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A WIRE FEEDTHROUGH FOR DRIFT CHAMBERS*

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ABSTRACT

A drift chamber wire feedthrough design employing crimped connections and compression springs for tension control is described.

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Wire feedthroughs are among the most critical drift chamber components. They must accurately locate and tension large numbers of fine wires while providing electrical insulation and gas sealing. Figure 1 shows the design used on the central drift chambers of the DELCO detector on the PEP storage ring at SLAC.

Electrical insulation in excess of 5 kV is provided by a feedthrough body (a) of molded acetal plastic.* This part is produced 30 μm larger than the hole bored to receive it in the aluminum chamber end plate. The feedthrough is then shrunk-fit into place after cooling in boiling Liq. Nitrogen. The 40 μm tungsten wire is located in the plastic feedthrough by a 1 mm dia. stainless steel capillary pin (b)† with 125 μm bore. This pin is crimped onto the wire in similar manner to the technique developed at CERN [1]. Crimping is done in a small air driven press‡ before the pin is pulled into the feedthrough. Before crimping, stainless steel pins were first Hydrogen furnace annealed at 900^{o}C to clean and anneal them. To avoid damage to the 40 μm wire and produce reliable crimps the capillary tube should be softer than the wire. Crimping avoids the need for skilled soldering and the problems of chemically active flux. The crimp results in a cold weld equal to the tensile strength of the wire.

Wires are tensioned to 160 gm by individual BeCu compression springs (c) which ride on the pin and bare against the shoulder formed by the crimp. A spring constant was chosen such that end plate deflections which develop during chamber stringing cause negligible change in wire tension. Rather than use weights, wire tension is set by the length of the preloaded spring before the wire is crimped into place at the opposite end of the chamber. Each wire carries a spring at only one end and a small metal sleeve is substituted for the spring at the opposite end. Measurements of spring heights as installed show wire tension uniform to $\pm 10\%$.

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* Delrin R Plastic, Du Pont Co.

† Uniform Tubes Inc., Collegeville, PA, USA.

‡ SP-02 Power Pack, Simonds Inc., Southbridge, MA, USA.

After all stringing is complete, each stainless steel pin is sealed into the plastic feedthrough with epoxy.* To hold the glue in place while hardening a short ring cut from polyvinyl tubing is temporarily placed over the feedthrough end to form a dam. An automatic air driven glue applicator was used to fill the thousands of feedthroughs with epoxy. Electrical connection to the wire is made with a spring loaded connector (d)† which is pressed onto each stainless steel pin and soldered to a printed circuit board (e).

15000 feedthroughs of this design were used without wire breakage or loss of tension during three years of operation. The overall spatial track fitting accuracy of the inner DELCO drift chamber is 150μm. Data analysis indicates that wire location uncertainties contribute < 60 μm to this number.

References

[1] F. Ceradini *et al.*, Nucl. Instrum. Methods 156 (1978) 172.

Figure Caption

Fig. 1. Feedthrough cross section: (a) feedthrough body; (b) capillary pin; (c) wire tensioning spring; (d) connector; (e) printed circuit board.

* Ecco Bond 45, Emerson & Cuming Inc., Canton, MA, USA.
† Connector #450-3704, Cambridge Thermionic Corp., Cambridge, MA, USA.

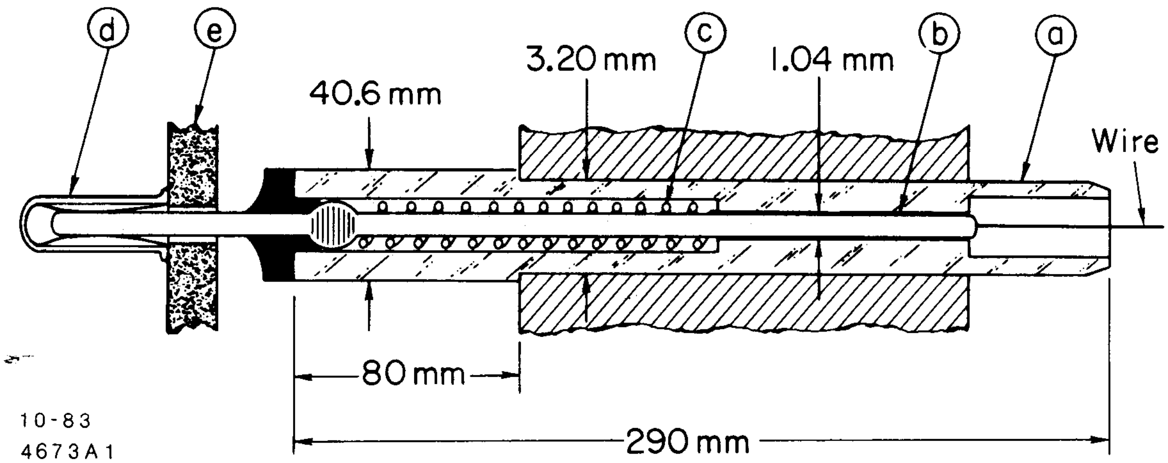

Fig. 1