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DESIGN OF A VERSATILE ESQ TRANSPORT SYSTEM*

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Summary

A versatile precision beam transport channel was built with inexpensive parts requiring minimum precision machining. The critical items, an optical bench and sliding bases are commercially available standard items. The only important precision machining is illustrated in Fig. 6, where a small section of an optical bench is used as a quadrupole assembly holding fixture. With this type of fixturing there is no loss of precision during the transfer of the quadrupole assembly from the EDM setup onto the final assembly, other than the manufacturer-specified mounting and dismounting tolerance. Displacement measurements of the pole tips taken on ten different quadrupole assemblies determined that RMS displacement in the "x" direction was .000307" and in the "y" direction was .000290". The actual performance of this system will be presented in other papers at this conference by A. W. Maschke and E. F. Meier.

General Description

Commercially available optical bench and sliding bases are used as a precision mounting medium for the quadrupole assembly. The sliding base allows the quadrupole assembly to be mounted, dismounted and rearranged longitudinally numerous times without the loss of the channel's precision. Various quadrupole assemblies can also be arranged to form single, double or triple lens combinations.

Construction of a 7 mm Channel

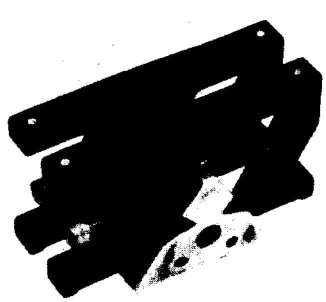

Fig. 1. Small section of an optical bench and sliding base

The quadrupole assembly consists of two identical investment castings and four .156" dia. x .312" long ceramic insulators with metallized ends. (One casting is modified by removal of one of its protruding mounting legs.)

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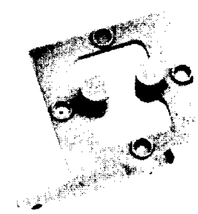

Fig. 2. Investment casting

Fig. 3. Ceramic insulators with metallized ends

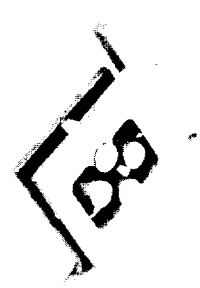

Fig. 4. Brazing assembly

Insulator seats (seen on a casting in Fig. 2) function as a brazing fixture, holding the two investment castings in proper position during brazing.

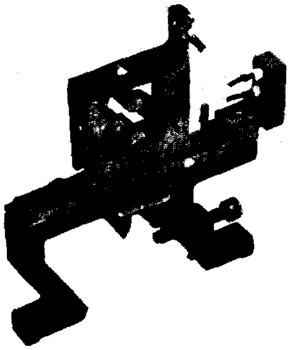

Fig. 5. 7 mm quadrupole assembly with wired connections

Brazed quadrupole assembly is mounted on a rexolite insulator, which in turn rests on top of the sliding base.

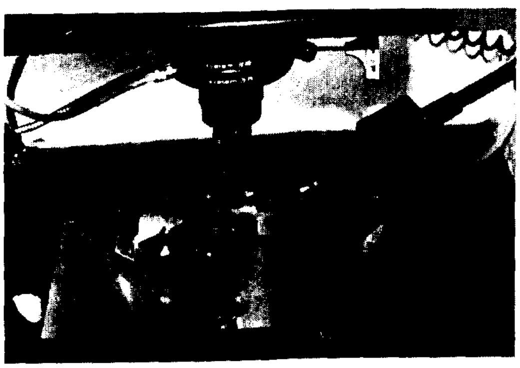

Fig. 6. Shown here is the electrical discharged machining setup used during final machining of the quadrupole assembly.

A small section of an optical bench was used as a holding fixture. Two graphite electrodes were used during machining. The first was slightly undersize and was used for rough cutting; the second produced final dimensions of the pole tips.

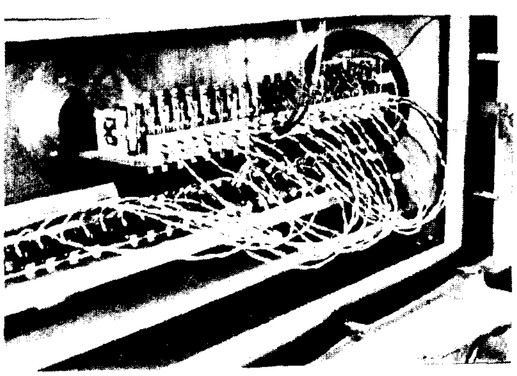

Fig. 7. 7 mm channel installed in the vacuum chamber

Vacuum chamber consists of roughly saw cut 3/4" thick 6061-T6 Al alloy plates. Internal dimensions of the chamber are 14" sq. x 60" long. One side of the chamber has a 10" x 57" cutout for easy access to the equipment mounted inside the chamber. The opening is covered with 1 1/4" thick plexiglas plate and sealed with a flat neoprene gasket.

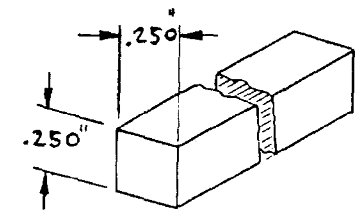

Fig. 8. Stainless steel square rod

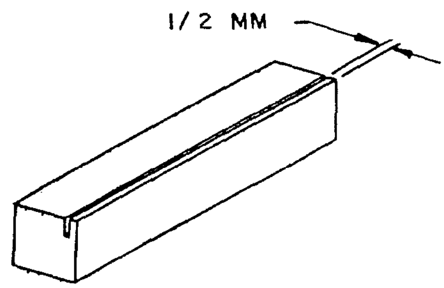

Fig. 9. Vertical slot was made along entire length of the square rod.

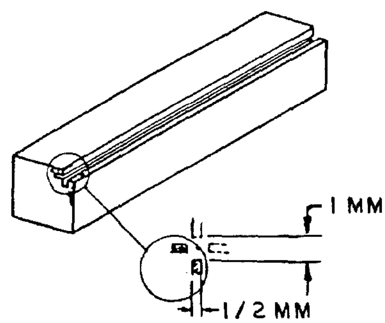

Fig. 10. Horizontal slotting produced 1/2 mm wide quadrupole sections over entire length of the square rod. It was determined that, for flat quadrupoles, the optimum ratio of the quadrupole width to the aperture's diameter is 1/2.

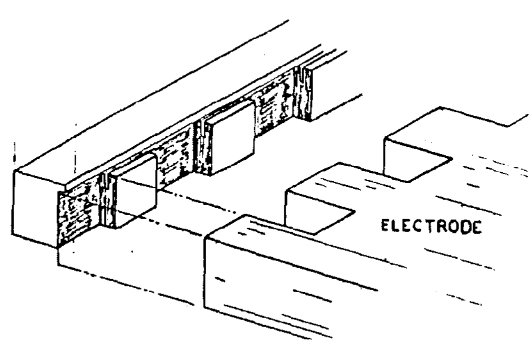

Fig. 11. Darkened areas shown on Fig. 4 indicate metal removed by the "EDM" electrode. This machining operation finished pole tips on one side of the square rod.

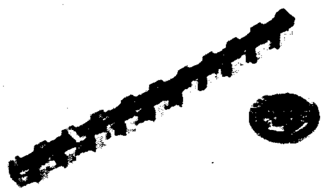

Fig. 12. Machining of the second side of the rod completes one of the four sections required for construction of a transport channel

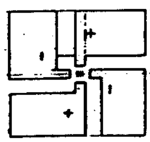

Fig. 13. Front view of the transport channel showing four finished sections of Fig. 5 properly oriented and assembled

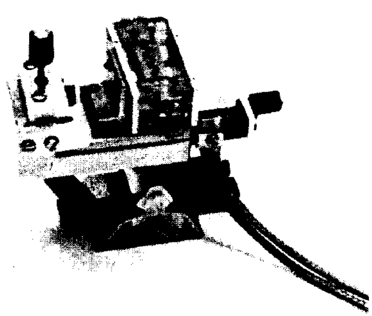

Fig. 14. 1 mm channel mounted on an optical bench. Targets and micrometer type adjustments were used for alignment of the channel's aperture with the source

Acknowledgment

We thank E. Meier and K. Riker for their assistance in building the system.

Reference

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