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OTTAWA January 2nd, 1943.

REPORT

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1338.

Torsion Tests on Two Steel Shafts
for 2-Pdr. Mark VIII Gun Mountings.

(Copy No. 10 .)

BUREAU OF MINES
DIVISION OF METALLIC MINERALS

ORE DRESSING AND
METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

O T T A W A   January 2nd, 1943.

R E P O R T

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Origin of Request and Purpose of Investigation:

The request letter for this work is reproduced below:

BRITISH ADMIRALTY TECHNICAL MISSION
58 Lyon Street, Ottawa
December 16, 1942

To: Mr. C. S. Parsons,
Dept. of Mines and Resources,
Booth St., Ottawa, Ontario.

From: British Admiralty Technical Mission,
Section 2.

Re: 2 Shafts from Canadian Locomotive Co., for use on 2-Pdr. Mark VIII Mountings.

1. We forward herewith two shafts in mild steel: we shall be glad if you will test these to destruction in

(Origin of Request and Purpose of Investigation, cont'd) -

torsion and determine the relative strengths and angular distortion under similar loading.

2. In practice the details perform a similar function but a request has been made by the firm that the shaft marked "I" be cut back as in "II" to allow the coupling shaft to slip back in dismantling: as the shafts take shock loads in torsion we are interested to learn what the increased deflection represented by "II" entails.

3. Please arrange to "drive" from the keys at each end, the unfinished key at one end of shaft "I" may be completed to suit your convenience.

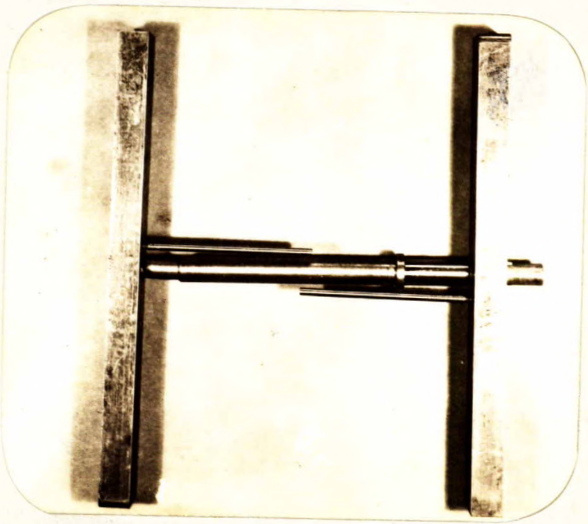
(sgd.) -
Lieut.Commander (E) G. Taylor, R.N.V.R.

GT/KA

Method of Obtaining Torsion:

The keyed ends of the shafts were fitted into bars as shown in Figure 1. Movement under load was measured by a micrometer placed over the two pins.

Figure 1.



TORSION FIXTURE.

(Continued on next page)

Results of Torsion Tests:

Figure 2.

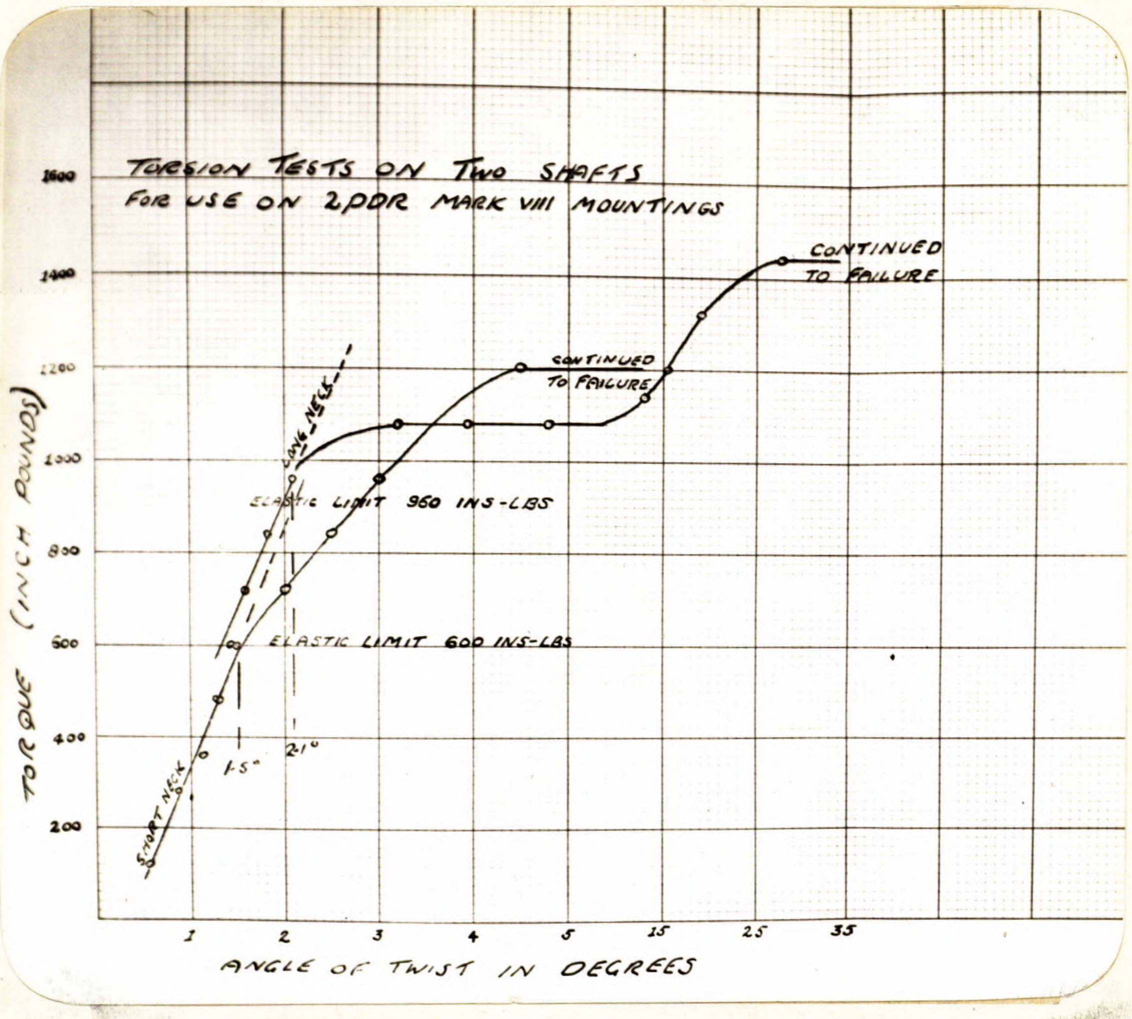


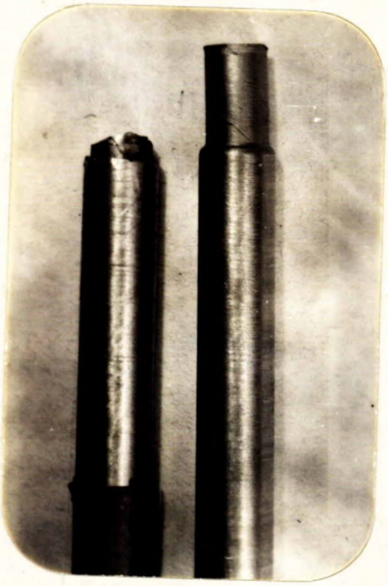
Figure 2 shows the load-angle curves obtained. The long-necked design has an elastic limit at least 33 per cent higher than that of the short-necked shaft. The long-necked shaft requires a breaking load 20 per cent greater than does the short-necked shaft.

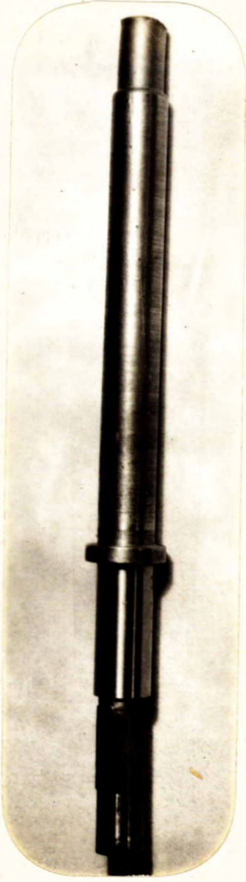
Figure 3 shows the shafts after they were twisted to failure.

(See Figure 3, on next page)

(Results of Torsion Tests, cont'd) -

Figure 3.





SHAFTS AFTER TWISTED TO FAILURE.

Long-necked shaft on right.

Hardness Tests:

Short-necked shaft	-	137 Brinell
Long-necked shaft	-	121 "

DISCUSSION:

The best way to evaluate these tests is on a torsion-impact machine.

According to PREVENTION OF THE FAILURE OF METALS UNDER REPEATED STRESSES,* by the Battelle Memorial Institute, the long-necked design would prove the best in service.

If the shaft is stressed under its elastic limit, the difference in angular elastic distortion will be negligible. If the shaft is stressed over its elastic limit, it will soon

* Handbook prepared for Bureau of Aeronautics - Navy Department, U.S.A. Published in 1941.

(Discussion, concluded) -

fail due to fatigue.

Elastic limit and yield strengths of both shafts are quite low, making them both unsuitable for shock loadings. It is assumed that these shafts are heat-treated to about Rockwell 'C' 30 before being put into service. It might be desirable, therefore, to perform torsion tests on the heat-treated shafts.

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