A Useful Tool for Shaping Spectrographic Graphite Electrodes

E. JOHN EASTMOND
Western Regional Research Laboratory, Albany, California*
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DIRECT current arc methods of spectrographic analysis commonly employ graphite electrodes with a central cup sample cavity. The size of this cavity is dependent on the form of the sample under investigation and the amount found necessary to give spectra suitable for the analysis required. Satisfactory results have been reported for cavities varying from wide shallow cups[1] to drilled holes of a centimeter[2] or more in depth. Several tools have been described[3] for simplifying and standardizing the cutting procedures.

For certain dry powder and dry ash samples encountered at this laboratory, an electrode with a central post and annular ring cavity (Fig. 1) has proved to give a steadier and more reproducible arc[4] than was possible with a central cavity. A somewhat similar shape, but more difficult to cut, has been used elsewhere in the analysis of stainless steel filings.[5] As previously described, the arc strikes chiefly to the central post and "wandering" around the cup rim is largely avoided. No serious background results provided exposures are not continued after the sample has been completely burned.

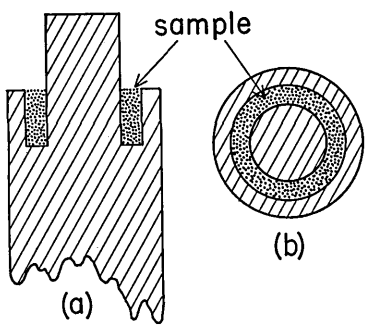

FIG. 1. Graphite electrode with annular ring sample cavity. (*a*) Longitudinal section. (*b*) Top view.

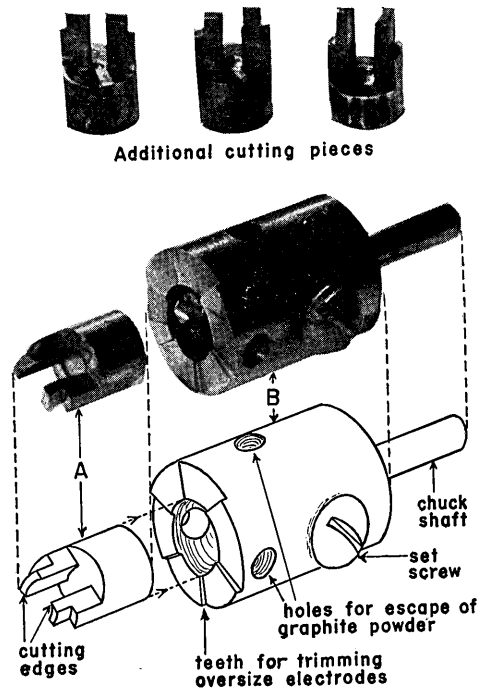

FIG. 2. Electrode cutting tool, unassembled.

While this electrode can be prepared with a small motor-driven electrode cutter and ordinary twist drills, such a procedure involves three separate steps and consequently necessitates considerable handling and expenditure of time. It is also difficult to reproduce drill settings from one batch of electrodes to another. The simple tool described here makes possible, in a single cutting operation, the shaping of a cavity of exactly reproducible size and shape.

The tool (shown unassembled in Fig. 2) consists of two essential pieces machined from tool

* Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

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[2] R. T. O'Connor, Ind. Eng. Chem. Anal. Ed. **13**, 597 (1941).

[3] A. T. Myers and B. C. Brunstetter, Ind. Eng. Chem. Anal. Ed. **11**, 218 (1939); K. R. Majors and T. H. Hopper, Ind. Eng. Chem. Anal. Ed. **13**, 647 (1941); H. I. Oshry, J. W. Ballard, and H. H. Schrenk, J. Opt. Soc. Am. **32**, 672 (1942); E. S. Hodge, Ind. Eng. Chem. Anal. Ed. **14**, 260 (1942); R. R. Hampton and H. N. Campbell, J. Opt. Soc. Am. **34**, 12 (1944).

[4] C. R. Jeppesen, E. J. Eastmond, and H. G. Logan, J. Opt. Soc. Am. **34**, 313 (1944).

[5] M. F. Hasler, C. E. Harvey, and H. W. Dietert, Ind. Eng. Chem. Anal. Ed. **15**, 102 (1943).

steel. Part *B* serves as a guide and is provided with cutting teeth on the front face so that any oversized electrode is trimmed to the proper size to insure uniform wall thickness. The $\frac{1}{8}$-in. chuck shaft on the back has been chosen to fit the available small motor-driven chuck. Part *A* is the cutting piece and is set into *B* with a set screw. It is machined and ground to shape and tempered to maintain the cutting edges.

Since reproducibility was sought, no attempt was made to make an adjustable cutting piece, but additional sizes and shapes are secured by different cutting pieces, each replaceable as a unit. The size is varied by varying either the width *e* or the depth *g* (Fig. 3) of the cutting edge, thus changing either the annular width or depth of the ring cavity in the electrode. The most suitable size for the material being tested in determined by experiment. The dimensions given in the diagram of Fig. 3 were found to be satisfactory for determination of lead in the ash of pectinous materials.[4]

An operator can prepare from 10 to 15 electrodes per minute with the small motor-driven electrode cutter used in this laboratory. Suitable alterations in design would make possible the adaptation to other types of motor-driven chucks or small lathes.

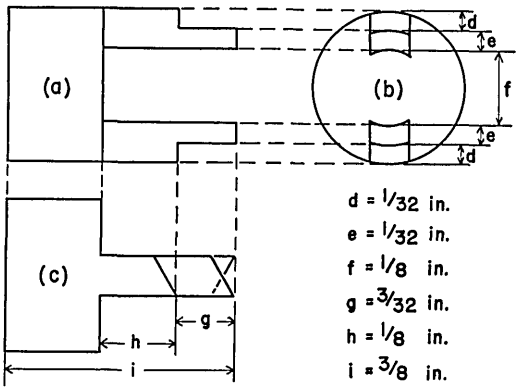

FIG. 3. Diagram of cutting piece. (*a*) Side view. (*b*) Front end view. (*c*) Top view.

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