of a metal frame with wood inserts, holding an array of parallel equidistant vertical copper wires. The spacing of the wires is 1/2" for the first screen and 3/4" for the second. The projectile is fitted with a flat-nosed dummy nose plug or the equivalent, so that after passing through the screens it bears two sets of impressions of the wires. The angle between the two sets of impressions is measured and from this measurement the rifling of the gun, the muzzle velocity, and the velocity at the spin screens, is computed the percentage of nominal spin. It is assumed that over the short distances involved the spin retardation is negligible.
Test of 3"/70 AA Projectiles with Armco Iron Rotating Bands

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