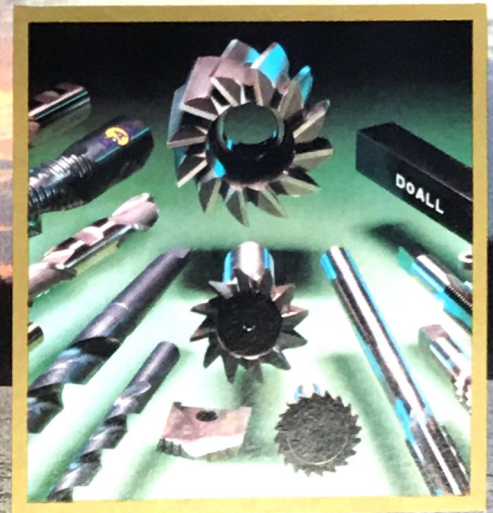
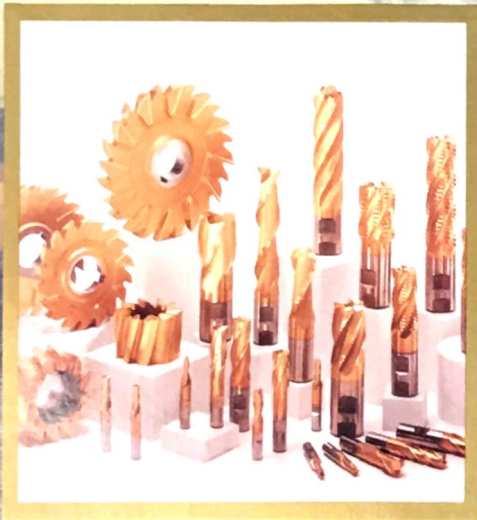


CUTTING TOOL ENGINEERING

December 1985

▪ Metal Cutting ▪ Metal Removal ▪ Abrasive Machining



FORECAST '86

Tooling Systems for Flexible Manufacturing

Manually-Operated Optical Comparators

An Alternative to Coolants: High Speed Lubricants

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Contents

Products in Action 20

Low-viscosity cutting oil provides high cooling capabilities for brass works; Oil skimming system increases coolant life; Cost-effective titanium nitride provides improved tool life; Wastewater treatment reduces costs; Carbide drill manufacturer cuts lead time.

Forecast '86 26

With 1986 just around the corner, it's time to look into the future and plan for what's ahead. A survey of industry leaders' views of the coming year.

An Alternative to Coolant: High Strength Lubricants 32

Machining with "vegetable oil" is no cure-all, however, it is a viable, tested method for numerous machining situations. Proper use can eliminate coolants.

Tooling System for Flexible Manufacturing: Economic/Technical Turning Considerations 37

Block tooling can provide a basis for tool use and management across all turning machine factory work, wherever quick-change tooling is necessary.

Equipment/Productivity Advancements In Manually Operated Optical Comparators 40

Optical comparators have not changed much down through the years, but the concept has continued to be refined and is in wide use in machine shops today.

Departments

Industry News	8
Meetings & Conventions	14
New Product Reports	43
New Literature	58
Calendar of Events	64
Reference Shelf	66
People & Companies	68
Advertisers Index	70
History of Tools: Part III	74

On The Cover

Cover Photo by Stan Michals. Right insert photo courtesy of DoALL Company, Des Plaines, IL. Left insert photo courtesy of Niagara Cutter Inc., North Tonawanda, New York



The History of Tools

The key to the stunning success of the Industrial Revolution with its factories and machinery made by powered machine tools, was the ability of these tools to do the work formerly done by men using hand tools.

The introduction of machine tools — the only machines that can also make the parts necessary to duplicate themselves — resulted in massive increases in production. Parts were produced more skillfully and accurately at a lower cost than was possible with hand tools.

Metalworking processes take countless forms beginning with the smelting of ore and production of metals, but because metal must be given a specific form for each specific use, metal shaping is basic to all metalworking.

The techniques, machines, and tooling employed for various metal shaping operations, vary tremendously, but there are two basic ways that metal can be given a new shape: metal cutting or metal forming.

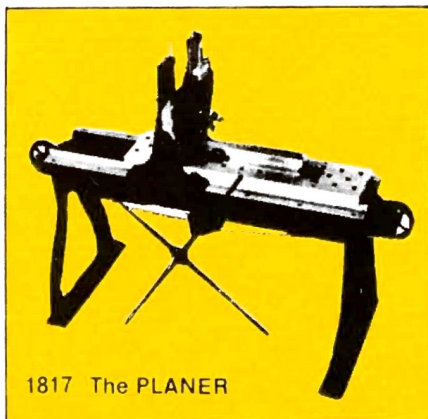
Metal cutting describes any process that removes a portion of a metal workpiece, leaving the remaining portion in the new shape or configuration desired. Most metal cutting is accomplished on machine tools equipped with sharp-edged tools that cut and remove metal in the form of “chips” to create the desired shape.

Metal forming is the second basic way of imparting a new shape to metal. The most common example of metal forming is in the process known as stamping.

Basic Machine Tools

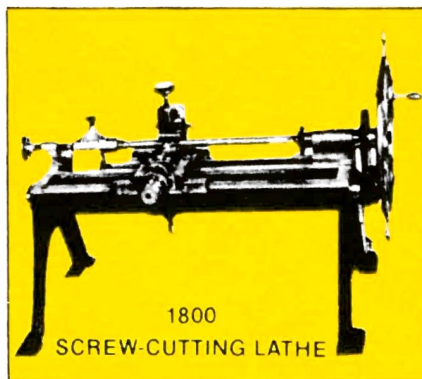
The modern machine tools used today in the metalworking process evolved from seven basic machine tools developed from 1800 through 1933.

The flat bed and ways of planer were made with a chisel and file.



1817 The PLANER

This is the third of a series dealing with the history of tools. It is being presented through the courtesy of Wilkie Brothers Foundation.



1800
SCREW-CUTTING LATHE

The first master lead screw was hand-made on lathe by Henry Maudslay.

1. Lathes: In 1800, Henry Maudslay's metal cutting lathe for making threads was one of the first of the powered machine tools invented. The turning machine uses a rigidly-mounted turning tool to remove chips to create a new shape as the workpiece is held and turned on its axis.

2. Drill Presses and Boring Machines: Drilling machines come in sizes not much larger than a power hand drill on up to huge, automated multispindle drilling machines that can precision drill scores of holes in seconds. The ability to use standard twist or spade drills is the most common application for these machines.

While a drilling machine can bore out small holes, a rigid, high-powered machine known as a boring mill must be used for boring out large or small predrilled holes that require extreme precision in dimensions and alignment.

3. Milling Machines: There are two basic types of milling machines — vertical and horizontal. They produce one or more flat or contoured surfaces, slots, grooves, and recesses or similar configurations in or on a part. Milling tools are rotating cutters with multiple cutting edges

4. Planers: Using the same basic principles that the ancient Egyptians, Greeks, and Romans used, modern planing machines produce flat metal surfaces. They are among the few machine tools on which the cutter does not rotate to take metal chips, but rather remove them with straight-line reciprocating action.

There are two types — the planer and the

shaper. On a planer, the cutting tool is held stationary and the workpiece, secured to a reciprocating table, moves into the cutter. In contrast, a shaper holds the workpiece stationary and the cutting tool moves.

5. Saws: The last of the basic machine tools was developed for metal cutting in 1933. It is a versatile machine used to perform cut-off sawing and contour sawing applications.

Cut-off band sawing is used to first cut to approximate workpiece size before any of the other basic machining steps can be performed.

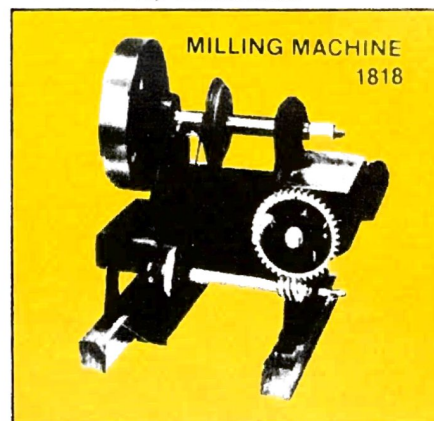
Contouring operations permit sawing of virtually any shape, internally or externally, with no limit to length of cut. The modern contour bandsaw can do the preliminary and often finish machining of anything from a turning fork on up to huge curved metal aircraft ribs.

6. Grinding: Grinding, like all other metal cutting operations, removes metal in chips through the use of a grinding wheel. The wheel spins at a high rate of speed against the workpiece. Grinding is routinely used wherever smooth, flat surfaces are needed. For many operations requiring both rapid and precise high-volume metal removal, a grinder is an absolute necessity.

7. Forming Machines -1839 Steam Hammer: The steam hammer was the forerunner of modern forging hammers and stamping presses. Pounding metals, cold, or softened by heat into various shapes, or melting them into molds, is the process of metal forming.

Thus, we see the many forms that the metalworking processes entail. Machine tools allow people to make better implements of production with less effort at lower cost. This, in turn, permits the sale of more goods at lower prices to more people. △

Eli Whitney invented the milling machine in New Haven, Connecticut.



MILLING MACHINE
1818