

# Tooling & Production<sup>®</sup>

A HUEBCORE PUBLICATION  
November 1994

Providing solutions for metalworking manufacturers



**Machining centers—  
virtual and otherwise**

**Turret presses:  
Cell or stand alone?**

**Medical machining  
challenges alloys**

MANAGEMENT UPDATE  
**Grinding ceramics  
in high gear**

MANUFACTURING UPDATE  
**Make it right  
the first time**

TECHNOLOGY UPDATE  
**Tool monitoring  
now computer based**

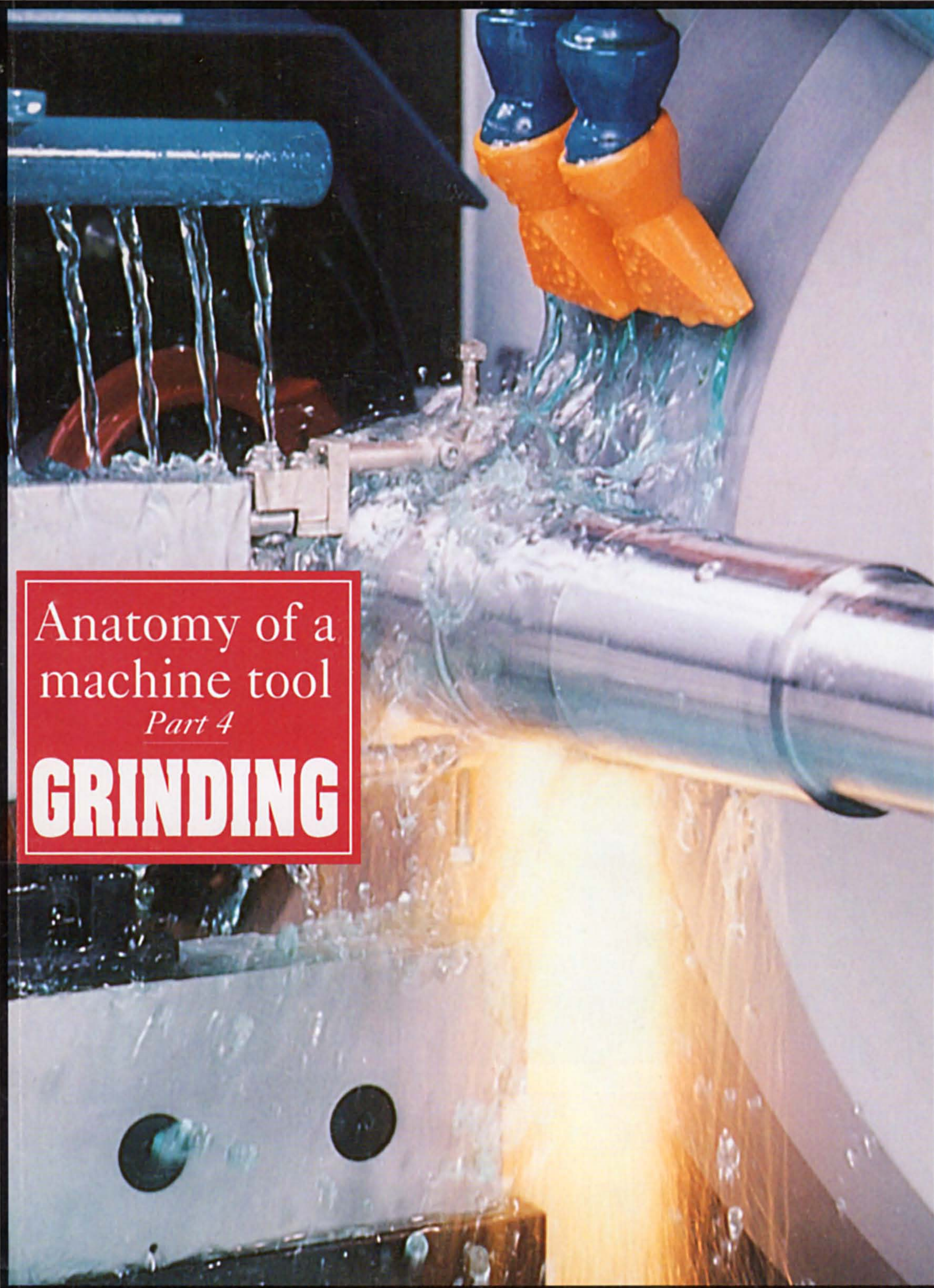
SOFTWARE SOLUTIONS  
**CAD/CAM takes model  
from art to part**

EDITORIAL  
**Happy days  
are here again**  
See page 5

**FOR MORE ON  
WHAT'S INSIDE**  
See page 3

Anatomy of a  
machine tool  
*Part 4*

**GRINDING**



# SOFTWARE SOLUTIONS & NC MACHINE CONTROLS

## CAD/CAM takes model from art to part

At Lite Machines Corp, West Lafayette, IN, brothers Paul and David Arlton, are using CAD/CAM software to perform an entire product development process from start to finish.

They call the process

their hobby grew into a business, their business grew in a whole new direction.

When looking around for a source of components, however, they found that bids ranged from \$120,000 to \$150,000 just for the

(with a 20"×16"×16" work envelope), and an injection molding machine were purchased at a total cost of slightly under \$200,000. With the exception of some bent wire parts, which can be produced with minimal tooling expense, the equipment gave them the capability to produce every component of the model.

The critical ingredient needed to convert their ideas into machine tool machining motions was the software, which had to be powerful enough to create the complicated surfaces yet inexpensive and easy to use. They chose Mastercam software from CNC Software Inc, Tolland, CT.

### Micromanufacturing

Both brothers have backgrounds in engineering, business, and computers. Each has the ability to design a part, generate a CNC program, cut a mold or operate a turning center, and run the molding machine. Their lean operating model requires far fewer people than conventional manufacturing, provides dramatically reduced cost, and also drastically reduces time to market.

Paul Arlton says that if he has the design in the computer today, he can have the mold completed and prototypes run within two days. His variable cost would run about \$10 of aluminum which, of course, doesn't include machine depreciation or the cost of his own labor.

In addition to eliminating the "hierarchy" needed to go from



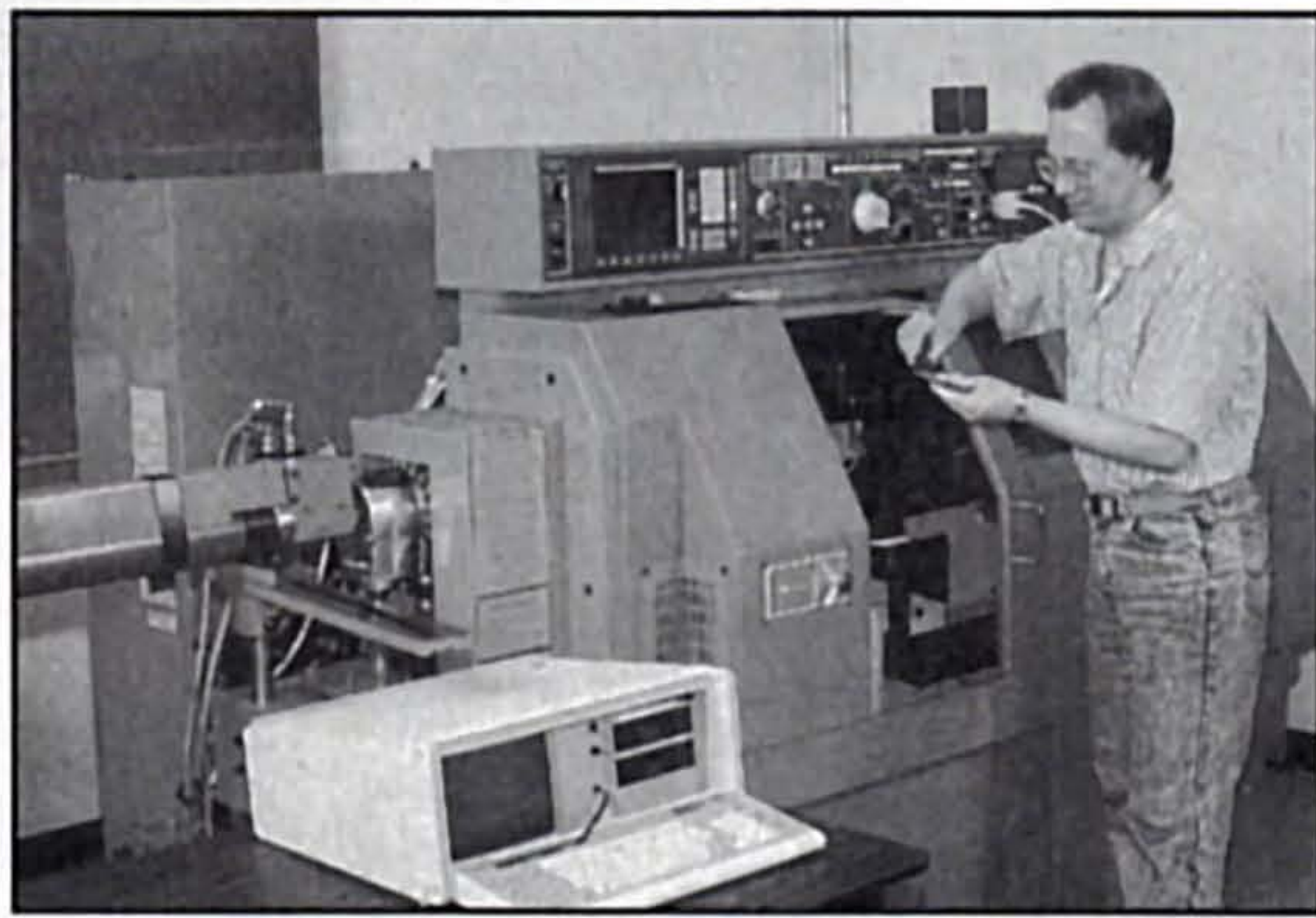
Paul (left) and Dave Arlton use Mastercam software to produce the 20 to 25 molds needed for their model helicopter from "art to part."

"micromanufacturing." Using it, Lite Machines is able to produce injection plastic molded parts in two days at a variable cost of about \$10 which, in this case, does not include labor since the owners of the company do all the work, explains President Paul Arlton.

The two brothers started Lite Machines to produce radio-controlled model helicopters. As

plastic parts. Moreover, after paying that much for the mold, a small company would be very reluctant to make changes that might improve the performance of the product.

They decided to buy all the equipment needed to manufacture the model themselves—for about the same cost. A Miyano three-axis CNC turning center, a Fadal vertical machining center



concept to production in traditional manufacturing, namely a separate engineer, NC programmer, operator, and manager, micromanufacturing streamlines the product development cycle by cutting down the need for meetings internally and with suppliers.

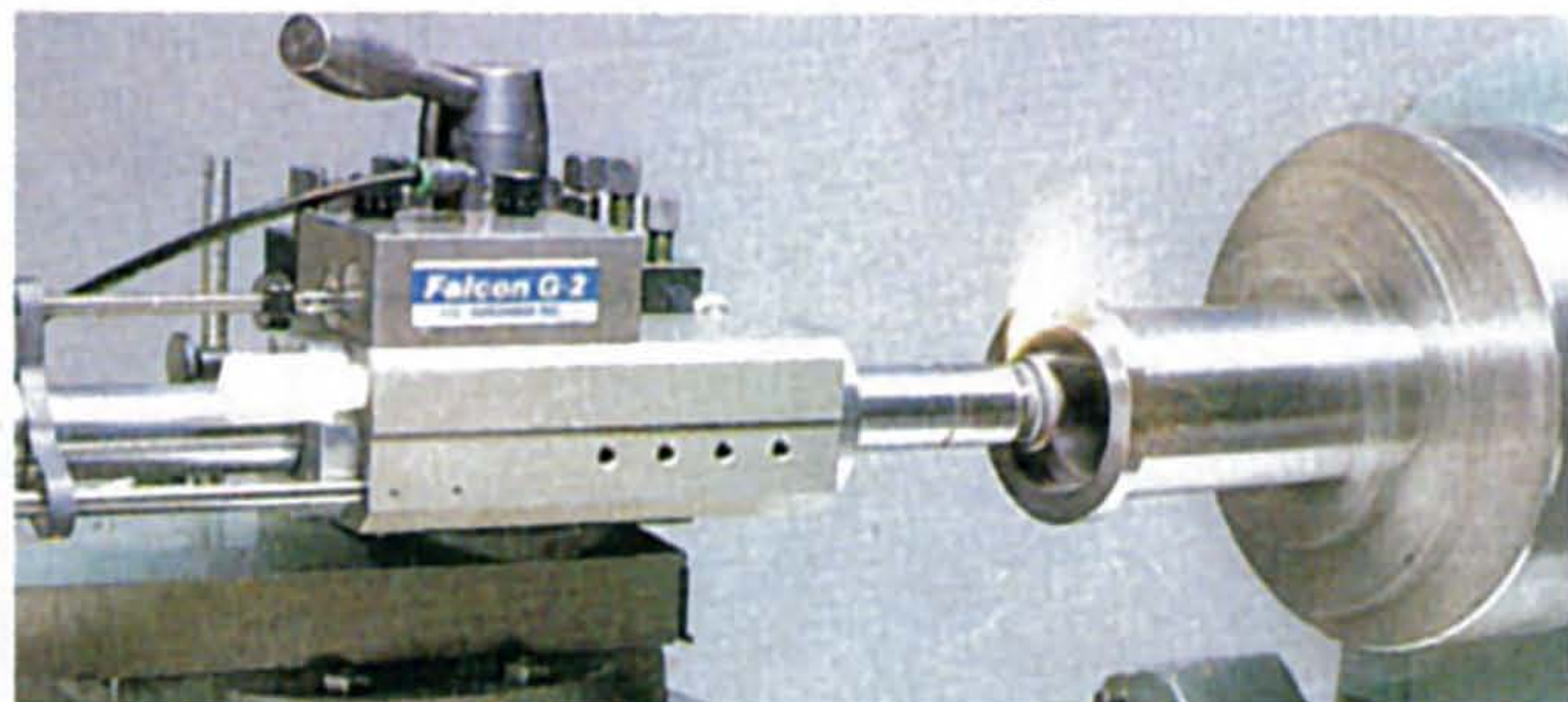
Micromanufacturing also streamlines the product development cycle by eliminating the need for strict dimension-

ing. Thorough dimensioning is required in conventional manufacturing because it is the only way to communicate the design concept throughout the hierarchy of functions involved.

Paul Arlton simply designs the product to scale and dimensions automatically flow into the CAM system during the importing process. When the model is produced, he just needs to measure a few key dimensions. If they are correct, he knows that the rest of the mold is also correct. The parts are small enough that warpage is not a serious concern. Time is also saved because there is no need to follow typical conventions such as making the model transferable to different machines.

# NSK FALCON SERIES

## Automatic Reciprocating Grinders



### Features

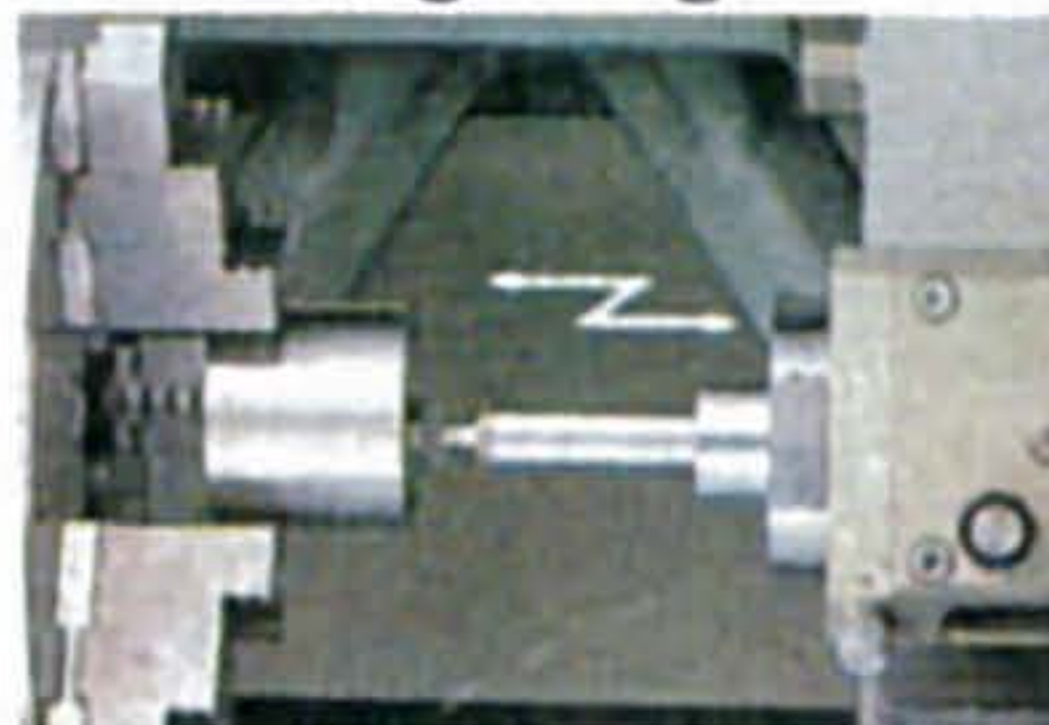
- Adjustable stroke Range FALCON-G1=0.2"~2.2" FALCON-G2=0.2"~5.0"
- Independent Fwd and Rev Stroke Feed 0.591"/sec~5.55"/sec
- Automatic oil supply
- Silencer equipped for quiet operation

The FALCON SERIES grinder may be retrofitted with the various "Astro series" air motors and spindles to suit the grinding application.

### Applications

The FALCON series grinders are easily retrofitted onto any lathe or specialized machine.

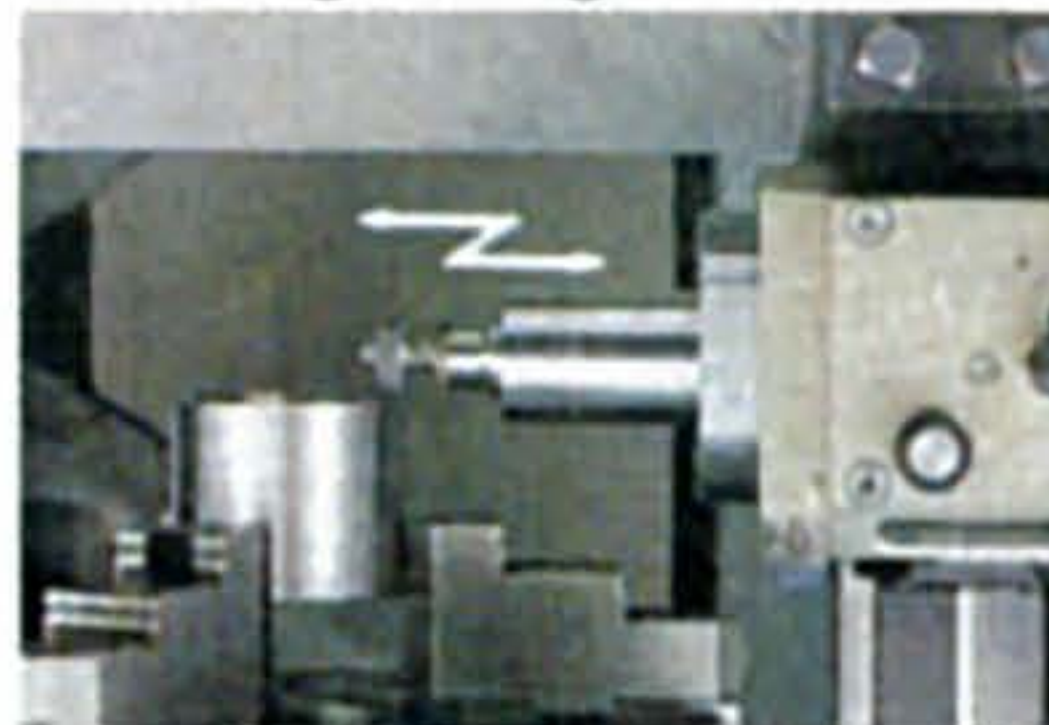
#### ■ Internal grinding



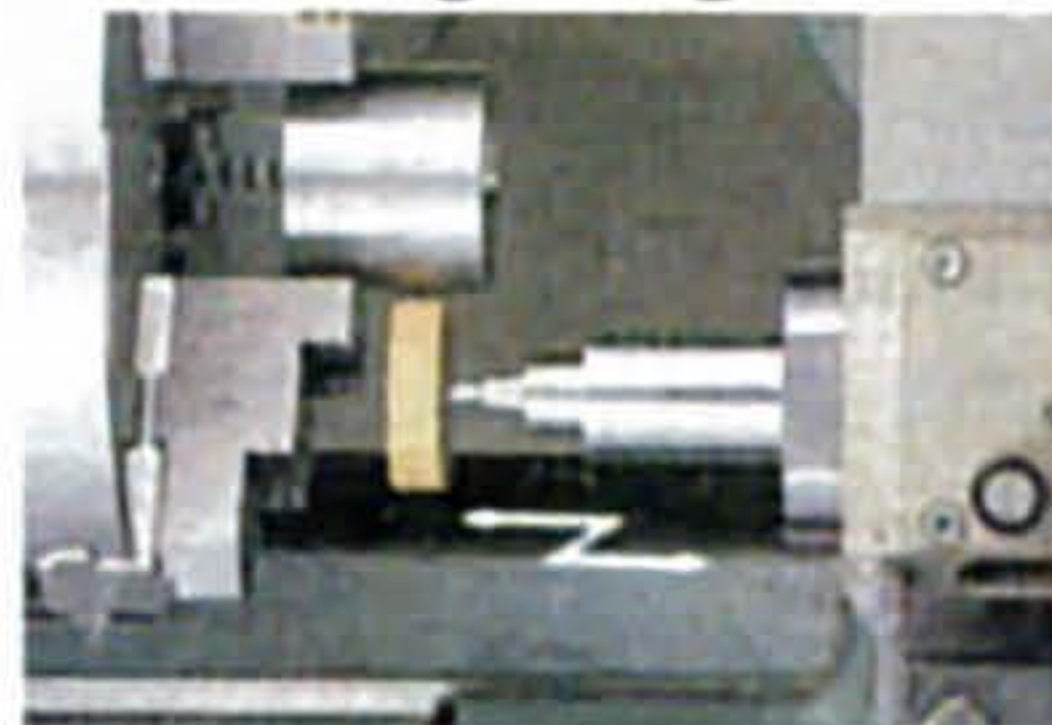
#### ■ Taper grinding



#### ■ Face grinding



#### ■ External grinding



**NSK AMERICA CORPORATION**

700B Cooper Court Schaumburg, Illinois 60173  
Tel. (708)-843-7664 Fax. (708)-843-7622

### Flexible design

At the cost that Lite Machines can produce a mold, there is no hesitancy in throwing one away if a better design idea comes up. The 6061 or 2024 aluminum that it used to produce molds typically lasts for 10,000 to 20,000 parts, but the company assumes that the parts will be obsolete long before the molds wear out.

These cost and leadtime advantages make it possible for the micromanufacturing approach to address niche markets that are often overlooked, the Arlton brothers say. Incremental cost of entering a niche market is tiny outside of labor expense. As owner-operators the Arlton brothers have the option of paying themselves well if the market pans out or foregoing pay if it doesn't.

Typically, a model helicopter requires between 20 and 25 molds, depending on the amount of consolidation in the design. Plans are in the works to produce the helicopter, which runs on an engine with 0.040 cubic inch displacement, in a wide range of sizes. The combination of the micromanufacturing concept and computer design makes it easy to change the size of the product.

Lite Machines is even exploring the possibility of producing its own engine. The helicopter includes a gyro stabilization unit on the tail rotor, which is even being evaluated by the Defense Department for use on full-sized craft.

### From 2D to 3D

A 2D CAD system is used for most of the design work because of the ease of working in 2D relative to 3D, says Paul Arlton. The entire helicopter is designed as a series of bulkheads. Conversion into a 3D surface model for machining comes after the 2D model is imported into Mastercam. The bulkheads are flipped up into the proper position. The result is

For free information, Circle 56 Reader Service Card

a 3D wireframe converted to a surface model with Mastercam's powerful surfacing features. Once the surface model is complete, it is merged with a drawing of the injection molding machine's mold base.

Mastercam was selected because of its capabilities, especially in generating surface models and in visualizing the models after they are created. In surface creation, the Coons patch function effortlessly produces a flowing surface-based on boundaries within a wireframe model. For visualization, dynamic rotation is directed by the mouse. Another feature is the program's ability to automatically generate a gear design simply by entering parameters such as number of teeth, pitch, and pitch diameter.

Given a workable design, Mr Arlton says he can usually produce a mold program in a few hours with Mastercam.

To date the most challenging part that Paul Arlton has produced by this method is the tail rotor blade. This complicated geometry includes drill holes, pockets, swept surface, and Coons patches. The swept surface which forms the twisted airfoil rotor blade is the most complicated section. The part also includes a rotor hub with pockets and swept surfaces. The top profile of the rotor and the cross sections were designed in different layers in the CAD system. After importing them into Mastercam and flipping up the bulkheads, a swept surface was flowed over them. With the surfaces created, generating the toolpath in Mastercam was highly automated.

Operator knowledge of the overall design and manufacturing process is required to select tools capable of producing the geometry. For example, the trailing edge of the rotor blade originally had a sharp corner which could not be cut with a ball nose end mill. The part geometry was modified to accept the geometry of the cutter, and a new Coons patch was flowed over the rotor blade.

For more information on CNC Software Inc's Mastercam, circle 339.

## A new paradigm for the automated factory

By John Layden

If you think of scheduling as something that is done far, far away on an MRP II system that is only updated on a weekly schedule, you may not see it as having much relevance to activities on the factory floor day by day, and minute by minute.

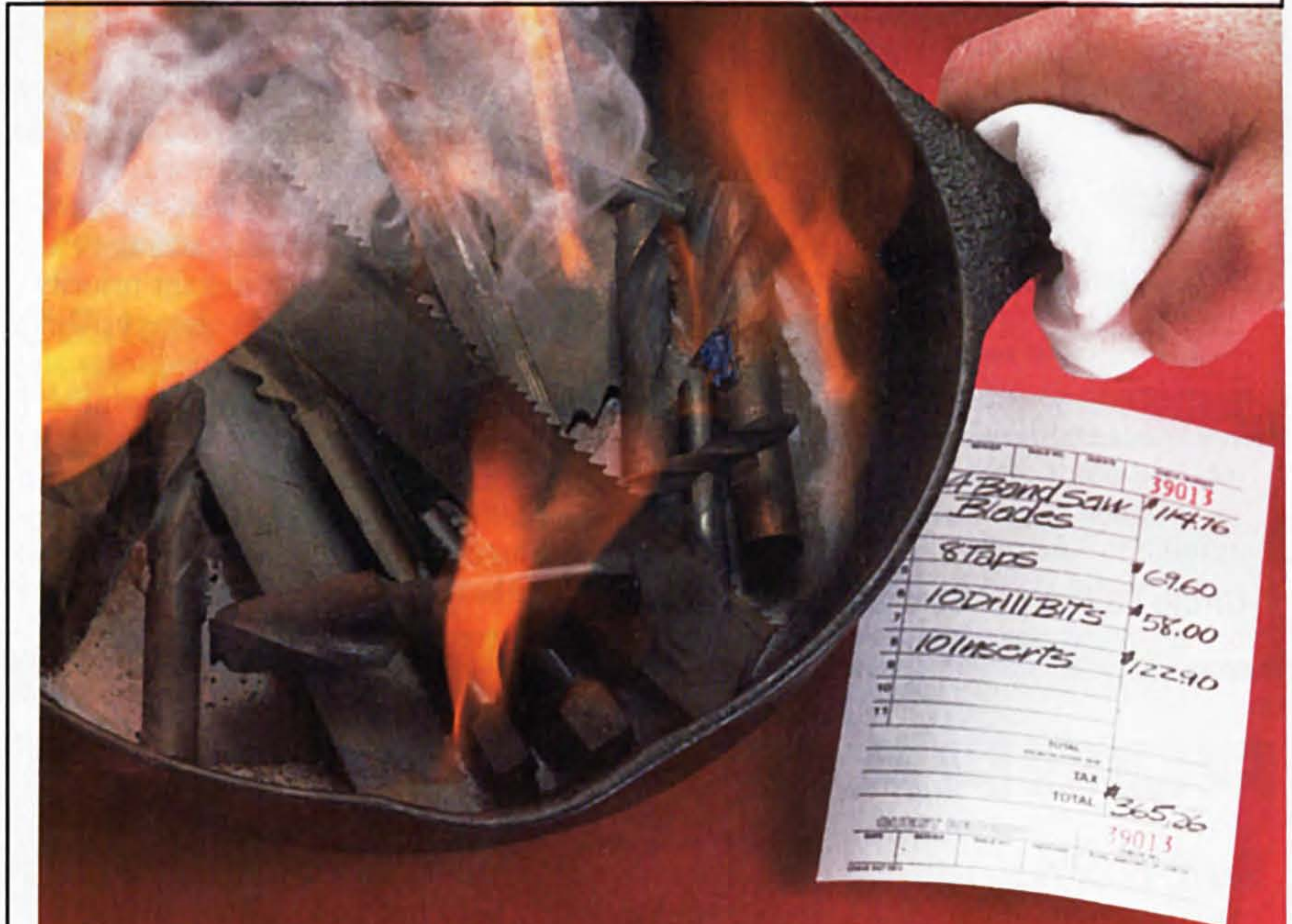
Whether or not the scheduling system reflects it, the factory is being rescheduled regularly. *De facto* rescheduling can

result from employee illness, machine malfunction, lost tools, late material, or a customer-requested change to an order. The only question is, how quickly do people become informed?

Traditionally, factory scheduling and accompanying work order production are done well in advance of the actual manufacturing activity. The programs are based on older computer and software technology that cannot respond to rapid changes on the factory floor. In a paper-driven environment, when an unscheduled change oc-

curs, manual expediting generates and distributes the work-arounds, reconfigurations, and overtime authorizations needed to react. It is not unusual to work overtime in one department only to find that the next resource isn't ready. The resulting upsets mean extra cost, extra stress, and a potential for confusion that is bad for quality, scheduling, and customer goodwill.

The fact is there is a new paradigm for the automated factory. Real-time scheduling takes advantage of advances in



## Enjoy picking up the tab for overcooked machine tools?

We've got the perfect recipe to reduce your machine tool costs

Trico's Micro-Drop® MD-1000 Metalworking Lubrication System delivers faster, cooler and safer machining than present mist or flood systems. Ideal for most metalworking operations, including sawing, milling, drilling or tapping, the MD-1000 extends tool life and virtually eliminates waste disposal and pollution problems.

The result is an easy to use system that is dependable, highly efficient and cost effective. All at a price that's less expensive than a few quality machine tools. Something to think about when you're picking up the tab!



Call, write or FAX for **FREE** sample of  
Micro-Drop® Lubricant

TRICO MFG. CORP., 1235 Hickory St., Pewaukee, WI 53072 • 1-800-558-7008 • FAX: 414-691-2576