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SPRINGFIELD ARMORY

SPRINGFIELD, MASSACHUSETTS

RESEARCH AND ENGINEERING

Report: SA-TR1-7021

Date: 7 June 1963

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Report Title: A Preliminary Study of a Method of Stretch-Straightening Gun Barrels for Small Arms

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Preparing Agency: Springfield Armory, Springfield, Mass.

ABSTRACT

The feasibility of straightening barrels for small arms by axially stretching these barrels was investigated. A standard tensile testing machine was used to apply the axial loading. This method of stretch-straightening is useful for all small arms barrels with particular emphasis on barrels having a length-to-bore ratio larger than 100 to 1. Test procedure is described, and results are discussed.

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SUBJECT

A method of straightening small arms gun barrels was investigated.

OBJECT

To determine the feasibility of using the stretch-straightening method for small arms gun barrels

SUMMARY OF CONCLUSIONS

1. The method of stretch-straightening gives good results for gun barrels having a ratio of length to bore greater than 100 to 1. These barrels are almost impossible to straighten accurately by present methods.

2. This method is also applicable to full length, lined and solid, steel barrels.

RECOMMENDATIONS

Further study of this method should be made to determine the amount of elongation permissible for various types of barrel material.

1. DISCUSSION

Present methods of straightening barrels involve the process of bending the curved section between fixed support points. This operation is accomplished by moving a third pressure point either mechanically or hydraulically to overcorrect the bend. The springback compensation of this overcorrection will result in a straight barrel.

This method results in localized residual stress points. The locked-in stresses tend to force the barrel to assume its original, curved shape. This straightening operation, in substance, is performed in increments so that the barrel will not be truly straight, but rather a series of arcs. The bends at either end of the barrel are difficult to remove.

Straightening problems are very much intensified when the distortions are of a "corkscrew " type of bend rather than a simple bend. These compound bends are more frequently found than are the plain, simple, one-plane type of bend.

Three methods are, at present, being used to determine the location, the magnitude, and the direction of the bends. These methods are identified as follows: (1) that of using reflection projection, (2) that of using optically deflected lines, and (3) that of using concentric rings. The latter two methods are effective only in a segment of the barrel and do not allow the checking of a complete length in one setting. This means of checking requires a high degree of skill to achieve satisfactory straightness.

. True or even satisfactory straightness is very difficult to achieve in small caliber barrels having a large length to bore ratio (over 100 to 1).

A standard tensile testing machine was used for the work described here rather than a special purpose machine. Improved results undoubtedly could be expected if a special purpose machine were used.

A patent disclosure has been made and is being processed in the Springfield Armory Legal Office.

2. PROCEDURE AND RESULTS

a. The two definitions listed below from the ASM Metals Handbook, Eighth Edition, tend to describe this straightening process.

(1) Stretcher Straightener

A process for straightening rod, tubing, and shapes by the application of tension at the ends of the stock. The products are elongated a definite percentage of length (1 to 3 per cent) to remove warpage and localized stress.

(2) Residual Stress

Stress present in a body that is free from external forces or thermal gradients.

b. A 200,000-pounds-per-square-inch-capacity tensile testing machine having a work length sufficient to handle the barrel was available at Springfield Armory. Stretch-straightening operation was performed on the caliber .14 barrel.

c. Barrel dimensions before straightening were 1.112-inch outside diameter, 0.134-inch bore diameter, and 0.1395-inch groove diameter. End plugs, in the bore, were inserted to prevent bore collapse during the operation.

d. Reference marks were placed on the barrel blank for 24 inches of its length. The barrel had a compound or "corkscrew" type of bend which, when gauged, indicated a 0.030- to 0.045-inch deviation from a straight line (Photograph 1).

e. The barrel was stretched approximately 3/8 of an inch or 1.56 per cent above the elastic limit. The barrel was then straight to an indicator reading 0.002 to 0.003 inch which is acceptable.

f. The dimensions of the barrel were now 1.098- to 1.100-inch outside diameter, 0.1335-inch bore diameter, and 0.1390-inch groove diameter. The lead or pitch of rifling was elongated 1.56 percent which is still within tolerance. This tube can be used to produce a satisfactory barrel after removal of the mutilated ends caused by the machine jaws.

2. PROCEDURE AND RESULTS - Continued

g. Allowance can be made for the change in outside diameter, and in the bore and groove diameters, as well as in rifling twist, to produce a truly straight barrel that will remain straight throughout its service life.

h. This limited study indicates that definite improvements over previous methods of barrel straightening are possible by use of this process. A line sketch of a typical stretcher straightener is shown in Photograph 2 (Appendix A).

APPENDICES

A - Illustrations

B - Distribution

APPENDIX A

ILLUSTRATIONS

Photographs	Title
19-058-361/ORD-62	Sketch-Straightening
19-058-108/AMC-63	Sketch-Straightener

STRETCH STRAIGHTENING

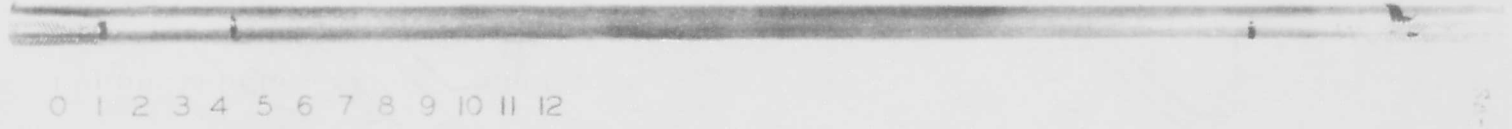
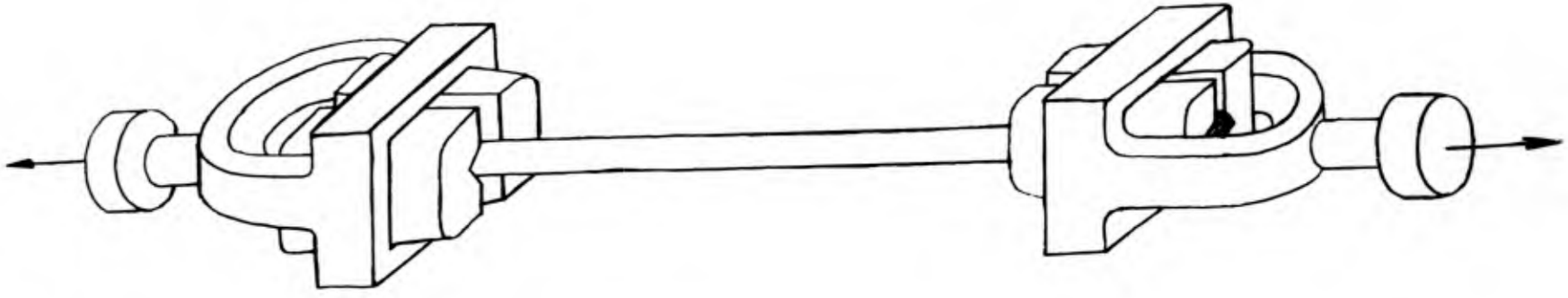


PHOTO #1



STRETCH STRAIGHTENER

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SKETCH #2

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Springfield Armory, Springfield, Mass.
A PRELIMINARY STUDY OF A METHOD OF STRETCH-STRAIGHTENING GUN BARRELS FOR SMALL ARMS, by J.R. Eves, Technical Report SA-TR1-7021, 7 June 1963, 11 pages, including illustrations. CMS CODE 5520.12.433C0.01.
UNCLASSIFIED REPORT

NONLIMITED DISTRIBUTION.

The feasibility of straightening barrels for small arms by axially stretching these barrels was investigated. A standard tensile testing machine was used to apply the axial loading. This method of stretch-straightening is useful for all small arms barrels with particular emphasis on barrels having a length-to-bore ratio larger than 100 to 1. Test procedure is described, and results are discussed.

1. Stretch straightening
2. Gun barrels
3. Small arms
4. Manufacturing methods
5. Material forming

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