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PROGRESS REPORT

10/28/48

PROJECT TD-475 - BARREL PROCESS IMPROVEMENT

SUBJECT: FRONT SIGHT RAMP BRAZING EFFECT ON M/721 BARREL
ACCURACY AND DIMENSIONS

INTRODUCTION:

This study has been a follow up of the information that a definite, measurable enlargement of the bore and rifling diameters under the ramp is caused by the brazing assembly for the M/721. (Reported 7/14/48 M. H. Smith to E. Sepp-letter).

The enlargement has been found to exceed .0005" in cases where the accuracy of the gun is questionable. However, a point of demarcation has yet to be positively established.

OBJECTIVES:

The study of the enlargement under the ramp was attempted on the basis that a small, carefully controlled test would show the trend of deterioration as an aid in future designs and in the emphasis placed on controlling the braze operation.

CONCLUSIONS:

1. A slight improvement is noted in accuracy and bore dimensions by increasing the stress relief temperature of the M/721 Barrel to 1100° under an atmosphere of nitrogen in place of the normal 950° stress relief. The test Barrels were done under ideal conditions with only two Barrels for load size. Greater variation would be expected under operating conditions.

2. A trend of deterioration of accuracy and bore enlargement is accentuated by repairing ramps by reheating to remove and rebrazing onto the Barrels.

3. The inherent accuracy of Barrels may be improved by developing other than brazing means of attaching ramps in which the always present stresses are not relieved by heating, thus changing critical dimensions.

October 28, 1948

RECOMMENDATIONS:

1. Develop new means of ramp attachment to Barrel.
(A screw and pin arrangement is now being tested on the M/742).
2. Restudy the present brazing process to reduce the amount of reramping repairs.
3. Set aside all of this type repairs to be processed separately to confirm the results of this study.

EXPERIMENTAL DETAILS:

Four rifled Barrel Blanks were selected for uniformity by carefully measuring the rifling diameters with air gages. Two Barrels of these Barrels were stress relieved at a normal operation temperature of 950° for 2 hours. (Load size-2). Two more Barrels were stress relieved in a special fixture with nitrogen in the bore (to prevent scale) in the Lindberg furnace.

The four test Barrels were finish processed into guns with the exception of the Front Sight Ramp brazing operation.

Preliminary accuracy data was taken by mounting scope blocks and shooting from the shoulder.

The accuracy device was available at this point and an attempt to improve the comparison effectiveness was made by changing to this type of accuracy determination.

Careful air gaging was done on all Barrels for the muzzle four inches as determined by uniform reading throughout the rest of the bore. Readings were recorded for each 1/4" and 1/2" before and after each operation.

Two charts are attached to demonstrate the trends reported under Conclusions. The details of the measurements are too voluminous to include in this report.

The data on measurements of bore and rifling was compiled to show a cumulative variation between lands and grooves taken at the same points under each set of conditions. Care must be taken in reading this effect due to the magnification and addition of variation taken in ten thousandths for ten readings. However, this method does indicate the general trend and based on the accuracy of air gaging can be qualified as proven by rechecking each set of results as was done in this test.

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RESULTS OF DIAMETER COMPARISONS

Rifling - Variation of Diameters (Ten readings under the ramp in four Barrels)

Before braze to after braze ramp.
Variations of diameter increased *21.7 times.
After braze to after reramp braze.
Variations of diameter increased *4.3 times.
Before braze to after reramp braze.
Variations of diameter increased *37.0 times.

Bore - Variation of Diameters (Ten readings under the ramp in four Barrels)

After braze to after reramp braze.
Variation of diameter increased *2.1 times.
Difference between grooves increased *3.6 times.

STRESS RELIEF COMPARISON (2 guns each)

Rifling

Before Braze to after Braze Ramp.
1100° S.R. Variation increased *3.5 times.
950° S.R. Variation increased *40 times.
After braze to after reramp.
1100° S.R. Variation increased *2.5 times.
950° S.R. Variation increased *1.7 times.
Before braze to after reramp.
1100° S.R. Variation increased *6.5 times.
950° S.R. Variation increased *64.5 times.

Bore

After braze to after reramp braze.
1100° S.R. Difference between grooves increased *2.2 times.
950° S.R. Difference between grooves increased *5.0 times.
1100° S.R. Variation of diameter increased *2.35 times.
950° S.R. Variation of diameter increased *1.8 times.

*A factor of $\frac{.0001''}{10}$ must be used to determine the actual variation
in the ten additive measurements involved.

<u>Examples:</u>	<u>Variation</u>	<u>Before</u>	<u>After</u>	<u>ReBraze</u>
		$\frac{.0006''}{10}$	$\frac{.0012''}{10}$	$\frac{.0051''}{10}$
	Increased		X 2 =	X 4 =
or Variation		$\frac{.0001''}{10}$	$\frac{.0051''}{10}$	$\frac{.0081''}{10}$
	Increased		51 times greater	1.6 times greater

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ACCURACY DATA OF BRAZING EFFECT

	<u>Extreme Spread (inches)</u>			<u>Mean Radius (inches)</u>		
	<u>Before</u>	<u>After</u>	<u>Rebrazed</u>	<u>B</u>	<u>A</u>	<u>R</u>
1.	2.81	2.38	3.95	.86	.88	1.29
2.	3.20	3.16	3.30	1.18	1.06	1.25
3.	2.65	2.9	3.54	.87	.93	1.13
4.	4.0	4.5	5.3	1.18	.61	1.51
Aves. Overall	3.16	3.23	4.02	1.02	.87	1.29

1100° Stress Relief (Barrels #1 and #2)

3.00	2.77	3.62	1.02	.97	1.27
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950° Stress Relief (Barrels #3 and #4)

3.32	3.7	4.42	1.02	.77	1.32
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The above Extreme Spreads and Mean Radii is the average of 5-10 shot groups at 100 yds. with Palma 180 gr cartridges.

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