

CUTTING TOOL ENGINEERING

October 1985

▪ Metal Cutting

▪ Metal Removal

▪ Abrasive Machining



**Coolants, Lubricants, Holemaking
Cutting Fluids-A Practical Approach to Productivity
Products In Action**

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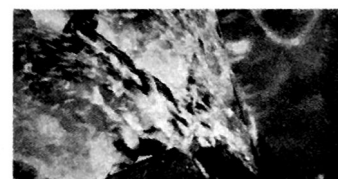
Gundrilling, a precise holemaking process, is not a new innovation, but it still is a suitable means of producing any hole - deep or shallow, large or small.

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High-speed Hertlein flute grinding machine produces precision twist drills with Pillsbury Chemical's Circlene coolant. Photo courtesy of Pillsbury Chemical & Oil Inc., Detroit, MI 48209



Civilization took a giant leap forward about 3500 years ago when the methods of smelting iron, alloying it with carbon to create steel and forging metal into tools, heralded the beginning of the Iron Age.

The great civilizations of Greece and Rome thrived during this epoch from their use of iron and steel tools. The advance in toolmaking brought enormous benefits to everyone since it delivered increased productivity and prosperity.

Because iron was more plentiful than copper, it could be used for a greater variety of tools and products. For the first time in history, a worker could own tools which were superior to the best bronze tools in existence. More importantly, iron and steel tools hold an edge longer than those made of bronze.

It was these tools and products that spawned superb architecture, flourishing art and literature, increased population arising from more efficient agriculture, and the transportation of goods and knowledge through the world's burgeoning civilizations.

The third giant step in man's development began about 200 years ago, when the dramatic and far-reaching Industrial Revolution had its beginnings. Profound changes in production, trade, transportation, and communications resulted. Such things as new and improved materials, advances in knowledge, and methods of organization played vital roles in creating the Industrial Revolution. But the key was the substitution of accurate, powered machine tools for hand tools.

Great Britain of the early 1700's bustled with developing industries — iron foundries, glass-making, shipbuilding — that consumed wood for energy and structural uses at prodigious rates. As these industries flourished they were stripping Britain of her timber. Consequently, two urgent needs emerged: a new source of energy to supplement wood and a dependable new source of power to replace waterwheels, windmills, and animal and human muscle power.

Coal became an obvious energy source; however, surface coal mines were quickly exhausted and because of water seepage, deep mines proved impossible to drain by traditional methods.

Industrial Revolution in U.S.

While the Industrial Revolution was spawned in the Old World, it grew up and matured in the United States. Progress vastly accelerated once muscle effort could be multiplied by mechanical power and machine tools. With steam to provide the power, America began inventing complicated production tools. To do this, a special group of tools, known as machine tools, was needed. These tools would do work much faster and more accurately than handheld tools.

In the early 1800's, conditions in the

had two characteristics that forced further change. They were too big to be used at home and too expensive to be owned by individuals. Special buildings called mills or factories were built to house these huge machines. To pay for the factories, the owners needed to divert a good portion of their personal wealth into pooled investments. This became the essence of capitalism.

The Steam Engine

The development of a dependable power source began in 1712 with the introduction of Thomas Newcomen's "atmospheric engine."

The engine used a rocker arm attached to a suction pump to extract water at great depths; thereby, making coal accessible. In 1765, James Watt recognized the fact that Newcomen's engine could be more powerful if steam instead of atmospheric pressure was used to push the piston — and push it up as well as down.

Watt tried for ten years to perfect his steam engine. It was his friend, John Wilkinson, who provided the key for a working steam engine. Wilkinson designed a boring mill, the first true machine tool, with a number of novel features that included a pilot bar to

support the cutters and prevent them from deflecting.

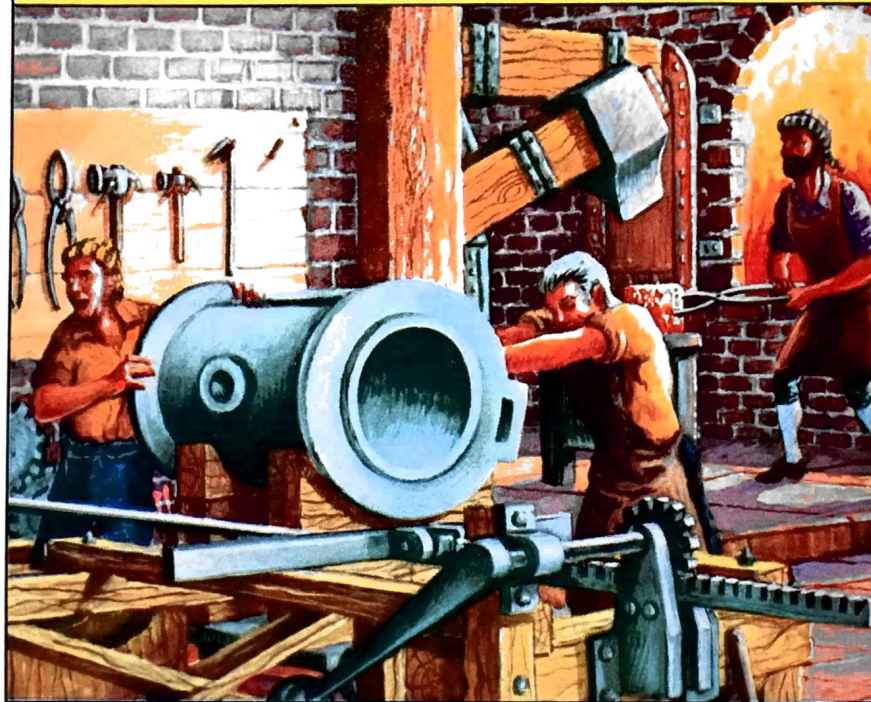
Thus, with cylinders bored to the required accuracy, Watt's steam engine supplanted the "atmospheric engine" in pumping applications and became the "Engine of Progress" powering iron and steel mills.

Both Watt and Wilkinson held basic patents and made many notable contributions to human progress; but their major joint achievement was setting the Industrial Revolution in motion. Watt with the steam engine that powered it, and Wilkinson with the boring mill that made it possible to build the steam engine.

After steam power and machine tools came electrical power, more zooming productivity and many new kinds of products. New methods of transportation and communication systems also emerged.

Thus, since greater output per worker created greater profits, wages steadily increased, hours of work per week were shortened, and purchasing power increased. △

The History of Tools



This is the second of a series dealing with the history of tools. It is being presented through the courtesy of Wilkie Brothers Foundation. The next part in the series will deal with metalworking and the seven basic machine tools.

United States were ideal for developing mass production tools. The new nation had enormous natural resources, a great labor shortage, and a form of government that allowed all citizens personal freedom of choice and action.

These conditions fueled ambition in America's young settlers with courage, the desire to be free, and the hope of improving their material welfare. The pioneers became extraordinary through the improved productivity that resulted from steam power and machine tools.

The new steam-powered production tools