6-9-75

Metalock Joint Strength Experiment

1.0 Objective:

1.1 Objective of the test was to determine if properly located "locks," installed with properly fitted mechanical joint and to the proper depth would evidence a strength equal to or greater than the base material when test specimen was put under tension test.

Note: This was not a test of INVAR per se (the material in the locks) a material that is known to have a T.S. of 140,000 psi.

2.0 Materials:

2.1 Base material was produced in the form of three 2 7/8" dia. cast gray iron bars, I-R spec 204, 13" long. A 6" long section from the drag end of the bars were used to produce six specimens.

2.1.1 Base material was machined in accordance with attached sketch.

2.2 The locks were of INVAR a standard material used by Metalock Repair Service.

2.2.1 The cross section area of the web of each lock (3/16" x 1/4") was .04675 sq. in. .05

3.0 Metalock of Joint between Specimens:

3.1 One pair of iron test specimens were locked together with locks at 120° intervals and at each lock point the locks were triple depth and seven lugs in length. 9 locks

3.2 A second pair of iron test specimens were locked together with locks at 90° intervals and at each lock point the locks were triple depth. The locks at 0 and 180° were 5 lugs in length while the locks at 90° and 270° were 8 lugs in length. 12 locks

3.3 A third pair of iron specimens were locked together with locks at 180° spacing. The locks were installed with four locks at each point. Each lock was seven lugs in length. 8 locks

3.4 Each set of locks in each specimen had a "keeper" pin on each side. There was 3/32" of base iron between the "locks" and the "keepers."

4.0 Test:

4.1 Each specimen was pulled in a Baldwin Tensile Test Machine. The "C" bar grips were used.

5.0 Result:

5.1 Two test specimens failed in the base material at the point turned to 1.250" dia.

5.1.1 The 3 lock specimens (120° spacing) produced a tensile strength of 24,700 PSI.

5.1.2 The 4 lock specimens (90° spacing) produced a tensile strength of 24,000 PSI.

5.2 The third specimen also failed in the base material but in a manner that allowed the locks to slip out of the test piece. The material remaining between the two lock points and the center pin, 1/4" on each side, failed and permitted the cast iron to separate, therefore, allowing the locks to slip. This specimen produced a tensile strength of 16,500 PSI at point of failure.

6.0 Evaluation:

6.1 The specimens with 90° and 120° spacing proved that the mechanical joint was efficient enough to produce a greater tensile strength than the base material.

6.2 The specimen with locks at 120° intervals had a total of 9 individual locks imbedded in the specimen. This was a total cross sectional area of .421 sq. in. The base material failed at 24,700 PSI.

6.3 The specimen with the locks at 90° intervals had a total of 12 individual locks imbedded in the specimen. This was a total cross sectional area of .561 sq. in. The base material in this specimen failed at 24,000 PSI.

6.4 The specimen with 180° lock spacing failed due to excessive depth of locks. There simply wasn't enough material remaining in the center area to hold the lock fit in position. However, this test did produce a tensile strength of 16,500 PSI before failure.

7.0 Conclusion:

7.1 Two test specimens evidenced mechanical joints that were of an efficiency and quality to produce a tensile strength in excess of the tensile strength of the base material.

7.1.1 After the test the locks were tight and did not give any appearance of slippage in any way.

7.1.2 It must be concluded that such lock spacing, location and depth have, and will, produce a mechanical joint with strength in excess of that strength expected of this class of gray iron material.

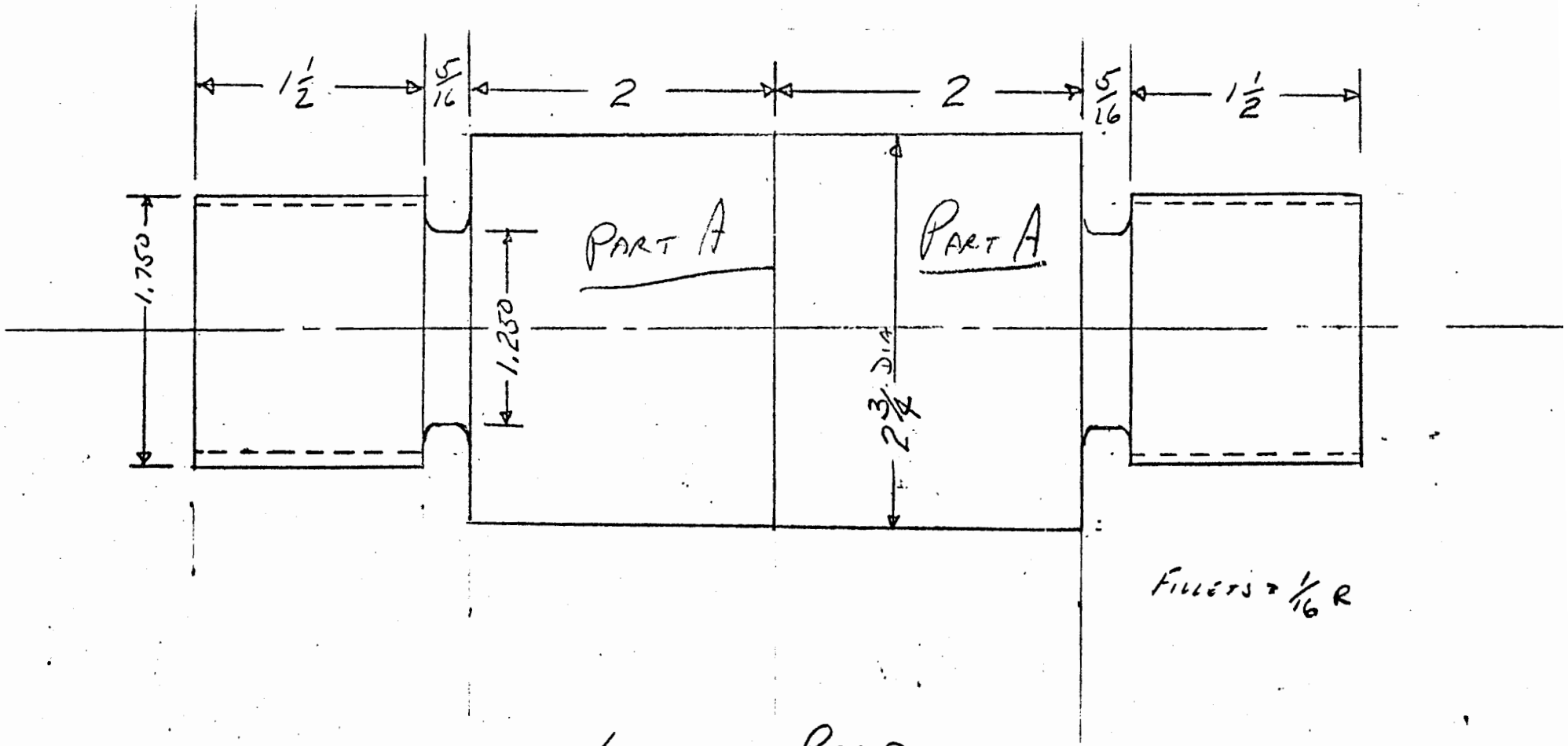
7.2 The mechanical joint in the third specimen, the one with 180° spacing, cannot be considered a satisfactory joint.

7.2.1 The locks were applied to an excessive depth and the volume of material remaining between the opposing locks was inadequate to hold the specimen together and prohibit the lock from slipping. In this case the base material merely opened up and the locks slipped out of the joint.

7.3 Therefore, it must be concluded that locks must be spaced close enough to attain strength but at a distance that will permit the base material to resist fracture under tension stress.

7.4 It is recommended that locks never be spaced closer than a distance equal to the base material section thickness.

METALOCK TEST SPECIMEN 5-28-75



6 PIECES REQ'D