

Electro-Discharge Machining of Gold Alloys

A NEW TECHNIQUE FOR JEWELLERY MANUFACTURE

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Although the erosion of electrodes caused by the passage of a spark between them has long been known, studies of this phenomenon were for many years aimed primarily at its prevention and it was not until World War II that it was exploited for the machining of metals. In the intervening years, spark erosion or electro-discharge machining (EDM) has developed into an accepted engineering technique.

Modern EDM equipment consists essentially of four parts:

- (1) A generator, by means of which sparks of controlled energy, frequency and duration are produced between a shaped electrode and the workpiece
- (2) A dielectric system, which may be circulating water or liquid hydrocarbon, and which concentrates the spark, restricts heating and removes the eroded metal particles. The latter are continuously separated from the dielectric by filtration
- (3) A servo system and work-head to guide and feed the electrode
- (4) A precision machine tool.

Although not applicable to the making of all designs of jewellery, EDM has been found to facilitate the fabrication and improve the finish of designs which require the cutting out of intricate shapes from precious metal sheets.

Such shapes are currently cut by EDM from carat gold sheets which may be stacked in different gauges and caratages to a thickness of up to 100 mm. A brass wire electrode 0.2 mm in diameter is used with distilled water as the dielectric medium to cut the desired shapes from the stacked sheets. It effects a cut about 0.42 mm wide and is guided by two stepping motors which are coordinated and computer-controlled. The cutting speed achieved on jewellery gold alloys is similar to that commonly achieved on steels. Details of the desired shapes are fed to the computer on punched paper tape and the size of a particular design can be very simply reduced or increased. Once the machine is set, it needs little supervision and can be left to run day and night virtually unattended.

In addition to providing intricate cut-out designs for direct incorporation into jewellery items, the process has facilitated the fabrication of what is called 'inset gold'. Both the cut-out patterns and the residual profiles in the sheets can be duplicated with precision in successive cuts so that profiled carat gold sheet in one colour can be inset or sleeved with ease and accuracy into corresponding cut-out profiles in a carat gold or other metal sheet of a different colour.

The use of this technique in jewellery production is in its infancy, but it is already apparent that it has considerable potential.



The gold pendants shown here have all been made by electro-discharge machining at Diamond Design Ltd. The 'snowflake' designs illustrate the ability of the technique to produce intricate shapes. The 'golfer' and 'apple' pendants illustrate the accuracy of EDM. They were made by machining the yellow gold cut-out profiles and the white gold residual profiles in separate operations and by sleeving them together