NASA TECH BRIEF

Ames Research Center

Optical Alignment of Electrodes on Electrical Discharge Machines

The problem:

To assure that small electrodes mounted on electrical discharge machines are aligned and true before starting the machining operation. Electrodes that are not exactly in alignment with the machine axis or that are slightly bent will generate cavities that are too large or incorrectly shaped.

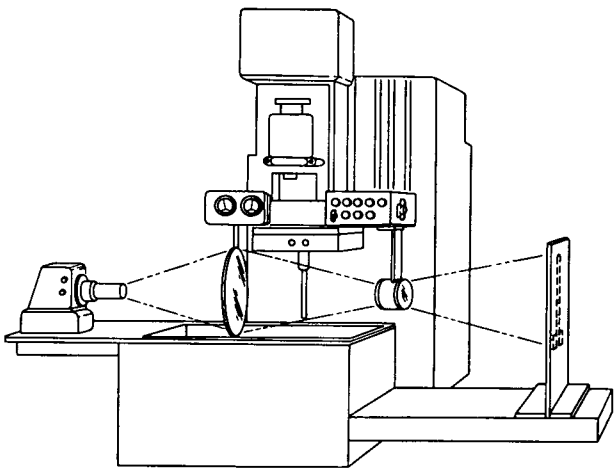
The solution:

A shadowgraph system that projects a magnified image on a screen so that the alignment of the electrode can be corrected and verified.

How it's done:

The system uses a conventional 500-watt slide projector as a light source. A Fresnel lens is positioned between the light source and the electrode to collect the light into an image-forming lens, or a projecting lens system, which forms an image of the electrode on a movable screen. The screen is placed at the position which provides the desired magnification, but it is usually located fairly close to the machine where it can provide a magnification of about two. If a flat screen is placed at an oblique angle to the optical axis of the system, one dimension of the image can be effectively magnified more than the other, for example, the width of an electrode can be magnified by a factor of 6 to 8 while the magnification of the length remains fixed.

The path of motion of the center of the tool holder can be established on the screen as the tool holder is raised and lowered, and a fiducial line can be scribed on the screen to provide a reference for alignment of the electrode. Since the fiducial line and the electrode are constantly in view, the process of positioning and straightening the electrode can continue until the operator achieves the requisite accuracy of alignment. An electrode 12 to 15 cm in length and 1 mm in diameter can be easily straightened to a runout well within 0.050 to 0.075 mm.



The optical system makes it possible to machine in hard materials very small, straight holes to depths that are limited only by the length of the electrode. Moreover, adjustments and corrections of the electrode can be made while work is in place, and the shape of the electrode can be readily monitored as machining progresses.

This technique may be adapted to other machine tool equipment where physical contact with the tool

(continued overleaf)

cannot be made during inspection and where access to the tool is so limited that conventional runout checking procedures (such as dial indicators) cannot be used.

Notes:

1. An erecting lens can be placed between the projecting lens system and the screen to cast an upright image. Sharp images of the electrodes will be obtained only if the projecting lens system is properly constructed and corrected for aberrations.
2. The screen can be curved to keep all portions of the image in focus; the curved screen compensates for optical aberrations due to finite depth of field of the imaging lens.
3. Requests for further information may be directed to:

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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

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(XAC-09489)