APPLICATION

Wire EDM Improves Cutting of Hardened Steel

EPRI Center for Materials Fabrication

Industrial and Agricultural Technologies and Services

The Challenge: Efficient High-Quality Precision Parts

Capitol Tool & Die, Inc. (CTD) has been designing, building, and repairing specialty parts and machinery for 50 years. Like many companies, CTD finds it must continue to upgrade its equipment to meet customer requirements and stay competitive. For products fabricated from hardened steel and carbide, state-of-the-art means a computer-controlled wire electrical discharge machine (EDM). The older technologies like CTD's computer numerical control vertical milling machine produce quality parts, but lack some capabilities of newer technologies. For Capitol Tool & Die to compete in its marketplace Dave Johnson, CTD's president, knew his company would have to invest in wire EDM technology.

The Conventional Way

Capitol Tool & Die builds and designs stamping dies, tools, and fixtures in addition to producing specialized parts and machinery. CTD used a computer numerical control (CNC) milling machine to create the different contours and details for the specialty parts it produces. The CNC machine was reliable, but could not cut hardened tool steel and was not accurate enough for some parts. After the part was cut to specification with the CNC milling machine or other tools, the part was heat treated. Hours were then spent grinding away excess material and bringing the part into tolerance. The conventional method, which often required several machines and processes, was time consuming.

Whenever an application required a wire EDM, CTD sent the job to a shop specializing in wire EDM work. Subcontracting EDM work made CTD reliant on other companies' schedules and priorities. Dave Johnson knew that purchasing a wire EDM would enable CTD to be more responsive to its customers' needs, but a wire EDM would not fit into the budget. Then Indianapolis Power and Light helped Capitol Tool & Die make some changes.

The New Way

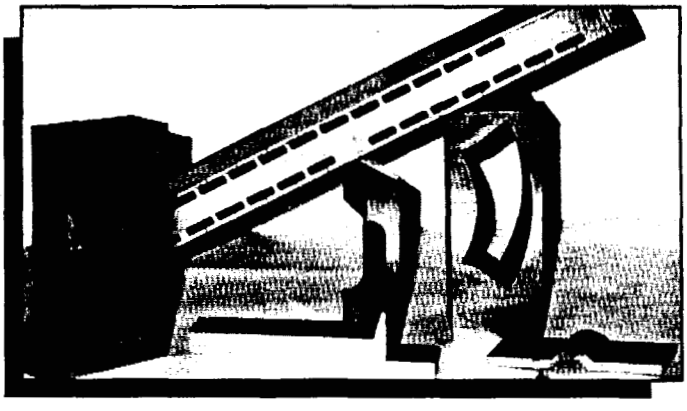
Indianapolis Power and Light Company helped Capitol Tool & Die obtain a grant from the State of Indiana for new equipment upgrades. The Electric Power Research Institute Centers for Materials Fabrication (EPRI CMF) worked with Johnson in choosing the proper wire EDM for CTD's applications. A submerged wire EDM fit the requirements. CTD enters customized part specifications into the EDM's computer memory to guide the electrically charged wire as it cuts through hardened steel or carbide substrates. Computerization along with EDM's accuracy ensure a high-quality finished product and consistency from part to part. The wire EDM reduces operator-hours because once programmed, it operates unattended. For some parts wire EDM saves time because it cuts faster than conventional machining. The unit also has fully automated cutting modes that constantly analyze the thickness and strength of the workpiece and adjust the machining pressure for best results.

CTD's submerged wire EDM performs the actual cutting within a water bath, which serves as a dielectric and coolant while constantly clearing the cutting surface of any residual material. These features make wire EDM one of the most accurate, high-quality metal cutting tools available.

The Results: Competitive High-Quality Production in Half the Time

Capitol Tool & Die realized the numerous advantages of the wire EDM as soon as it was installed. EDM benefits include:

- **Greater Production Capabilities**. CTD can contract more work that requires wire EDM precision. Higher quality work can be completed in less time, making CTD more competitive.
- **Increased Profit**. All wire EDM cutting is done in house, eliminating subcontracting. The company no longer depends on its suppliers' schedules, which saves both time and money for CTD and its customers.
- **Safety Benefits**. The wire EDM is quieter than grinding, and much cleaner, due to the lack of debris that is created. Wire EDM does not use a conventional cutting tool which makes it safer to operate than conventional machinery.
- **Customer Satisfaction**. Not only does CTD provide competitive costs, but improved quality and consistent uniformity all contribute to overall customer satisfaction.



Capitol Tool & Die, Inc. uses wire EDM to cut various shapes from hardened steel.

- **Simplified Operation**. The computer-controlled wire EDM does not require an operator. The unit can be programmed to run unattended.
- **Corporate Perception**. Associating wire EDM with the company name has given Capitol Tool & Die a competitive advantage in reputation and corporate perception.

What Did It All Cost?

Wire EDM equipment like that installed at CTD costs approximately $136,000. Because Capitol Tool & Die qualified for a $50,000 grant from the State of Indiana, its capital investment was lowered to approximately $86,000. Additional expenses including electrical wiring, air conditioning modifications, and freight costs added $4,500.

With the savings in labor, time, and energy, CTD expects a payback period of two to three years.

The Bottom Line: Greater Capability To Be Competitive

The wire EDM gives CTD the competitive edge it needs to excel in the tool and die industry. With the most reliable, quality-producing equipment in the industry, CTD projects a high-tech image to its customers. CTD expects to increase its wire EDM volume beyond the current 20% as more customers understand the benefits of wire EDM capability.

Role of Electric Utility

Indianapolis Power and Light Company supplies power to Capitol Tool & Die and is credited for the new success CTD is experiencing. By promoting new process-efficient technologies, locating a grant, and helping evaluate alternatives, Indianapolis Power and Light was able to help CTD purchase the wire EDM.

Other Applications of Wire Electrical Discharge Machines

Wire EDM is capable of cutting any material that is conductive. Wire EDM has been used to cut diamond compounds used in the tool industry, and research is being done on cutting conductive ceramic with wire EDM. Wire EDM technology can be used in many different applications including the manufacture of orthopedic implants, aerospace and automotive components, extrusion dies for rubber and plastics, cutting tools, and even jewelry.

Wire EDM has the ability to produce intricate cuts and detailed shapes. Irregularly shaped parts can be cut from hardened steels and other materials where cutting, heating, and grinding are not practical.

Company Profile

Capitol Tool & Die, Inc. has been building and designing dies, tools, fixtures, and special machinery in Indianapolis for 50 years. In 1947, Sam Johnson founded Capitol Tool & Die with an emphasis on service and quality. Today Sam's nephew Dave, owner and president since 1990, still holds the same quality and service goals.

The company has 10 employees.

Company philosophy: "A Complete Manufacturing Service."

IPL's Dave Borst (left) and Alex Goloschokin (right), assisted Dave Johnson (center) in purchasing this state-of-the-art wire EDM.

Dave Johnson, Capitol Tool & Die; Gary Paulson and Stephen Bond, Joachim Machinery; and Alex Goloschokin and Dave Borst, Indianapolis Power and Light provided valuable contributions to this issue.

Basic funding for this *TechApplication* is provided by the Electric Power Research Institute (EPRI), a nonprofit institute that conducts applications and development on behalf of the United States electric utility industry. *TechApplication* is one way that the EPRI Industrial and Agricultural business area assists in communicating information concerning energy-efficient, electric-based technologies.

This issue of *TechApplication* was written and produced by ProWrite Inc.

Photographs are courtesy of Indianapolis Power and Light.

Applicable SIC Codes:
33—66; **34**—69; **35**—19, 41, 42, 44, 49, 59, 68, 72, 99; **37**—21, 24, 28; **38**—42

For technical information call
EPRI Center for Materials Fabrication
929 Harrison Avenue
Suite 201
Columbus, OH 43215
614-421-3440 • Fax: 614-421-3446

For additional copies of this publication call
EPRIAMP Customer Assistance Center
1-800-4320-AMP
International: 614-841-7585

Printed on recycled paper in the United States of America

TA - 108992