A Look at How Construction Tools Have Evolved

By Steven Ferry

As you purchase, use, repair or swear at the tools used on the job, you probably don’t give a second thought to how far we have come in our ability to swiftly and safely erect and finish ever larger, taller and more durable homes, offices, factories and other buildings in the United States.

In 400 years, we have moved from the crude grass and hide structures of the first settlers to timber, brick, concrete, steel, glass and now plastic material—in the process freeing the builder from the need to also manufacture or find the building materials. We can create whatever climate we want indoors while remaining impervious to the one outside.

Design tools have moved from ideas in the builder’s head, and the occasional sketch, to computers. Code officials, architects and consultants in everything from construction management to quality control have made building into a series and sequence of highly specialized activities that together bring about the fabulously efficient constructions of today—efficient in terms of outlay of effort in the construction and running of the buildings.

Pivotal to all the successes in construction are the tools we use to accomplish the work on the job site. If Henry David Thoreau...
had thought back to the time he spent building his cabin in the woods, he might not have insisted that men had become the tools of their tools. In the right hands, the tool is the tool of the man (or woman).

All Power to the Tool

If there is one trend that has sped up work the most and given the workman a break, it is the introduction of power tools, an event that occurred long before the advent of electricity.

Two centuries ago, Americans were using what is possibly the first power tool—the water-mill powered saw that took half an hour to cut 20 feet of log at 10 revolutions a minute. The “sawyer” would “switch off” his machine by closing a sluice gate, then remove and pile up the sawn plank. He would then drag the heavy log on its carriage back to the starting position and jimmy the new log into place for the next cut, and then open the sluice gate again. As tedious as this sounds when compared to flicking an on/off switch, or buying a plank from the lumberyard, it produced straight cuts and was a lot easier than using a hand saw and chalk line.

Before that, in colonial times, cutting wood for houses was even more arduous. They would use a free to split a 3-foot log lengthwise to make 1-inch thick clapboards for the roof A froe is a wedge-shaped device with a wooden handle and an extension that was hit with a wooden club to drive the wedge through the log.

For the walls, they would square timbers with a broadax, which took a couple of hours per log. The surface was then finished with an “adz,” an ax shaped like a hoe. The adz-man either stood or sat on the timber and cut toward himself. As the adz was honed fine, the technique was not something OSHA would approve of today, but it did produce almost as smooth a surface as a plane.

Another job requiring power was lifting materials on site, an action carried out either by human muscle or horses. With the rise of high-rise construction, this became impractical. So when Nikolaus Otto built the first internal-combustion engine in 1876, it was not long before it was adapted to the work site.

Harnessing the power of machines for construction was originally carried out with large equipment. We think of power tools today as hand tools or portable power tools driven by electricity, compressed air and gasoline engines—the technology to build such small tools has only been in existence during this century. Many of these tools are adaptations of old, manual tools, such as the drill, but equally many have been introduced in the last few decades and would have impressed our forebears as marvelous conveniences they had never even imagined.

The Industrial Revolution of the 18th century was the turning point for tool production, graduating from hand-made hand tools to machine made, following the introduction of the steam-power-driven machine tools that could, by the 19th century, mass-produce tools with great precision. Our own 20th century has seen the introduction of numerous refinements in machine tools, including automated operations governed by electronic and
fluid-control systems and techniques, such as electrochemical and ultrasonic machining. The result is what you see in your toolbox today, from laser bobs to nail guns. While the tools have improved speed and efficiency of work, they still do the same basic job as their predecessors.

**Rummaging Through the Tool Box of History**

Many of the tools we use today trace back to the sharpened stones that early man used to hack, cut and pound. With different applications came specialization and the invention of single-purpose tools. As long ago as 4,000 years, man had developed axes, chisels and saws—a big improvement on sharpened stones. The simple expediency of adding a handle to his tools represented a quantum leap in tool efficiency.

By the 15th century, box wrenches were in use and a century later, someone thought up T-handled socket wrenches. And so it went, little by little, the tools we know today were added to the collective tool box.

Slotted, round-headed screws with left-handed threads were introduced in the 16th century, as were metal screws that were screwed into threaded holes.

The original screwdrivers from the 18th century had flat-bladed bits but were not much in use until the mid-19th century, when automatic screw machines made possible the mass production of tapered, gimlet-pointed wood screws. The familiar rounded shafts followed, providing a stronger screwdriver.

Sliding-jaw wrenches were introduced around 1830 to overcome the restrictions imposed by fixed-opening wrenches. In the first versions, the sliding jaw was hammered into place by a wedge. A screw was used to replace the wedge in later models.

Some tools, of course, have a much longer heritage. The Egyptians were using pliers in the form of two bow-shaped metal bars 3,500 years ago. A thousand years later, the Greeks developed hinged tongs. Later still, the Romans sharpened the jaws of small tongs to create cutters and pincers.

As for drilling tools, the first versions were simply a thong wrapped around a stick and pulled from side to side. This evolved into a bow drill, a tool still used today in some parts of the world. The earliest drill points had two cutting edges until the 1860s, when machine-made spiral-fluted drills became available. It was the Romans, by the way, who invented the spiral-stemmed augurs that brought the shavings or chips to the surface.

The Egyptians obviously found their E-shaped plumb very useful in determining verticals and their A-shaped one for horizontals. Although the “E” shape fell out of use, the “A” shape was still to be found on building sites in Europe until the 1850s. As for levels, they were first used in the early 17th century in the form of a small channel filled with water, which, of course, is always horizontal. The sealed spirit or bubble level containing alcohol and an air bubble was invented in 1661 but not used in carpentry until the mid-19th century.

Not shy of undertaking large projects,
the Egyptians obviously knew their trade and had quite a tool-
box at their disposal. The square and the chalk line also origi-
nated in Egypt 5,000 years ago, although they used wet, red
and yellow ochres instead of dry, white chalks.

If getting the correct measurements can still be a bear, it is a
lot easier now than using the “cubit” (the length from the
elbow to the end of the middle finger) and the “palm” (the
width of the fingers) and the “digits” (four digits to a palm)
that were used in the ancient world. The proverbial “How
long is a piece of string?” might have had its roots in frustrat-
ed site foremen whose forearms differed from the regulation
size. The rule was otherwise similar in look to the stiffwood-
en rulers we have today. It seems graduated rulers were not
used in the West until the 18th century.

Closer to Home

The toolbox grew slowly until the machine tools of the Indus-
trial Revolution opened Pandora’s box with new technologies
that will continue to bring us easier and better ways of con-
structing walls and ceilings. Next time you feel inclined to cuss
the tool or the technique, however, perhaps it might help to
consider what contractors (or “undertakers” as they were
known three centuries ago) had to work with.

The first issue was having to find and use the few, naturally
occurring, building-friendly materials in the area. The first set-
lements in Roanoke, St. Augustine and Jamestown more than
400 years ago were “cabbins” with thatched roofs supported
on forked posts, with daub and wattle walls.

The wall spaces were filled with vertical stakes set a few inch-
es apart, and willow and hazel branches were woven in and out
horizontally. Both sides were then plastered with mud. These
structures followed the pattern that poorer folk had been using
for centuries in Europe.

The Mayflower folks had little knowledge of building, so they
dug holes into hills to make hovels and used bark and sod to
cover the walls and roof. The Puritans, who landed in Massa-
chusetts Bay in 1630, copied the Indians lodges, while adding
chimneys of sticks and clay that often caught fire. The frame
lodges were made of poles lashed together with vines, with
bark or woven mat coverings.

Obviously, a key drawback was a lack of tools, one that didn’t
put off the Swedes who landed in Delaware. With just one ax,
they would build sturdy log houses with the bark still on
them, by deeply notching both ends of each log. Side and end
walls were alternated, with the notches resting in each other.
Wood chips, clay and moss were used to fill the gaps between
the logs.

Where available, lime mortar was used for plaster between the
logs, together with small stones or wood. Lime was scarce dur-
ing the 17th and 18th centuries, so mud was the more usual
mortar. In the Chesapeake Bay area, the builders had an
unusual resource: piles of oyster shells, which they burnt into
lime and then mixed with sand for mortar. They also used the
oyster shell lime for plastering and whitewashing the interior
walls.

By 1650, spaces between wall studs were filled with nagging
as insulation—rolls of straw-bonded clay, and later, bricks.
The interior walls were covered with pine or poplar sheathing
boards. Ceilings were generally the floor planking of the second story.

Interior design was generally non-existent or rudimentary for many years. After a while, blue-washed ceilings (whitewash with indigo added) perked up the insides, and some walls were plastered. Doors and window frames were painted with a mix of powdered clay and sour milk that provided a brownish-red coloring.

After 1750, with plaster walls more common, it then became possible to hang wallpaper (paper hangings as they were called). The paper did not come in rolls, but small sheets, limited by the size of the paper-maker’s molds. The designs were hand printed from engraved wooden blocks. The paper was supplied in one color, and the rest of the color was either stenciled on or painted free-hand. Whole scenes, with no repeats, were often supplied for the walls.

With plaster walls came plaster cornices that were “run’ in place by an apprentice who provided a continuous supply of mixed material for the master. He would follow behind the apprentice, pushing a cutout metal form around the wall to shape the cornice.

By the end of the 18th century, frame, brick and stone houses were being built in towns, but the process was slow at a time when a burgeoning population demanded more housing. Framed houses, for instance, used 6-inch timbers with mortised-and-tenoned joints that were pegged together with treenails. As you can imagine, this wasn’t the kind of house one could erect with any great speed or volume. Two key breakthroughs allowed housing production to increase dramatically. The water-powered sawmills mentioned earlier improved over time and, together with steam-powered sawmills, made it possible to produce standard-dimension timbers in volume during the 1820s. The second breakthrough was the mass production of cheap machine-made nails in the 1830s. This opened the door to balloon-framed houses, which were first introduced in Chicago. Contractors then had available small timbers that they could nail together at a rapid rate.

Building Up to Today

Next time a contractor feels less than charitable about an architect’s lack of direction in the specs, he might want to consider what his predecessors had to put up with in the early 18th century. They generally used no plans other than an illustrated architectural book (the first, a “Book of Architecture” by James Gibbs, was published in 1728) to design and build a house. They might occasionally make use of a board to scratch a diagram on with an awl. If that seems too unreliable and hokey, bear in mind that Independence Hall, for instance, was built this way.

And lastly, if we think we have trouble with leaking window frames today, imagine the problems when windows were nothing more than oiled paper!

So next time you think about the state of the industry, the tools and what you do with them, or the fact that your back hurts, remember how far we’ve come.

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