The CHRONICLE

of the

Early American Industries Association

The Tinsmith in America—The Trade, Materials, Tradesmen, Tools, and Products

A History of Water Pump Pliers

A Unique Tongue Plane

Who Is Christian Bodmer? Part I

Volume 66 Number 2 June 2013

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Front. Bill McMillen setting a locked seam on a pint-and-a-half tin mug over a small English beakhorn stake at the The Tools and Trades History Society (TATHS) Conference in Sheffield, England, in 2012. Bill's demonstration was part of his presentation as the Mark Rees Memorial Lecture at the conference. The finished mug sold for £75 at the TATHS auction during the conference. To make the cup, Bill used mostly English tinners tools, because, as he points out, his American tools would have been difficult to transport. The tools he discusses in the article in this issue are primarily American. Bill reprised the talk and demonstration at the EAIA annual meeting in 2013. Photo by Jane Rees.

Back. Water pump pliers and some 90-degree siblings. Warren Hewertson and George Radion's history of water pump pliers—known also as slip-lock or channellock pliers—begins on page 56. Photo by Bruce Sandie.

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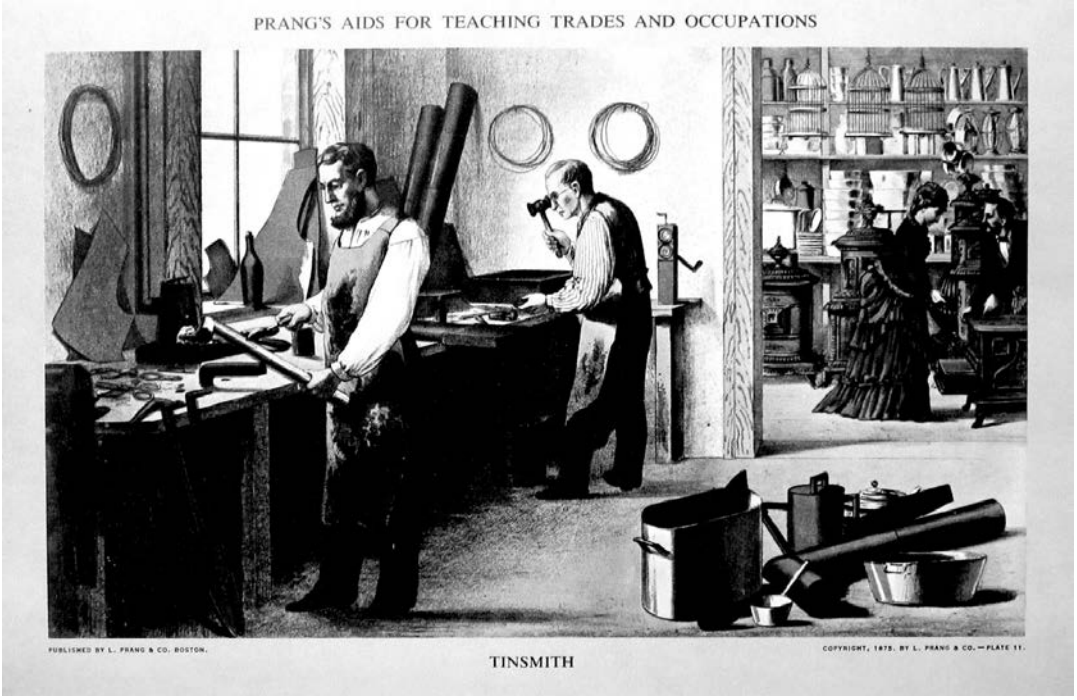


Figure 1. "Tinsmith," an illustration from Prang's Aids for Object Teaching. *Note the variety of items in the shop in the background on the right side.*
Library of Congress

The Tinsmith in America– The Trade, Materials, Tradesmen, Tools, and Products

by William McMillen

This article is based on a talk first presented to members of the Tools and Trades Historic Society of England as the 2012 Mark Rees Memorial lecture in Sheffield, England, and reprised at the 2013 EAIA annual meeting.

The trade of tinsmithing, which was well established by 1640 in Germany and England, came to the North American colonies at the rather late date of 1740. The metal tin had been well known in the Cornwall area of England before it was discovered in Bohemia (present-day Czechoslovakia), circa 1250 A.D. One of the earliest uses of tin, other than to make the alloys pewter, bronze, and bell metal, was as a coating for already-made metal items. Dipping these items in tin helped prevent rust and corrosion.

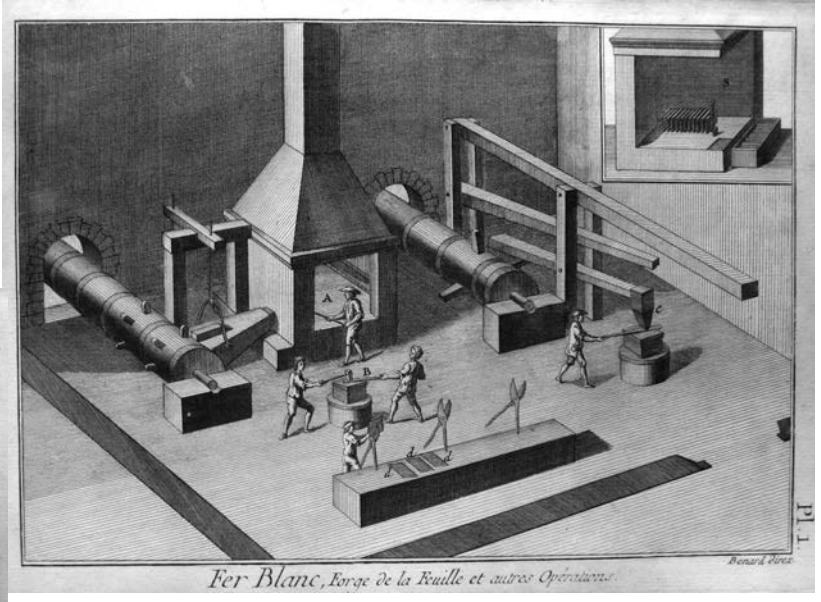
Eventually thin sheets of wrought iron were coated with a thin layer of tin, and tinsmiths would use this "tinplate" to manufacture a variety of items (Figure 1). Although tinplate had first been made circa 1550 in Bohemia, by 1620 it was being produced in the Saxony area of Germany. This German tinplate is what was used in Europe and England throughout the seventeenth century.

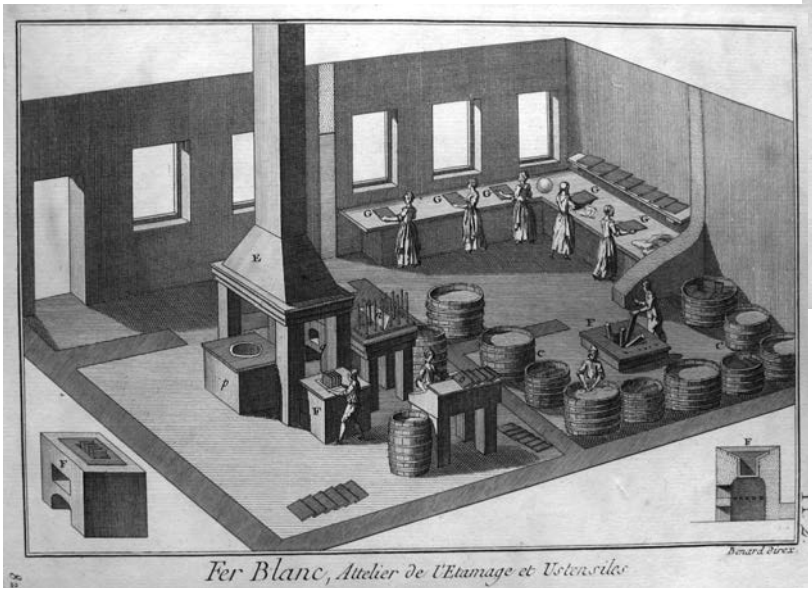
The process of making tinplate is illustrated in *Diderot's Encyclopedia* showing the various steps (Figures 2 and 3). In these early years the iron sheets were forged out under a water-powered triphammer. The sheets were cut to size, then pickled in a weak acid or brine to remove all the scale from forging. After that, the sheets were dipped into melted tin to coat the plates.

Great Britain had long wanted to free itself from importing the German tinplate, and in 1665 Andrew Yarranton, with help from some investors, visited Saxony and figured out the process. Before Yarranton and his investors could produce the tinplate in any quantity the process was patented, and the investors, at that point, abandoned the project either because they were unwilling or, as it was shortly after the Restoration, they were afraid of offending those in power. Therefore, no one made tinplate under this patent, and England continued to import it from Germany.

More than fifty years later in 1720-28, another attempt to produce tinplate in England was made. This time, however, tinplate manufacturing was accomplished through the use of the rolling mill, which was introduced

Figures 2 (right) and 3 (below). Illustrations from Diderot's Encyclopedia *showing the process of tinplate manufacturing. The water-powered triphammer (seen above at right) was used to forge the iron sheets. The cutting, pickling, and dipping of the sheets into the tin are illustrated in Figure 3.*

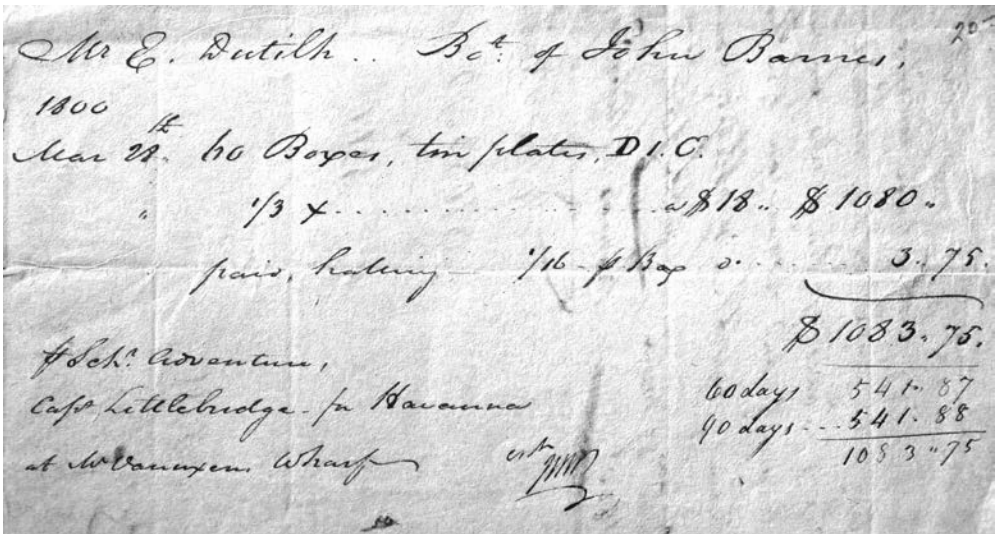




by Major John Hanbury, with tin that was mined in the Cornwall area of England.

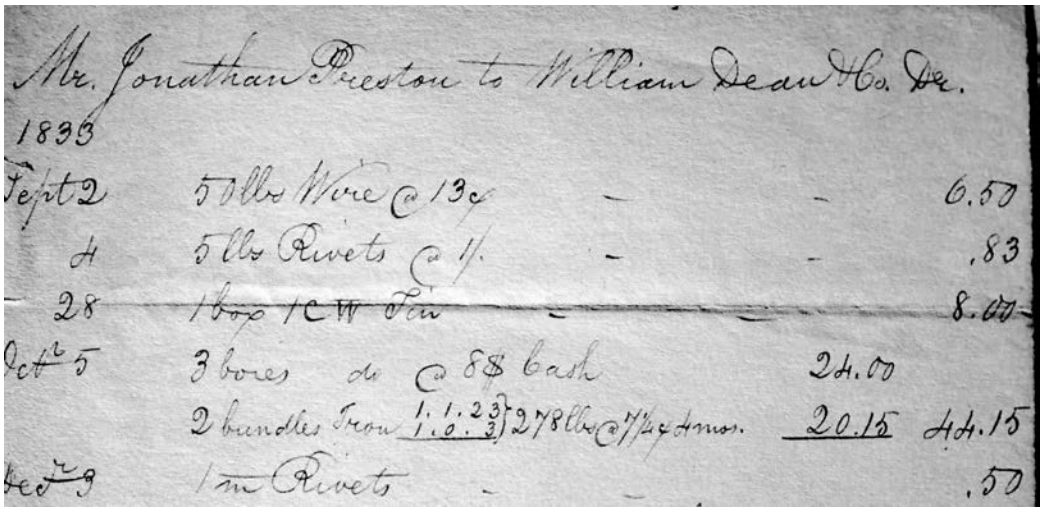
Tinplate was made in two sizes: 10 inches x 14 inches and 12½ inches x 16¼ inches, with the 10-x-14 size dominating most of the production (as seen in the receipts for the purchase of tin and related materials in Figures 4 and 5). The tinplate was sorted by thickness and quality and then packed into a wooden box containing 225 sheets for the 10-x-14 size and 100 sheets for the 12-x-16 size (Figures 6 and 7). This is how the tinplate was shipped to America and sold.

In America, the standard wage of a journeyman tinsmith circa 1800-1820 would have been about a $1 a day. A box of 225 10-x-14 sheets could make about 125 2-quart coffee pots or 75 2½-gallon camp kettles, or 450 4¼-inch diameter by 3-inch high handled cups. A typical sheet of 10-x-14 tinplate at that time


Mr E. Dutilh .. Bot of John Barnes, 20
1800
Mar 28. 60 Boxes, tin plates, D I C
1/3 X ..... @ $18.. $ 1080.
pais, Packing 1/16 ₱ Box 2 ..... 3.75.
$ 1083.75.
₱ Schr Adventure,
Capt Littlebridge - fm Havanna
at Mr Thompsons Wharf
60 days 541.87
90 days .. 541.88
1083.75

Figures 4 (above). A receipt from 1800 for sixty boxes of tin plates. The "D" stands for the double size and the "IC" for the common thickness of 12 thousandths of an inch. The total, with the inclusion of $3.75 for shipping, was $1,083.75!

Figure 5 (right). An 1833 receipt for wire, rivets, and 1CW tinplate (#1 common wasters, 225 sheets, 112 pound base weight).


Mr. Jonathan Preston to William Dean & Co. Dr.
1833
Sept 2 5 lbs Wire @ 13¢ - - 6.50
4 5 lbs Rivets @ 1/. - - .83
28 1 Box 1CW Tin - - 8.00
Oct 5 3 boxes do @ 8$ cash 24.00
2 bundles Iron 1.1.23 / 1.0.3 278 lbs @ 7½¢ 4 mos. 20.15 44.15
Dec 9 1 m Rivets - .50

Unless otherwise noted, all illustrations courtesy William McMillen

Figure 6 (above). A reproduction wooden box for shipping tinplate. This box holds 225 sheets of 10-by-14 inch tinplates. The IXX indicates the that base weight of the contents is 150 pounds.
Author's collection

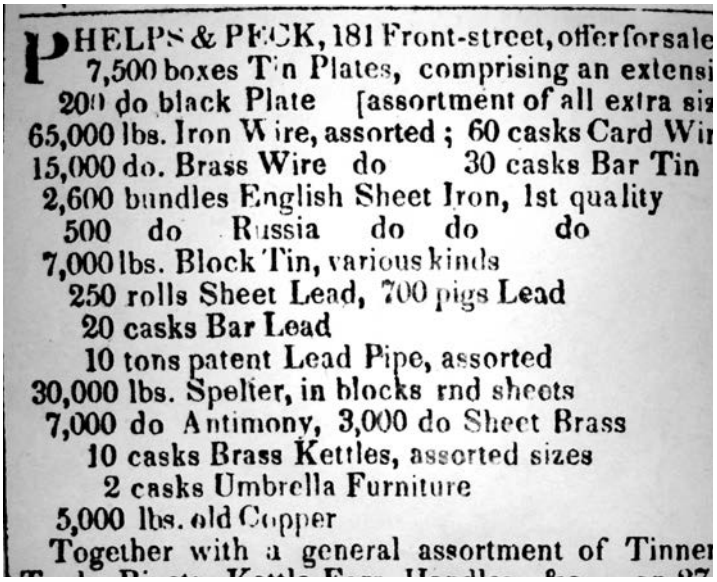

PHELPS & PECK, 181 Front-street, offer for sale
7,500 boxes Tin Plates, comprising an extensi
200 do black Plate [assortment of all extra siz
65,000 lbs. Iron Wire, assorted ; 60 casks Card Wi
15,000 do. Brass Wire do 30 casks Bar Tin
2,600 bundles English Sheet Iron, 1st quality
500 do Russia do do do
7,000 lbs. Block Tin, various kinds
250 rolls Sheet Lead, 700 pigs Lead
20 casks Bar Lead
10 tons patent Lead Pipe, assorted
30,000 lbs. Spelter, in blocks and sheets
7,000 do Antimony, 3,000 do Sheet Brass
10 casks Brass Kettles, assorted sizes
2 casks Umbrella Furniture
5,000 lbs. old Copper
Together with a general assortment of Tinner

Figure 7 (right). An advertisement in The New York Commercial Advertiser, *1830, showing "7,500 boxes Tin Plates."*

cost about 7¢ per sheet. It took a little less than two sheets of tin to make a coffee pot, or about 12½¢ worth of tin. A tinsmith could have made about ten coffee pots in a day. The tin to make the ten pots ($1.25) cost more than the labor to produce it ($1.00). There were additional costs for solder and wire (see Figure 5), of course, as well as the consideration for tools, other overhead, and profit. The coffee pot would sell for about 30–35¢.

American tinsmiths continued to rely on English tinplate throughout the eighteenth and most of the nineteenth centuries. The McKinley Tariff Act of 1890 raised the duty on imports, which prodded manufacturers in America to produce tinplate in the United States.

The Tradesmen

One of the first recorded persons to make tinware in the American colonies was Shem Drowne (December 4, 1683–January 13, 1774), a Boston coppersmith. It is generally acknowledged that the first full-time tinsmith was Edward Patterson, a Scotch-Irish, English-trained immigrant. He settled in Berlin, in central Connecticut, around 1750 and started making tinware, which became increasingly popular within the area (Figure 8). He was soon apprenticing others in the trade, including his sons, who continued in the trade well into the nineteenth century. Berlin became the hub of the tinsmith trade and soon Berlin-trained tinsmiths began to set up shop in other parts of the country.

By the 1770s, on the eve of the American Revolution, tin shops had been established in all the major American cities. By 1810, there were twelve shops for making tinware in Berlin alone, and many more in other areas of the country.

James Upson opened a shop in Marion, Connecticut, prior to the American Revolution. His sons continued in the business into the 1850s. Zachariah Stevens opened a tin shop in Stevens Plains, Maine, and by 1830 there were eleven tin shops in Stevens Plains. By 1806 Oliver Filley became a tinware dealer

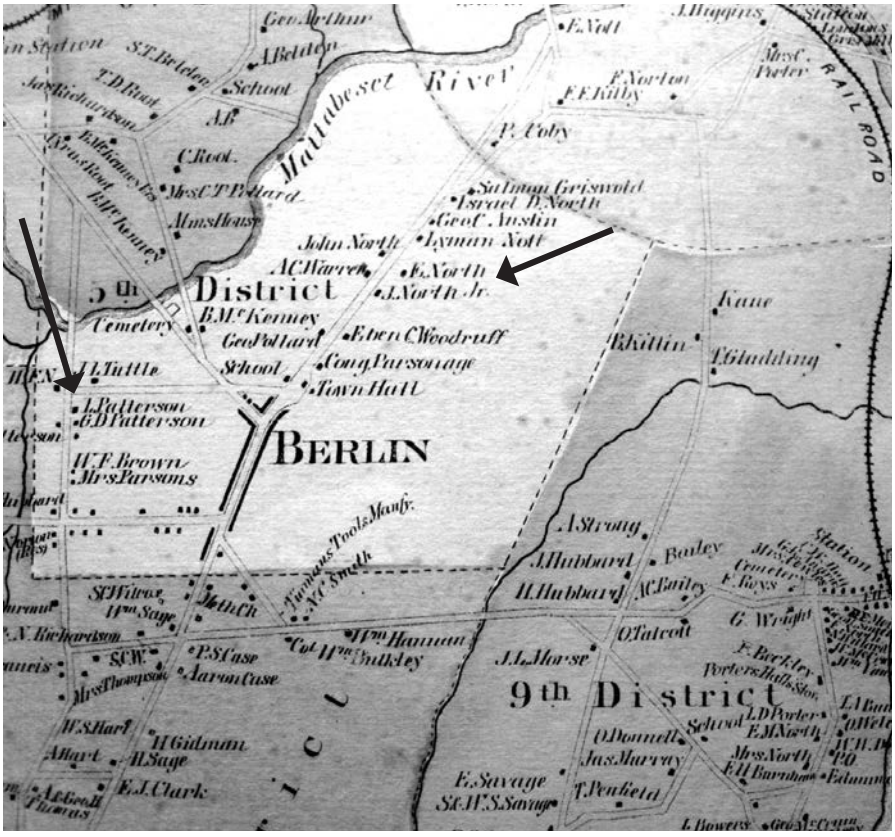


Figure 8. Berlin, Connecticut, was the home (marked on the left side of the map) of Edward Patterson, thought to be American's first full-time tinsmith. Jeddiah and Edmond North (whose names are marked on the right of the map) made tinsmith's tools.

Figure 9 (above). A set of American tinsmith stakes and swedges. From left are a double-seaming stake, square-pen swedge (behind the stake), bench shears, beakhorn stake, blowhorn stake, square stake, bottoming stake, creasing stake, candlemold stake, hatchet stake, and a needlecase stake. At the back of the bench on the left is a creasing swedge and on the right a cullender swedge.

Figure 10 (below). More tools: (top row) hollow punches; (middle row) seam set; rivet set; (bottom row) shears, wire nips, scribe, setting hammer, two raising hammers, and a wooden mallet.

in Bloomfield, Connecticut. He employed many tinsmiths, producing tinware that was peddled and sold all over New England. He also opened branch shops in New Jersey, New York, and Pennsylvania, which continued into the 1860s.

The Tools

In the earliest years the American tinsmith used imported tools, but not too long after tinsmith Edward Patterson began working in Berlin, Connecticut, he began training apprentices who then became journeymen, and the number of tinsmiths grew. Soon, there was greater demand for tools, and the local blacksmiths in Berlin began making tinners tools. At first, they copied the imported tools but soon they were making and improving the design according to the tinsmith's needs. By the 1780s,

CONTINUED ON PAGE 51

Figure 11 (right). A bench shear made by "J. & E. North Berlin Conn." circa 1824–1840, 29 inches long.

Bench Stakes and Swedges and How They Were Used

All of the stakes and swedges described in Figures 13-24 are meant to be placed in tapered square holes along the front of the work bench. The names of these tools have been associated with them since the third quarter of the eighteenth century, if not earlier. The name of each particular stake implies what the item being made with it was, such as a "candle mold" stake. In reality, however, these stakes were used for forming whatever item best fit the stake. For instance, I would use at least six stakes to make a one-quart drinking mug.

A hatchet stake (Figure 13) was used to turn the edge of a straight piece of tin plate to form a sharp fold in order to make a locked seam with two pieces or to lock together the edges of a cylinder. It is also used to form an open fold in order to insert a wire to stiffen an edge.

After a wire is inserted into the open fold of tinplate it is hammered down onto the proper size groove on a **creasing or wireing stake** (Figure 14) to form the tin completely around the wire.

The **square stake** (Figure 15) is used to burr or turn a 90-degree fold on straight tinplate, as on the bottom and sides of a square pan.

The **bottoming stake** (Figure 16) is used to turn a burr on round or oval disks to form the bottom of a round or oval container.

The **beakhorn stake** (Figure 17) is a larger stake that has a long, flat section with a 90-degree edge and a 130-degree edge. It is used to form a long 90-degree or more edge or fold. The flat edge can also set fast a set-down seam on the bottom of a vessel by inverting the piece and hammering the bottom of the seam as it sits on the edge of the stake. The round end can be used to form all types of cylinders and also to set a locked seam with a hand grooving tool, which is moved along the seam as it is hammered to lock it.

The **blowhorn stake** (Figure 18) is used to make a tapered objects such as a coffee pot spout on the long, thin end and funnel-shaped objects on the flared end.

The long end of the **candle mold stake** (Figure 19) is used to form a long, slightly tapered tube, such as a candle mold or dipper handle.

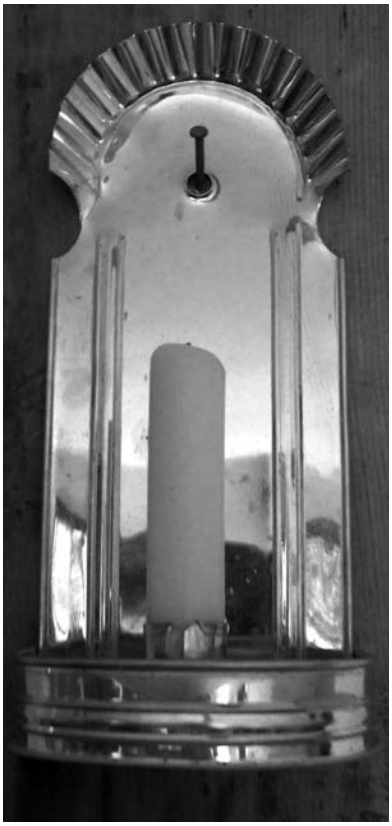
The **needlecase stake** (Figure 20) is used to form thin tubes or rings on the round end and small items that have to be turned 90 degrees on the flat end.

The **double-seaming stake** (Figure 21) has two oval arms, which have larger oval ends that will accept different size round or oval vessels in order to make a double seam on their bottoms. The seam is made by hammering the set down seam up against the body of the vessel.

A **square-pan swedge** (Figure 22) is used to crease a straight line in order to turn up the sides or to form a square or rectangular tray or pan. It is also used to scallop or flute the edge of a round pan or sconce. One edge is sharper to crease a sharp line, and the other edge is rounded to create the fluted edge.

A **cullender swedge** (Figure 23) can make two different size triple beads—a larger center bead flanked by two smaller beads (see the scone in Figure 12). It is used on coffee pots, colanders, and other tinware to stiffen or decorate a piece.

A **creasing swedge** (Figure 24) is used to crease a line on a round or curved piece of tin. It has four different size grooves to fit the sharper edges of the two hammers. The flat end of one hammer creased a raised bead on the edge of a small can to provide a stop for a lid.



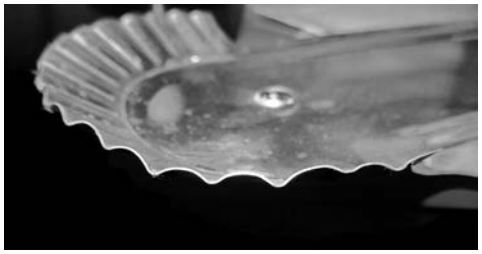


Figure 12 and detail (above). A sconce formed using all three swedges (Figures 22-24). The curve on the top of the sconce was formed with the creasing swedge. The fluted top edge was made with the square-pan swedge. The decorative triple bead that was added on the bottom and on the vertical edges was made using the cullender swedge. Wire was inserted along the vertical edges of the sconce to strengthen it. The edges of the sconce were turned on a hatchet stake and then the wireing stake was used to set the wire within the turned edges.

Sconce by the author. Collection of Bruce and Patty MacLeish

Figure 13 (above). Hatchet stake marked "J. & E. NORTH /BERLIN CT" circa 1835-1854, 14½ inches wide.

Figure 14 (right). A creasing or wireing stake marked "J. & E. NORTH/BERLIN/CONN" circa 1824–1840, 11 inches long.

Figure 15 (left). A square stake marked "J.&E. NORTH/ BERLIN CT" circa 1835-1854; 5 inches x 2½ inches at top.

Figure 16 (right). A bottoming stake, unmarked, circa 1820, 1½ inches wide x 14 inches high.

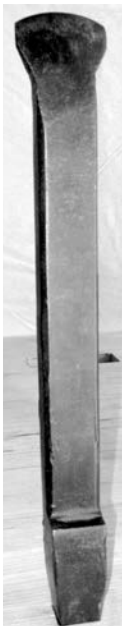
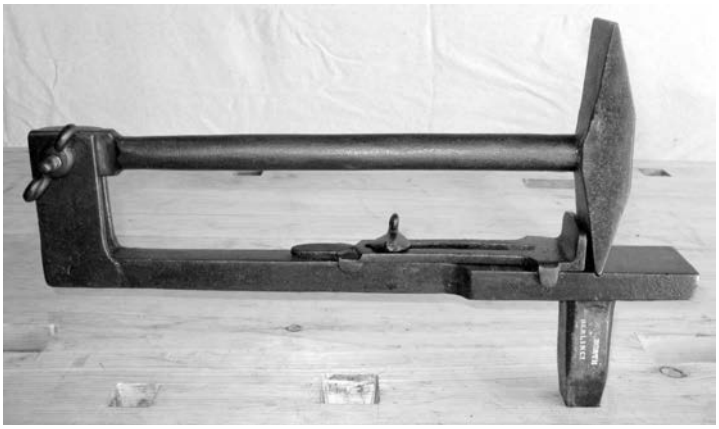


Figure 17 (above). A beakhorn stake marked "J. & E. NORTH /BERLIN CT" circa 1835-1854, 40 inches long.

Figure 18 (left). A blowhorn stake made by J.&E. North Berlin, Connecticut, circa 1834-1854, 25½ inches.

Figure 19 (above, left) A candlemold stake marked "J.&E. NORTH/BERLIN/CONN" circa 1824–1840, 24 inches long.

Figure 20 (above, right) A needlecase stake marked "J.&E. NORTH/BERLIN/CONN" circa 1824–1840, 18 inches long.



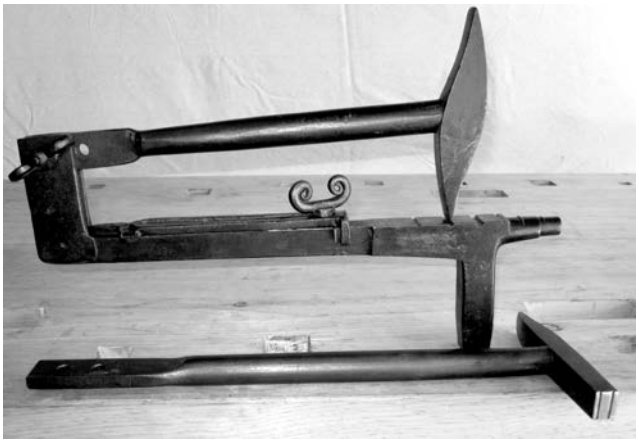
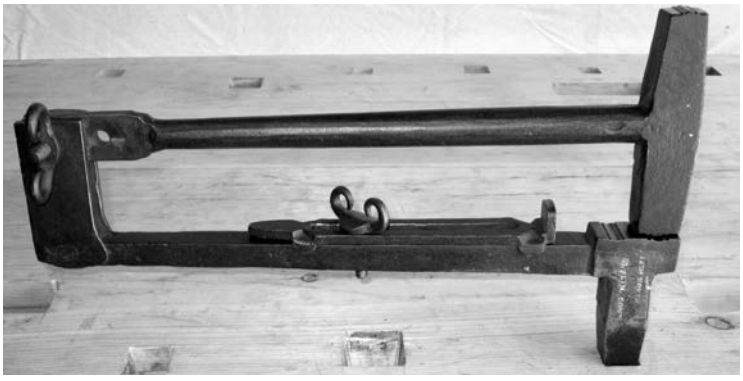


Figure 21 (above). A double-seaming stake marked "J. NORTH" (Berlin, Connecticut), 1810-1824; 21 inches long.

Figure 22 (right, top). A square-pen swedge marked "J.&E. NORTH BERLIN CT" circa 1835-1854.

Figure 23 (below). A cullender swedge marked J.&E. NORTH/BERLIN/CONN."

Figure 24 (right). A creasing swedge with two hammers made by Wilcox & Roys Sawpit N.Y., 1834.



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a distinctively American set of tin tools was being manufactured, and by 1810 there were six blacksmith shops in Berlin making tinsmith tools.

A full set of tinsmith's tools consisted of a double-seaming stake, a bench and hand shears, a beakhorn stake, a blowhorn stake, a square stake, a bottoming stake, a creasing stake, a candlemold stake, a hatchet stake, a needlecase stake, a raising hammer, hollow punches, a setting hammer, a creasing swedge, a cullender swedge, and a square-pan swedge. (Figures 9–11 and 13-24 illustrate many of the tools; see the box "Bench Stakes and Swedges and How They Were Used" for information on how the tools were used.) Most of the earliest tools were not marked by their makers, but by 1800 the manufacturers began to do so.

One of the major makers of tinsmith tools was Jedediah North, who opened his blacksmith and tool shop in 1810 (Figure 25). He marked his tools with his name and "BERLIN CONN."(Figure 26). In 1824 he took his brother Edmond in as a partner, and from that

Figures 25 (left). A broadside advertising toolmaker J. & E. North of Berlin, Connecticut. North was active 1824-1854. As Berlin became a center of production of tinware, the need for tinners tools increased and the town's toolmaking business took off.

Figure 26 (left, top). Jedediah North's mark.

Figure 27 (left, bottom). The mark of Jedediah and Edmond North.

Figure 28 (right, top). A "J. WILCOX" mark on a seam set.

Figure 29 (right, bottom). The Wilcox & Roys, Sawpit, New York, mark 1830-1838.


WM. BULKLEY,
BERLIN, CONN.
MANUFACTURER AND DEALER IN ALL KINDS
OF
TINMEN'S TOOLS
OF
Every description for the Manufacture of Tin and Sheet Iron Ware.
ALSO,
PATENT ROTARY SHEARS,
For cutting Circles from Tin or other Sheet Metals, and turning an Edge at the same time,
A SUPERIOR MACHINE
to any manufactured in the United States.
All orders addressed to him or his Agents in the principal Cities of the Union, will be promptly attended to.

Figure 30 . A broadsides advertising Wm. Bulkley of Berlin Connecticut. Bulkley's ad featured machines rather than hand tools.

point, their tools were marked "J & E NORTH BERLIN CONN" (Figure 27). The firm continued manufacturing tinsmith's hand tools until 1854 when Jedediah died.

Other makers of tinsmith's hand tools in the early nineteenth century who marked their tools were Josiah Wilcox, Sawpit, New York (Figure 28); Wilcox & Roys, Sawpit, New York (Figure 29); Roys & Wilcox Co., East Berlin, Connecticut; Justus and William Bulkey, Berlin, Connecticut (Figure 30); Lyman Wilcox, Berlin, Connecticut; and Franklin Roys & Co., Berlin, Connecticut.

Machines

On April 14, 1804, two men from Dedham, Massachusetts, Eli Parsons and Calvin Whiting, received a United States patent for machines to do the various steps in forming parts for tinware. Work on these machines progressed slowly until 1810 when Seth Peck, a tinsmith himself, along with his two brothers, signed an agreement with the patent holders to make, improve, and sell the machines. In 1819, Seth Peck bought the patent rights and continued his improvements as well as obtaining patents of his own from his factory in Southington, Connecticut. His machines were sold through agents throughout the country (Figures 31 and 32). By 1835 most tinsmiths were using Seth Peck

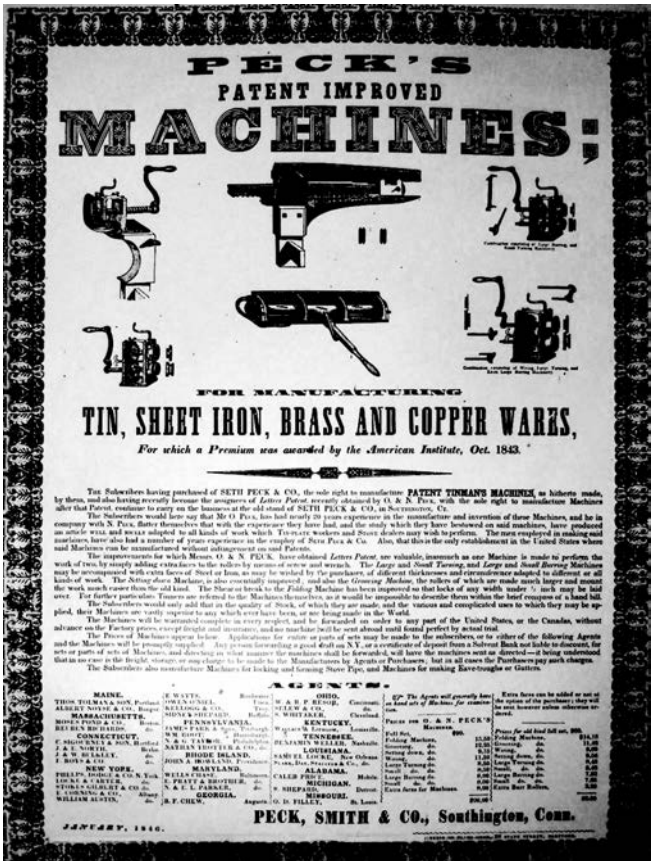
CONTINUED ON PAGE 54


IMPROVEMENT.
THE Public are informed, that the Subscriber, at Southington, (Connecticut,) has made such arrangement
will enable him to supply, at short notice, those persons in any part of the United States, who may want
Patent Improved Machinery,
For manufacturing WARE of TIN PLATE, SHEET IRON, BRASS or COPPER.
Facts authorize him to state, that his MACHINERY has at length overcome every opposition, and quieted
ery doubt. So general has become its use, in the various parts of the country, as to supersede the necessity o
enumeration of its merits. This Machinery is in successful operation in the cities of New-York, Philadel
Baltimore, Boston, Albany, Providence, Charleston, Portland, Augusta, Cincinnati, Pittsburgh, and in almos
ery other place in the United States; and is throughout the principal part of New-England used as the only
of manufacturing Tin Ware.
The principles of the Machinery, as also the Letters Patent of the Subscriber, embrace the Manufacture of
and other apparatus for Stoves; and Machines for this purpose are already made use of, with great approbatio
Application for entire sets or parts of this Machinery, may be made to either of the following mentioned A
for the Subscriber:—
Andrew Seger, No. 28, Bowery, New-York City.
John Hazlet, corner of Chatham and Chamber-sts. do.
Orrin Peck, Scipio, N. Y.
William Austin, Market-street, Albany.
Burrage Yale, South-Reading, (near Boston,) Mass.
Andrew Johnson, Providence, R. I.
John Black, Easton, Penn.
John Butterworth, 335, North-Third-st. Philadel
Harvey Filley, Philadelphia.
Leonard Hitchcock, Charleston, S. C.
Isaac Mansfield, Lexington, Ken.
Norman Bird, Cincinnati, Ohio.
Nathan Winslow, or } Portland, Maine.
Silas North, }
Southington, May 10, 1822.
SETH PECK

Figure 31(above, left). A circa 1835 Seth Peck trade token. It reads, "PECK'S PATENT MACHINES/IN COMPLETE SETTS/MADE AT /TROY, N.Y."

Figure 32 (above, right). Seth Peck's 1822 advertisement for his machines; the ad lists Peck's agents found along the east coast and into Kentucky and Ohio.

Figure 33 (right). Seth Peck's mark. His machines were not marked until after circa 1830.



PECK'S
PATENT IMPROVED
MACHINES;

FOR MANUFACTURING
TIN, SHEET IRON, BRASS AND COPPER WARES,
For which a Premium was awarded by the American Institute, Oct. 1843.

The Subscribers having purchased of SETH PECK & CO. the sole right to manufacture PATENT TINMAN'S MACHINES, as hitherto made, by them, and also having recently become the assignees of *Letters Patent* recently obtained by O. & N. Peck, with the sole right to manufacture Machines after that Patent, continue to carry on the business at the old stand of SETH PECK & CO., in Southington, Ct.

The Subscribers would here say that Mr O. Peck, has had nearly 20 years experience in the manufacture and invention of these Machines, and he in company with N. Peck, flatter themselves that with the experience they have had, and the study which they have bestowed on said machines, have produced an article well and widely adapted to all kinds of work which Tin-ware workers and Store dealers may wish to perform. The men employed in making said machines, have also had a number of years experience in the employ of Seth Peck & Co. Also, that this is the only establishment in the United States where said Machines can be manufactured without infringement on said Patents.

The improvements for which Messrs. O. & N. PECK. have obtained *Letters Patent*, are valuable, inasmuch as one Machine is made to perform the work of two, by simply adding extra faces to the rollers by means of screw and wrench. The *Large* and *Small Turning*, and *Large* and *Small Burring* Machines may be accompanied with extra faces of Steel or Iron, as may be wished by the purchasers, of different thicknesses and circumference adapted to different or all kinds of work. The *Setting down* Machine, is also essentially improved, and also the *Grooving Machine*, the rollers of which are made much larger and mount the work much easier than the old kind. The Shear or break to the *Folding* Machine has been improved so that locks of any width under ½ inch may be laid erect. For further particulars Tinmen are referred to the Machines themselves, as it would be impossible to describe them within the brief compass of a hand bill.

The Subscribers would only add that in the quality of Stock, of which they are made, and the various and complicated uses to which they may be applied, their Machines are vastly superior to any which ever have been, or are being made in the World.

The Machines will be warranted complete in every respect, and be forwarded on order to any part of the United States, or the Canadas, without advance on the Factory prices except freight and insurance, and no machine will be sent abroad until found perfect by actual trial.

The Prices of Machines appear below. Applications for entire or parts of sets may be made to the subscribers, or to either of the following Agents and the Machines will be promptly supplied. Any person forwarding a good draft on N.Y., or a certificate of deposit from a Solvent Bank not liable to discount, for sets or parts of sets of Machines, and directing in what manner the machines shall be forwarded, will have the machines sent as directed—it being understood that in no case is the freight, storage, or any charge to be made to the Manufacturers by Agents or Purchasers, but in all cases the Purchasers pay such charges.

The Subscribers also manufacture Machines for locking and forming Stove Pipe, and Machines for making Eave-troughs or Gutters.

AGENTS.

MAINE.	OHIO.	
THOS TOLMAN & SON, Portland	E. WATTS, Baltimore	
ALBERT NOYES & CO., Bangor	O'NEAL & NEAL, Troy	W. & D. P. BISSO, Cincinnati, do.
MASSACHUSETTS.	KELLOGG & CO., Troy	ALLEN & CO., Cleveland
MOSES PUND & CO., Boston	SIDNEY & SHEPARD, Albany	A. WHITAKER, do.
REUBEN RICHARDS, do.	PENNSYLVANIA.	KENTUCKY.
CONNECTICUT.	JAMES PARK & Son, Pittsburgh	WILSON & LEMON, Louisville
C. SHOWERS & SON, Hartford	WM. ——, Philadelphia	TENNESSEE.
J. & W. SCALLY, do.	N. & G. TAYLOR, do.	BENJAMIN WELLER, Nashville
J. & W. SCALLY, do.	NATHAN LIGHTER & Co., do.	LOUISIANA.
J. BOYS & CO. do.	RHODE ISLAND.	SAMUEL LOCKE, New Orleans
NEW YORK.	JOHN A. HOWLAND, Providence	ALABAMA.
PHILLIPS, DODGE & CO. N. York	MARYLAND.	CALEB FORD, Mobile
LOCKE & CARTER, do.	WELLS CHASE, Baltimore	MICHIGAN.
STORRS GILBERT & CO. do.	PRATT & BROTHER, do.	S. SHEPARD, Detroit.
I. LOCKWOOD & CO., Albany	A. E. L. PARKER, do.	GEORGIA.
WILLIAM ALSTIN, do.	B. F. CHEW, Augusta.	MISSOURI.
		O. D. FILLEY, St. Louis.

☞ *The Agents will generally have on hand sets of Machines for examination.*

PRICES FOR O. & N. PECK'S Machines.

Full Set,	$90.
Folding Machine,	15.00
Grooving, do.	12.00
Setting down, do.	9.00
Wiring, do.	11.00
Large Turning do.	8.00
Small do. do.	6.00
Large Burring do.	6.00
Small do. do.	6.00
Extra Burr Rollers,	3.00
Extra faces for Machines,	6.00

Extra faces can be added or not at the option of the purchaser; they will be sent however unless otherwise reserved.

Prices for old fixed full set, $80.

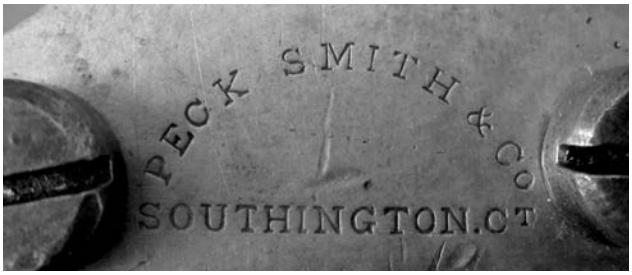
Folding Machine,	$14.00
Grooving, do.	11.00
Setting down, do.	8.00
Wiring, do.	8.00
Large Turning do.	8.00
Small do. do.	6.00
Large Burring do.	7.00
Small do. do.	6.00
Extra Burr Rollers,	3.00

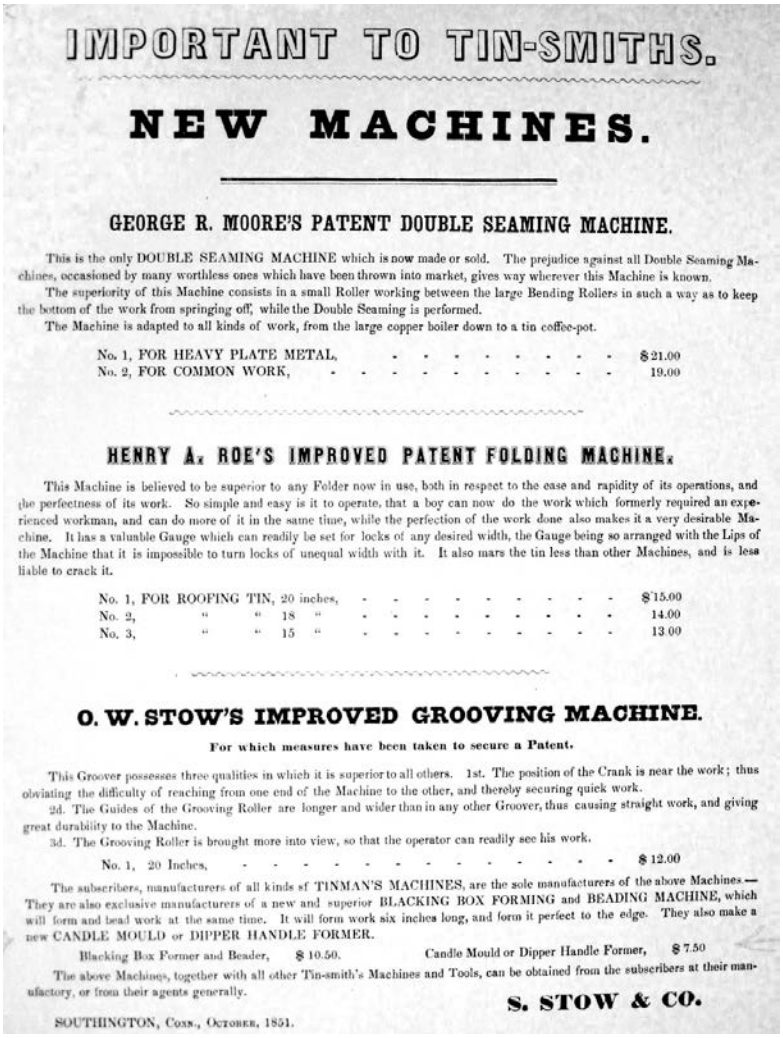
JANUARY, 1846.

PECK, SMITH & CO., Southington, Conn.

Figure 34 (above). An 1846 broadside for Peck, Smith & Co., which notes that "...this is the only establishment in the United States where said Machines can be manufactured without infringement on said Patents."

Figure 35 (below). The mark of Peck, Smith & Co.





IMPORTANT TO TIN-SMITHS.

NEW MACHINES.

GEORGE R. MOORE'S PATENT DOUBLE SEAMING MACHINE.

This is the only DOUBLE SEAMING MACHINE which is now made or sold. The prejudice against all Double Seaming Machines, occasioned by many worthless ones which have been thrown into market, gives way wherever this Machine is known.

The superiority of this Machine consists in a small Roller working between the large Bending Rollers in such a way as to keep the bottom of the work from springing off, while the Double Seaming is performed.

The Machine is adapted to all kinds of work, from the large copper boiler down to a tin coffee-pot.

No. 1, FOR HEAVY PLATE METAL,	$21.00
No. 2, FOR COMMON WORK,	19.00

HENRY A. ROE'S IMPROVED PATENT FOLDING MACHINE.

This Machine is believed to be superior to any Folder now in use, both in respect to the ease and rapidity of its operations, and the perfectness of its work. So simple and easy is it to operate, that a boy can now do the work which formerly required an experienced workman, and can do more of it in the same time, while the perfection of the work done also makes it a very desirable Machine. It has a valuable Gauge which can readily be set for locks of any desired width, the Gauge being so arranged with the Lips of the Machine that it is impossible to turn locks of unequal width with it. It also mars the tin less than other Machines, and is less liable to crack it.

No. 1, FOR ROOFING TIN, 20 inches,	$15.00
No. 2, " " 18 "	14.00
No. 3, " " 15 "	13.00

O. W. STOW'S IMPROVED GROOVING MACHINE.

For which measures have been taken to secure a Patent.

This Groover possesses three qualities in which it is superior to all others. 1st. The position of the Crank is near the work; thus obviating the difficulty of reaching from one end of the Machine to the other, and thereby securing quick work.

2d. The Guides of the Grooving Roller are longer and wider than in any other Groover, thus causing straight work, and giving great durability to the Machine.

3d. The Grooving Roller is brought more into view, so that the operator can readily see his work.

No. 1, 20 Inches,	$12.00

The subscribers, manufacturers of all kinds of TINMAN'S MACHINES, are the sole manufacturers of the above Machines.—They are also exclusive manufacturers of a new and superior BLACKING BOX FORMING and BEADING MACHINE, which will form and bead work at the same time. It will form work six inches long, and form it perfect to the edge. They also make a new CANDLE MOULD or DIPPER HANDLE FORMER.

Blacking Box Former and Beader, $10.50. Candle Mould or Dipper Handle Former, $7.50

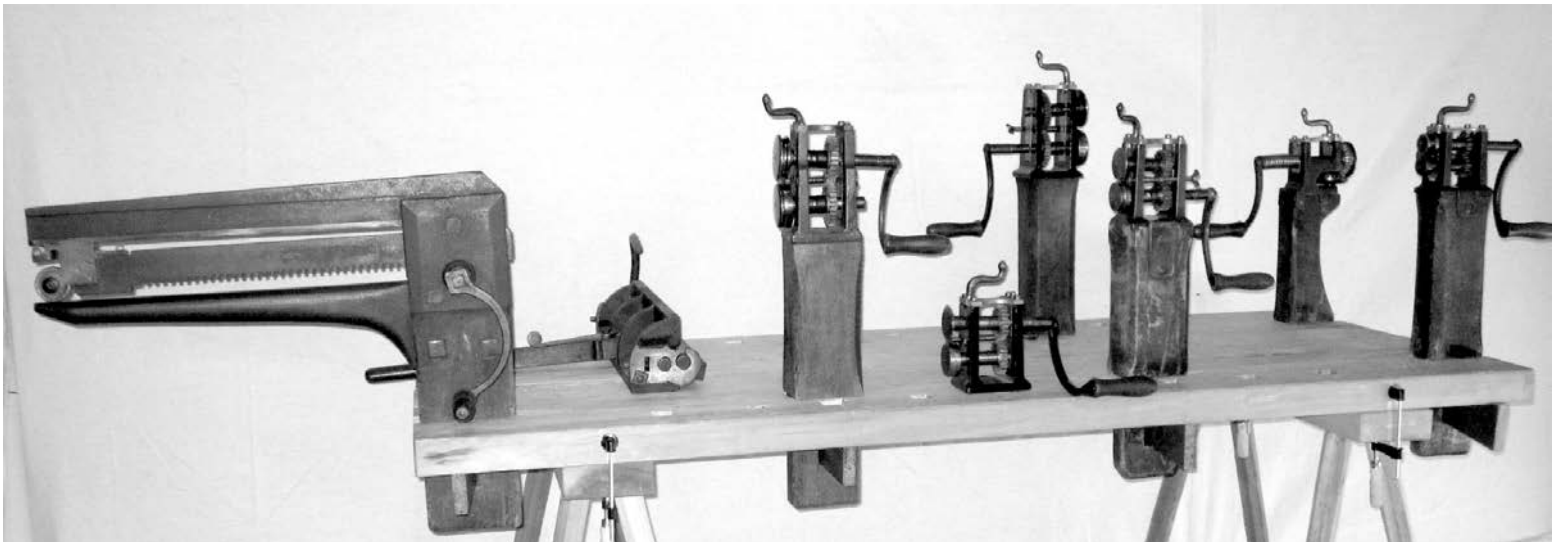
The above Machines, together with all other Tin-smith's Machines and Tools, can be obtained from the subscribers at their manufactory, or from their agents generally.

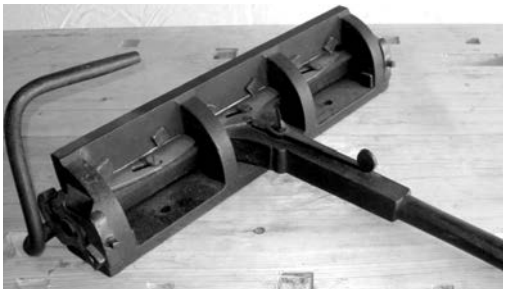
S. STOW & CO.

SOUTHINGTON, Conn., October, 1851.

Figure 36 (above). An 1851 advertisement for new tinsmith machines from S. Stow & Co.

Figure 37 (below). A set of tinsmith's machines. From left are a grooving machine, a folding machine, a wireing machine, a large burring machine (without post), a large turning machine, a small turning machine, a setting down machine, and a small burring machine..





Figures 38 (above). An unmarked bar folder, 1820-1840.

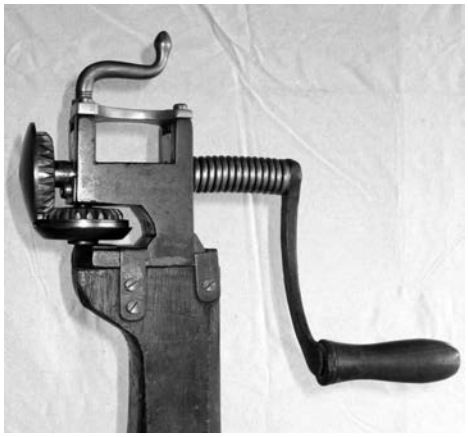


Figure 39 (near right). A setting down machine.

Figure 40 (far right). A wireing machine.

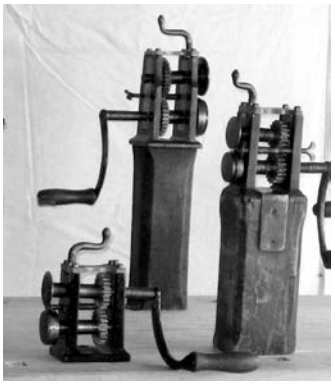


Figure 41 (above). Before circa 1850, tinsmiths made wooden bases to hold machines.

Figure 42 (right) After 1850, detachable iron standards were sold with the machines.

machines. After circa 1830, Seth Peck marked his machines (Figure 33).

In 1843 Peck conveyed his rights to the machines to newly-formed Peck, Smith & Company (Figure 34), and, thereafter, his machines were so marked (Figure 35). Other companies—Solomon Stowe in Southington, Connecticut (Figure 36); Aaron Whitney of Woodstock, Vermont; and Roys Wilcox in East Berlin, Connecticut—began to manufacture machines.

A set of tinners machines consisted of a folding machine, a grooving machine, a small burring machine, a large burring machine, a small turning machine, a large turning machine, a wireing machine, and a setting-down machine (Figures 37-40).

The early machines were purchased without a base, and the tinsmith would have made a wooden post to hold them (Figure 41). Starting in about 1850, detachable iron standards were being included with the machines (Figure 42). The main advantage of these new stands was that unlike on the wooden posts, which were fixed, the iron standards could rotate. These machines greatly improved the production in the shops which, in turn, made tinware available to everyone.

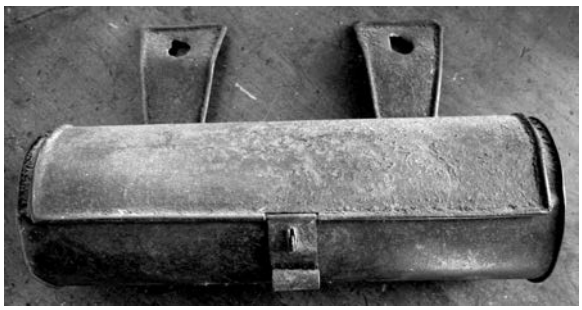
Products

Almost all tinware is constructed in three basic forms: square, cylindrical, and cone (Figures 43 and 44). Tinplate is not easily formed into round spherical shapes except for small items such as domed lids (as seen in the coffee pots and other items in Figures 43 and 44). During the American Revolution, the supply of tinplate from England was, of course, cut off. What little tinplate tinsmiths could obtain was made into camp kettles (like those shown on the left in Figure 43) and tin cartridge boxes (Figure 45) as an alternative to leather ones. The majority of items made by tinsmiths were common lighting devices, cooking, and kitchen items and serving and storage items (Figures 46-49). Most all of these products were bright and shiny tin but dulled with use and age. Tinsmiths also made house heads for under the gutters, conductor pipes, or down spouts (Figure 47).

By 1810, most of the larger shops, such as those operated by James Upton, Oliver Filley, and Zachariah Stevens, were also japanning and flowering tinware (Figure 50).

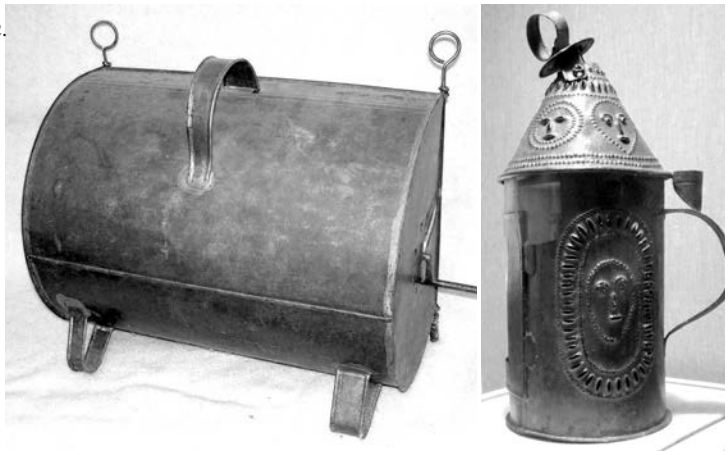
Figures 43(above). Reproductions of typical eighteenth-century tin items.
AUTHOR'S COLLECTION

Figure 44 (right). Typical nineteenth-century tin items. These and the items in Figure 50 illustrate the basic shapes into which tin could be formed—square, cylindrical and coned.
Figure 45 (below). A tin cartridge box from the Revolutionary War in America. Tin was used as a replacement for leather in the war.



Figures 46–49. Typical tin household items.
Figure 46 (above, middle). A hanging candlebox, 1780-1840.
Figure 47 (right). House heads for gutters and downspouts on houses.

Figure 48 (near right). A small, three-sheet tin kitchen or roasting oven.
Figure 49 (far right). An eighteenth-century pierced lantern.
Figure 50 (below). Examples of japanned and flowered tinware.



Japanning is a mixture of clear varnish and asphaltum. The flowering was done by women hired by the tin shop. The designs were executed with light brush strokes using primary and secondary colors mixed with turpentine and varnish.

By the 1850s stamping companies were selling factory-made tinware with stamped out parts with japanned and stenciled finishes, which signaled the beginning of the end of the handmade tinware industry. The small tin shops still produced work but turned away from household items towards duct work and tin roofing.

Author

Longtime EAIA member William McMillen (Figure 51) is a master tinsmith. He regularly teaches courses in tinsmithing at the EAIA workshops at Eastfield Village, where he is a regular instructor. This article will be followed with one that describes how a tinsmith forms seams and the purpose of the various tin machines.

Figure 51. The author.

A History of Water Pump Pliers

by Warren Hewertson and George Radion

This article celebrates the centennial of the arrival on the market of patented water pump pliers—angled adjustable pliers sometimes known as slip-joints or channellocks (after two joint types) Examples are shown on the back cover. They soon proved to be perfect for access to hard-to-reach nuts and bolts, and were invaluable to auto mechanics working on engine water pumps—hence their name. From invention and manufacture in Illinois, these tools found widespread acceptance. This paper is based on information published previously,[1] together with recently acquired detail of early manufacture and more recent developments.

The Industrial Revolution was initially powered by water, which drove the wheels, pulleys, and belts of the mill. The care and maintenance of this power depended on the traditional skills of the millwright. The invention of steam engines was first applied in Cornish tin mines in the south of England. The use of steam spread rapidly during the eighteenth century, most particularly in the processing of the product that provided the massive economic growth of the Western economy—cotton. The early replacement of horse-drawn heavy transport by steam locomotion is probably best known through Stephenson's Rocket. The phenomenal growth of rail transport gave rise to huge demands for steel for locomotives, rolling stock, rails, and later bridges. Additionally, the mid-nineteenth century witnessed the demise of wooden ships and a huge increase in steel shipbuilding. The first trans-Atlantic crossing on an iron-hulled steamship was in 1846. Along with the urbanizatin of the West came the demand for agricultural machinery to replace the diminished rural workforce. These factors had a major impact in North America with the opening up of vast areas of country for agriculture and the need for reliable rapid transport over great distances. In something like fifty years, the skills in demand for stationary and motive power moved largely from woodworking, via blacksmithing, to factory engineering—hence, the huge rise in the number of implements to service the man-made power generation replacing millennia-old wind, water, and animal power.

Steam generation was fuelled largely by coal. Coal was in demand, also, for the smelting of metals—via coke. This relieved the pressure on the forests of Britain that had provided charcoal for the early build-up of the iron and steel industries. Other fossil fuels, oil and gas, were used, initially for light and heat generation. Much later, in the early-twentieth century, these fossil fuels replaced coal as the feedstock for the large-scale chemical industry. The long, slow, development—from the studies of Michael Faraday (in the 1840s) and others, to electricity generation and its use for lighting and power supply—culminated in huge coal fired power stations. These advancements were followed by the return of water power in the spectacular harnessing of Niagara Falls by Nikola Tesla's technology for alternating current generation. In recent times, wind power has re-emerged—also using new technology. Specialist tools evolved to build and support these advances. Despite the Civil War, in the last half of the nineteenth century, North America rivaled Europe in technology and trade.

In the 1890s the introduction of road transport vehicles—first steam driven, then those using the internal combustion engine—brought about the ability to travel independently of rail tracks, allowing great freedom over short and long distances and individual travel. The safety bicycle had replaced the cumbersome "penny farthing" by this time, which brought transport within the reach of low-paid employees. These factors increased the demand for steel. Before the subject of this article had developed to the early stages of the form known today, the Wright brothers ushered in air travel. With World War I came the development of the tank and a great increase in steel shipping.

The foregoing goes some way to setting the scene for the vast array of tools for manufacturing, maintaining, adjusting, tightening, and dismantling all manner of mechanical contrivances. Tools for all these developments have demonstrated the incredible ingenuity of man. Variations were broad ranging, developed to achieve a specific purpose, to broaden an application, or to overcome patents. Because of their functional nature, such tools as wrenches (called spanners in the United Kingdom), tongs, and pliers are usually unadorned. They certainly have not attracted the attention of collectors and tool enthusiasts as, say, woodworking planes. This is perhaps not surprising, considering the appeal of wood and the importance of building beautiful furniture and early coaches. However, the permutations of design and function of mechanics tools displays sophistication of the highest order. The already classic works of Alfred and Lucile Schulz and Kenneth L. Cope have demonstrated this point.[2] This article concentrates on a tool born a century ago in the United States after a gestation period of about fifty-five years. Contributions before and after 1913, mainly from North America and Europe, are discussed. By and large, original developments and significant improvements are dealt with, rather than an exhaustive survey of companies producing their versions on the demise of inventors' patents.

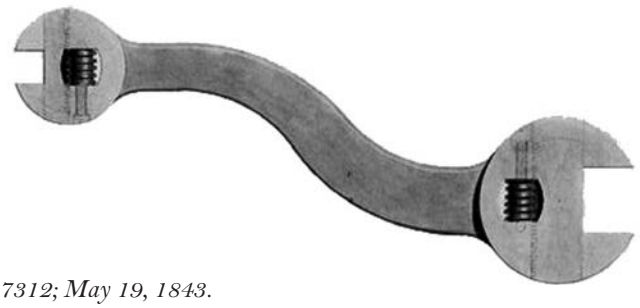


Figure 1 (above). Budding's adjustable spanner, British-registered design no. 7312; May 19, 1843.

Figure 2 (above, right). Clyburn's double-headed, S-shaped handle, adjustable spanner; British-registered design no. 9250; August 15, 1843.

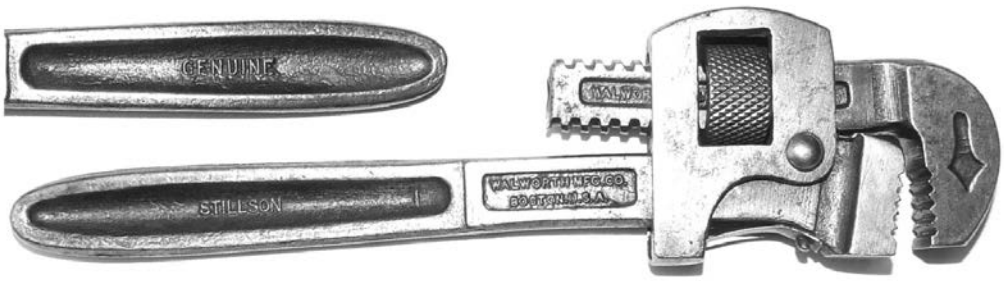


Figure 3. An 8-inch example of the original Walworth Stillson patent wrench. Its ease of adjustment and serrated jaws contributed to its worldwide adoption. Sizes ranged from 8 inches to 30 inches. Stillson's name is embossed in three places.

Early Adjustable Wrenches

The first adjustable, single-handled spanner was by Edwin B. Budding (Figure 1) in England in 1843. He used a rack-and-worm drive in the back of the handle as the adjustment mechanism. Budding was the inventor of the lawn mower (1830). Richard Clyburn, also from the United Kingdom, registered his famous lateral version later in the same year. He utilized S-shaped handles, and even claimed a double-headed model (Figure 2). This worm gear mechanism was favoured, some fifty years later, by the Crescent Tool Company in North America and by B.A. Hjorth (later BAHCO) in Europe. Both Budding and Clyburn were engineers in different works near Stroud, Gloucestershire.[3] These single-handled, adjustable spanners were developed some seventy years before the first true water pump pliers.

Daniel C. Stillson, of Charlestown, Massachusetts, invented the first universally acclaimed pipe wrench (U.S. patent no. 95,744; October 12, 1869). This, and subsequent improvements, became perhaps the most copied new tool of the nineteenth century (Figure 3). Patented refinements were still being lodged more than a century after its first appearance. Stillson's pipe wrench saved his employer, Walworth Manufacturing Company of Boston, from financial problems.

Water Pump Pliers—A Definition

Figure 4 shows typical examples of the familiar style of pliers under discussion. Excluded from this article is a whole range of tools, whether simply patented or actually manufactured, that are deemed to have an overly bulky gripping head. Grip-lock pliers are not considered; they have a fixed fulcrum.

The tools described in this article as water pump pliers incorporate three features:

- two lever handles connected through a fulcrum to two jaws; i.e. they are pliers, not adjustable spanners/wrenches;
- a mechanism to allow the fulcrum (or pivot) to change from one firm position to another; and
- jaws angled away from the axis, about 45 degrees, in the plane of the lever handles. Each jaw is usually designed to meet across the width to attain a firm grip.

By and large, pliers are one-handed, and tongs are rather larger two-handed tools.

The First Steps

Many of the common hand tools used today were known in ancient Greek and Roman times. As now, conquerors were expert in appropriating technology from defeated

Figure 4. The three most commonly found mechanisms of water pump pliers: slip joint, rack-and-dog joint, and groove-joint.

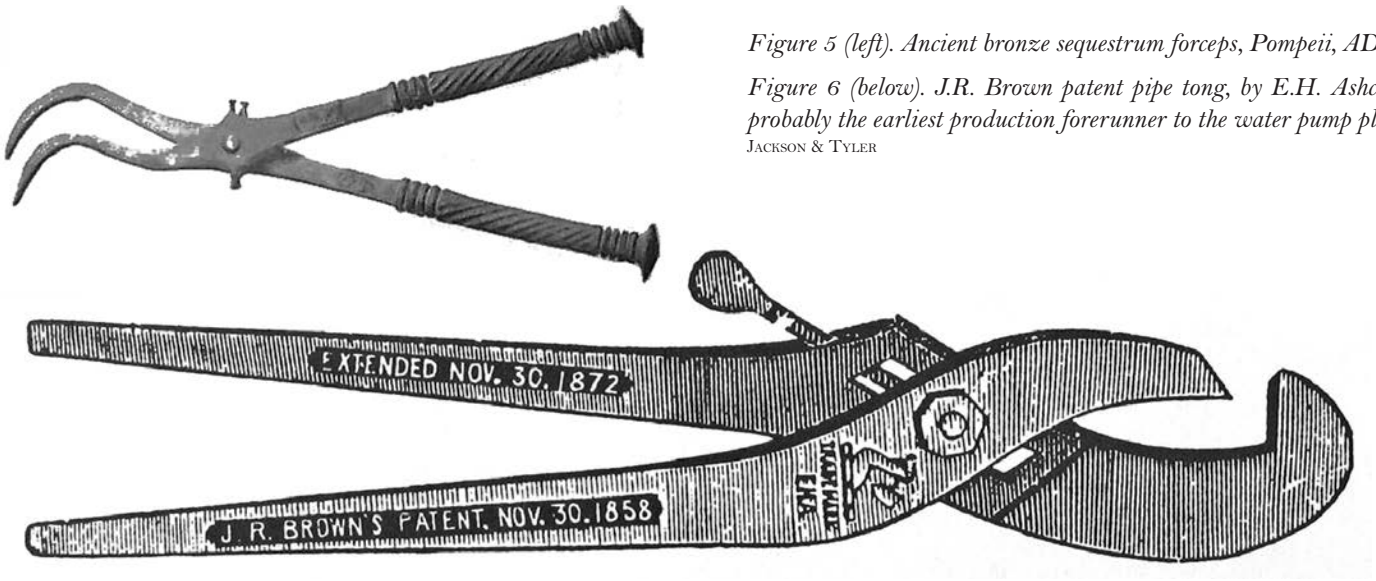


Figure 5 (left). Ancient bronze sequestrum forceps, Pompeii, AD 79.

Figure 6 (below). J.R. Brown patent pipe tong, by E.H. Ashcroft, probably the earliest production forerunner to the water pump pliers.
Jackson & Tyler

countries. Bronze pliers were used as surgical tools (tongs and forceps). Removal of fractured bone fragments was achieved by the use of sequestrum forceps cast in bronze (Figure 5).[4] These differed little from some tools described in the next section. The example shown is in the Naples Museum. Ancient examples of pliers with both jaws bent away from the line of the lever handles may well have been used by smiths.

Incredible as it may seem, three inventors obtained patents for adjustable pipe tongs within nine months in 1858. The first, H.H. Gilmore (U.S. patent no. 19,842; April 6, 1858) employed a pivot that could be tightened, with one slotted jaw and ridged, wedge-shaped washers to allow adjustment. Production models have not been encountered. A completely different mechanism was advanced by A.G. Coes, (U.S. patent no. 20,407; June 1, 1858). Although the brothers Coes ran a very successful wrench company, this device was not put into production; the only extant example is the patent model.[5] In the November 1858, J.R. Brown (U.S. patent no. 22,157) claimed a pipe tong with one lever fixed to the fulcrum and the other slotted. The device allowed movement up and down the slot with a thumbscrew (Figure 6). A second coincidence is that all three of these entrepreneurs were residents of Massachusetts. The J.R. Brown pipe tong was being manufactured by E.H. Ashcroft, New York, by 1873. An early catalog that features Brown's tongs is that of Jackson & Tyler.[6] Adjustable pipe tongs by Barnes and by Jarechi appear alongside the Brown design. However, neither of these is in the lineage of water pump pliers. In fact, the standard works on tongs, wrenches and pliers—Cope's *American Wrench Makers* and the Schulzes *Antique & Unusual Wrenches*—show a plethora of inventions in this category. Even Starrett produced a well-engineered but rather bulky affair.

Figure 7 (above, left). A centuries-old, 90-degree, duck bill tong used for handling hot metal fixtures.
Drawing by Keith Towe

Figure 8 (above, right). Lasting pliers (a no. 2 manufactured by George Barnsley, Sheffield, England). Up to ten models were made for various sizes of leather footwear and different parts of the upper.

Precursors

Water pump pliers may be regarded as a hybrid of a fixed-fulcrum, angled tong and slip-joint pliers. By the mid-nineteenth century, there existed various designs of pliers and tongs having jaws bent away from the axis of the handles. One was the cooper's tong for dealing with hot metal barrel hoops. Very similar was the duckbill tong (Figure 7), a blacksmith's tool. It was used also by wheelwrights to hold hot iron strakes in place to fit to the felloes of wagon wheels. The same tools were used later to fit iron hoop tires.

Probably the most familiar tools in this category is the shoemaker's lasting pliers (Figure 8). These were often described as pincers in early catalogs.[7] In the days of hand-made boots and shoes, the lasting pliers were used for pulling the upper leather over the last. In the United States, these pliers, with a round hammerhead, were sometimes referred to as whitchers.[8]

Another example is one of a range of dental pliers (Figure 9). This elegant and robust tool employed a strong inner handle boxed in the channel of the outer handle.

The glazier's pliers were the most acute angled at circa 135 degrees (Figure 10). These were used when taking a narrow strip from a sheet of glass. The jaws met at the tips.

The second aspect of the development of water pump pliers was sturdy and simple fulcrum adjustment; this was a

Figure 9 (above, top). A pair of 6-inch Aescapular 127, stainless steel dental pliers. It is a modern example of traditional molar extraction pliers.

Figure 10 (above, bottom). Traditional smooth and wide-jawed glazier's pliers; 8½-inch Red Devil, Irvington, New Jersey , 1930s, marked "310."

Figure 11 (above). A 15-inch tong, Oil Well Supplies Company, Limited, of Oil City, Pennsylvania, circa 1900. This is virtually identical to Brown's original 1858 patent.

Figure 12 (below). An 18-inch Johansson's patent plumbers' wrench—"The Iron Hand."

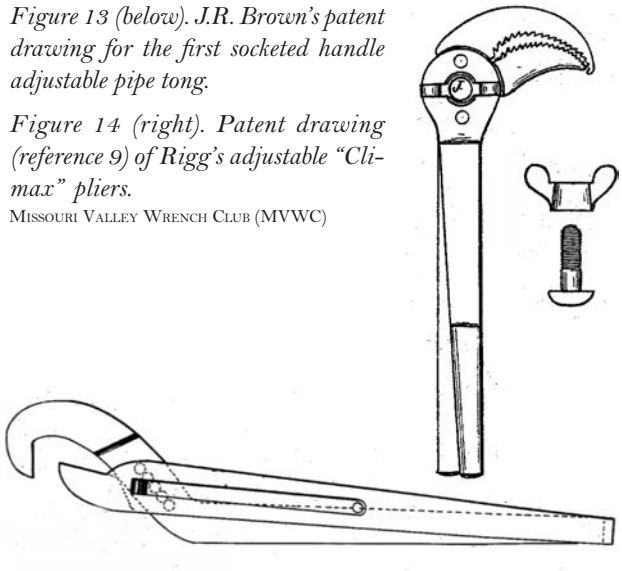
long, slow, evolution. J.R. Brown's 1858 patent was extended in 1872 and 1873. By the turn of the century, there were still various examples of adjustable tongs extremely similar to Brown's patent. An interesting example is the Oil Well Supplies Company tong (Figure 11). Some inventors were granted patents even though there was little difference between theirs and Brown's designs. Apparently, blacksmiths found use for these tongs in holding work pieces together for welding.

This type of tong had two disadvantages; firstly, when used on pipe, the lower jaw would cause damage. The O.W.S. tong was used mainly on hardened drill rod; thus damage would not result. Secondly, its long handles demanded two-handed operation (as opposed to, say, a stillson). Neither of these faults was solved with the introduction of the Swedish plumbers wrench designed by J.P. Johansson in 1888 (Swedish patent no. 5636; August 17, 1888, re-issued January 23, 1894; Trademark no. 35765). This example combined a Stillson-type screw with a pair of long-lever handles to produce an effective, but unwieldy, adjustable tong (Figure 12). The manufacturer

Figure 13 (below). J.R. Brown's patent drawing for the first socketed handle adjustable pipe tong.

Figure 14 (right). Patent drawing (reference 9) of Rigg's adjustable "Climax" pliers.

Missouri Valley Wrench Club (MVWC)



was one of the original group of companies that formed BAHCO – B.A. Hjorth Co. of Stockholm. A virtually identical wrench was produced by Dowidat of Remsheid, Germany, in the 1920s. Neither tool was popular in North America.

The breakthrough that led eventually to the compact and effective adjustable pliers was to move away from continuous change of fulcrum to discrete socket positions. The first mention of this approach that we have encountered is J.R. Brown's claim (U.S. patent no. 65,162; May 1867) to replace the thumbscrew on his earlier tong with five sockets. These were in the bend of one handle, and fitted into a slot in the length of the other (Figure 13).

By this time, the need for adjustable pliers to parallel the Clyburn spanner/wrench and the Stillson pipe wrench was well recognized. At least half a dozen new approaches were patented in the following twenty years. Each was ingenious, original, and elegant. "The Climax" by John Rigg of Ohio epitomized the approach of an engineer; he took proven technology and adapted it for a specific purpose. His 1873 patent drawing (U.S. patent no. 139,520) is shown in Figure 14. This pipe wrench went into production, but it is rare.[9] Presumably, the need to dismantle it to vary the opening was a deterrent. Of course, these pliers had a fixed fulcrum.

A modification of Brown's socket approach was disclosed by Thomas Booth, of Toronto in 1875 (Canada patent no. 5,344). This beautiful hand-written Canadian application was followed by his U.S. patent no. 178,902 in 1876. A pivot pin with parallel, flattened faces allowed movement of the fulcrum between positions of the swinging head (Figure 15). The employment of sockets along one handle allowed discrete fulcrum positions, hence a range of overlapping jaw openings. Manufactured examples are unknown.

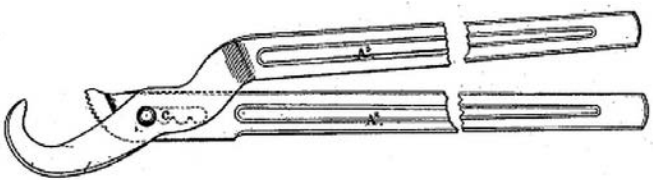
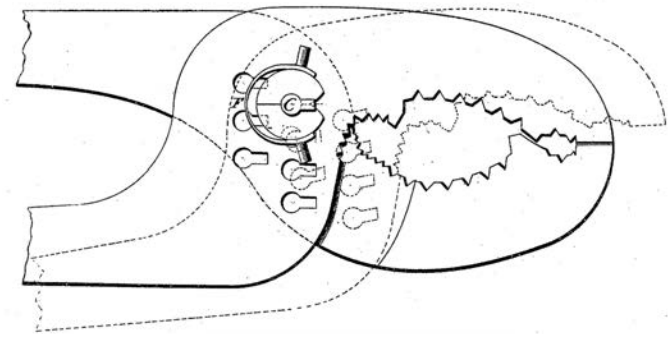


Figure 15 (above). Booth's 1876 U.S. patent drawing for his adjustable, swinging-head and two-handled pipe wrenches.

Figure 16 (below). The Pease patent (January 25, 1876) for Billings & Spencer adjustable pliers
Directory of American Tool and Machinery Patents (hereafter DATAMP)



In 1876, A.A. Pease of New Haven, Connecticut, took an entirely different approach (U.S. patent no. 172,649). He also developed straight pliers that could be taken apart to re-set. This consisted of two parts only; one with a series of "T" studs in the handle, the other with a slot shaped to take a protrusion (Figure 16). This design gave rise to the first Billings & Spenser adjustable pliers. Although this tool also had to be separated to alter the fulcrum, it was a simple and convenient process. In the last few years, Buck Knives, a United States company, has revived the T-stud in a pair of strong household scissors (Figure 17), which assists ease of cleaning and sharpening.

The first manufactured straight, slip-joint pliers were by Billings & Spenser using H.S. Pullman's patent (U.S. patent no. 295,885; February 6, 1884). This was a lateral version of Brown's and Booth's along-the-handle approaches. The inventor used a pair of sockets joined by a slot. The fulcrum pin had a pair of flats that moved freely in this slot. By simply changing the angle of the lever handles, the fulcrum could be slipped to the other socket (Figure 18). Thus, although Pullman was not the inventor of the slip-joint mechanism, his was the first use of the concept. This technique replaced that of Pease in the Billings & Spenser production line; thus the Pease patent was used for less than nine years. The straightforward pliers were hugely successful. On the expiry of Pullman's patents, they were copied worldwide. Peck, Stow, & Wilcox, for example, had twenty models, each in two different finishes and various sizes in an early PEXTO catalog.[10]

Figure 17 (above). A pair modern chicken carcass shears (top) and a pair of 8-inch Buck Workman™ stainless steel kitchen scissors with T-bar stud, circa 1990.

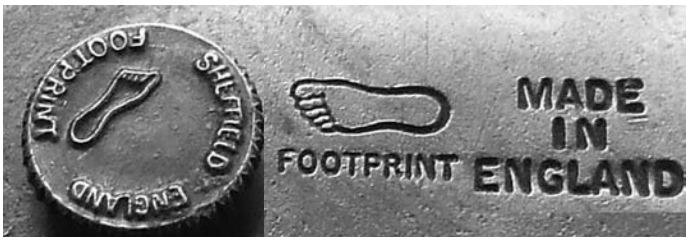
Figure 18 (below). The famous Billings & Spencer slip-joint pliers.

Another unique concept was patented by John Charles Bauer of London (British patent no. 2,968; June 14, 1883; the U.S. equivalent was patent no. 313,571; March 10, 1885). In this case, the junction near the end of the handles turns them into an effective single unit when gripped. In the early patent drawings, this connection is shown as a bolt and nut, suggesting that the two lever handles required separation with a tool to adjust. In fact, in the dozen or so examples known to us, all have a hooked pin; the handles are held together when they are gripped to tighten, or loosen (by turning over,) a fixture. The number of sockets—there could be up to six—varies with the

Figure 19. Bauer's patented, 10-inch wrench showing sockets and hooked stud and a 6-inch model (at top). These examples were made in Belgium and are stamped with a crown and patent or design numbers.
HTPAA collection

Figure 20a (top and middle) and 20b (bottom). At top is a 7-inch Footprint brand no. 698 plumbers wrench and in the middle is the same wrench in dismantled form. Lower jaw has a hardened steel infill. At bottom is a 7-inch Keyco example of the wrench; the date is unknown.

Figure 21 (below). Two of a number of Footprint marks.



size of the wrench. As the tool is employed, the top jaw tightens down and the bottom jaw thrusts up on the nut. This elegant two-piece tool was patented in most European countries as well as in North America (Figure 19). The U.S. examples are likely to be marked Paine, Diehl & Company, Philadelphia.[11] Obviously, the actual fulcrum in use is, like that on an open-ended spanner/wrench, at the center of the nut or bolt being levered. The principle behind this tool was used in a couple of twentieth-century examples reported by the Missouri Valley Wrench Club (MVWC).[12]

Thomas Ellin and Co. of Sheffield, United Kingdom, manufactured the first adjustable-fulcrum pipe wrench in 1886. It was rumored within the factory to have been designed by a knife grinder in 1875. A patent covering the design of the tool is unknown. Ellin's 90-degree wrench comprised a sturdy, forged-metal, U-shaped lever outer handle, a drop-forged boxed inner handle having a number of apertures, and a moveable fulcrum bolt. This is screwed through the inner handle (Figure 20a). Tens of millions of the tool have been sold. It has been manufactured for almost 130 years, in many sizes, from Tom Thumb (3 inches) to 16 inches; it has a straight upper jaw and a convex lower jaw. One catalog offered the wrench range from 12 to 30 inches in length.[13] It is currently available in three sizes—7, 9, and 12 inches, the design largely unaltered. Although this plumbers wrench requires unscrewing of the pivot bolt to adjust it, this is a rapid and simple operation. Part of the commercial success is probably due to its simplicity and good value. As will be seen later, this basic design has been subject to many improvements. These have originated largely in Europe and British Commonwealth countries. There is, however, an example in the United States that is marked "Keyco" (Figure 20b), and "Patent Applied For."[14] If the application was post 1886, it is unlikely to have been granted a patent. Whether this was made in the United States or imported is uncertain.

The trademark, Footprint (Figure 21), was registered in 1886 for a range of tools. It is said that Thomas R. Ellin was inspired by the character Man Friday (in Daniel Defoe's novel, *Robinson Crusoe*), whose footprint was left in the sand. Like a number of companies, the trade name was adopted later—circa 1960—for the company name, Footprint Tools Ltd. After about a year in voluntary liquidation following the financial crisis of 2008, the company relaunched as Footprint Sheffield Ltd. Generic pipe wrenches of the style shown in Figure 20 are known widely as footprints.

In 1898, C.D. Eames, of Worcester, Massachusetts, employed an approach similar to those of Brown and Booth (U.S. patent no. 601,506; March 29, 1898). He used a pear-shaped pivot to engage with recesses in the slot of the other handle (Figure 22). This jaw design was a return to the traditional tongs long used by blacksmiths and others. We have not found evidence of this invention entering into production. However, the patent disclosures of Brown, Booth, and Eames were of immense importance to the development of the first slip-joint water pump pliers.

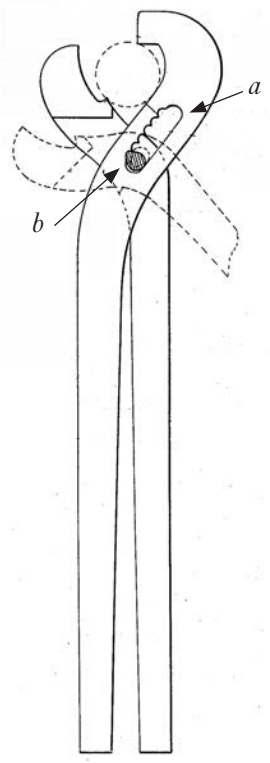


Figure 22 (right). Eames's patent drawing for his adjustable tongs. Note the slip-joint mechanism (a) in bent part of one lever handle and pear-shaped fulcrum (b) in the other.

In the first decade of the twentieth century, Thomas R. Ellin produced (for a short time) an improved Footprint that could be regarded as the penultimate precursor to water pump pliers. The inner handle carried four sockets cut in the back. These could engage with the pivot in the housing handle, which was held in place by a strong bar spring (Figure 23). Effectively this resulted in a slip-joint wrench. No dismantling was required to change the fulcrum. The patent (British patent no. 13,065; September, 1887) simply covered the method of construction. This tool was superseded rather quickly; hence it is rare. In the first decade of the twentieth century, two other footprint modifications were published. One, by J.T. Williams of Liverpool, United Kingdom (U.S. patent number 793,257; March 22, 1905), was simplified and entered production much later in Australia (see "Rack-and-Dog Mechanisms"). The other, F. Hartridge, T.G. Thorpe, & E. Rookes, of Kent, United Kingdom (U.S. patent number 870,510; November 5, 1907), does not seem to have been manufactured.

Figure 23. Ellin's patent improved Footprint. Apparently, this was the first production plier-wrench not requiring dismantling to change positions.
Courtesy the Ken Hawley Collection Trust

The First True Water Pump Pliers

The year 1912 was momentous in this account. It produced two immediate precursors for one of the mechanic's few new tools for centuries. The first was akin to a small version of a cooper's hoop tong, or blacksmith's duckbill tong, with adjustable handles. The 10-inch example was a heavy pair of pliers that had five sockets within a slot of one handle. The jaws laid in the plane of the handles and at 90-degree to their common axis. As is conventional in pliers design, the jaws were offset equally in an opposing sense. This ensured that they gripped across their full width. The novel feature of these pliers was in the jaw, which was designed to act as a bolt holder for a number of different heads. Joseph A. Schlehr's patent (U.S. patent no. 1,016,296; February 6, 1912) relied entirely on this element (Figure 24). The short throw of the head, combined with long handles, produced a considerable mechanical advantage. He used prior art for the oblong pivot and a three-position slot for the short 7-inch pliers; the 10-inch version has five sockets.

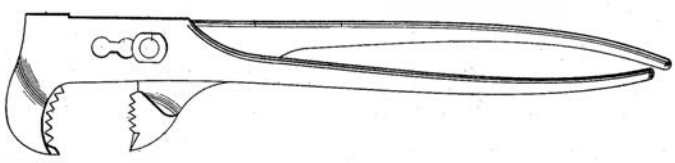


Figure 24. 1912 patent drawing of (simplified) side view of Schlehr's 90-degree "Bolt Holder."
From the DATAMP

Schlehr of Chicago, Illinois, chose a most appropriate name for his company (and pliers); it epitomized a major characteristic and its association with the United States—Eagle Claw Wrench Co. ("Prior art" is all the information previously known about an invention; if a claimed invention has been described in prior art, it can not be patented.)

The production pliers differed little from the patent drawings (Figure 25). The jaws are unmistakable. In retrospect, the overall design of Schlehr's pliers might well have allowed stronger patent claims than simply the shape of the jaws. The prior art was obviously considerable, but something drawing on the mechanical advantage and grip afforded might have been worth claiming. An example of a 10-inch model was marked "Rockford, Ill." (Figure 26). Rockford is some eighty-six miles northwest of Chicago.

Many specimens of identical 90-degree adjustable pliers are marked "M.T.Co." (Mechanics Tool Co.), also of Rockford. A clue to this situation is found in a snippet from a brief history of GKN Rockford prepared by the company:

> **[In 1911]** Mechanics Machine Company becomes involved with the Eagle Claw Wrench Company, and for financial reasons was forced to begin producing the "Eagle Claw" wrench. Incorporated, becoming MECHANICS MACHINE TOOL COMPANY. Made the wrenches in a new building erected at 9th Street and 20th Avenue [in Rockford].[15]

It seems that Eagle Claw had become a small cog in a very large wheel, The Mechanics Machine Tool Company (later the Borg Warner Corp.), and its interests were dwarfed. Nonetheless, the manufacturers of the "Bolt Holder" are listed as Mechanics Tool Co. and Eagle Claw Wrench Company in DATAMP. It is apparent from the excerpt above that production began well before the issue of patents.

The second disclosure, which was made by Hermann Zerver of Remsheid, Germany, was the re-designed footprint wrench (British patent no. 10,112; October 24, 1912). Zerver disclosed a method of changing the position of the fulcrum

Figure 25 (above). The 7-inch Schlehr patent was a 90-degree precursor to the first true water pump pliers. Marked "Eagle Claw Wrench Co. Chicago, Ill, USA. Pat'd Feb. 6 1912."

Figure 26 (below). J Schlehr's patent 10-inch, 90-degree parrot jaw, bolt holder. It is marked "Eagle Claw Wrench Co., Rockford, Ill. Pat'd Feb. 6. 1912" and has five sockets.

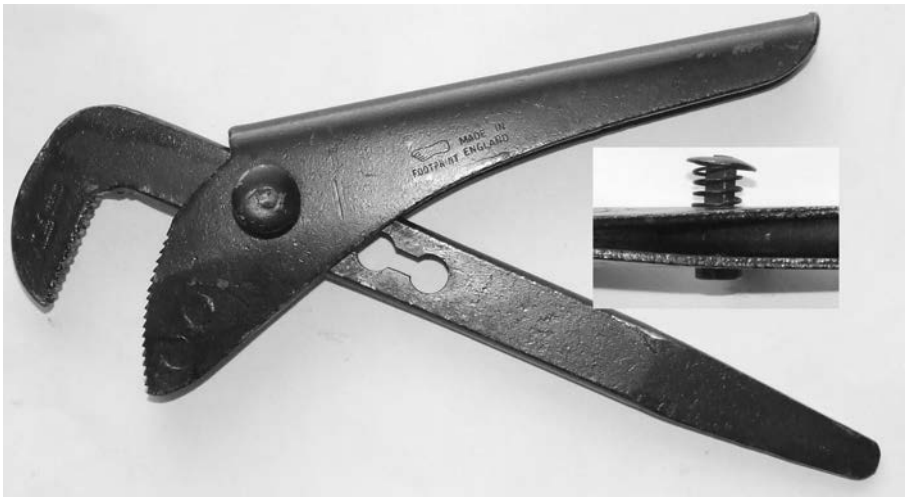


Figure 27a (above). T.R. Ellin's adjustable 9-inch, slip-joint Footprint wrench with locking pin (inset).

Figurer 27b (below) A catalog illustration of a Rytos wrench, 1913.

without the need to rotate the lever handles to a specific angle (as in foregoing slip-joint pliers). Adjustment was made by depressing a button so that the milled pivot, with part parallel flats, could slide from one socket to another in the broad inner handle slot. The pivot would spring back to lock it into its selected socket. A specific claim of this patent is that it allowed adjustment without the need to open the handles to a particular position to move the pivot from one socket to another. It is assumed that Thomas R. Ellin acquired this patent (or rights under it). The sizes included an 8 inch, a 10 inch, and a 12 inch (Figure 27a). The wrench was also available as the "Domino" brand, also made by T.R. Ellin. A virtually identical slip-joint footprint wrench branded "Rytos" was advertised in an Australian catalog circa 1913 (Figure 27b).[16] This could have been made by Zerver or another licensee. The Footprint 2142 would remain in production for more than fifty years. Figure 28 shows both the adjustment details and the extended range offered by 1957. So, by 1912 there were three manufactured angled, slip-joint pliers/wrenches, none of which needed dismantling to adjust—Ellin's patent, Schlehr's patent, and Zerver's patent.

Now mechanics had at their disposal both 90-degree variable jawed pliers and straight versions. The latter, by Billings & Spencer, had only two adjustment positions. Almost a year to the day after receiving his bolt holder patent, Schlehr was granted the incredibly important patent for what became known as "water pump pliers." This designation arose because the tool could access nuts and bolts located in awkward, hard-to-reach places in vehicle engines. The patent was for pliers with jaws at about 45-degrees to the axis of the lever handles (U.S. patent no. 1,051,921; February 4, 1913). Various additional characteristics were incorporated into the patent, as was common at that time. Perhaps it was this feature that led to the prosaic title of "Tool" for the patent application (Figure 29).

Examples of the Schlehr patent pliers in our collections include a 7½-inch pliers that has four sockets (Figure 30) and a

THOS. R. ELLIN SHEFFIELD — FOOTPRINT — (Footprint Works) LTD. ENGLAND

No. 2142 ALL STEEL ADJUSTABLE PIPE WRENCH

(With Press Pin Adjustment)

No. 2142

Length Closed ...	5¾"	7"	9"	12"	14"
Jaws Open ...	1/16–1½"	1/16–1½"	⅛–2½"	½–3"	½–3⅜"
Weight each ...	6 oz.	8 oz.	1¼ lb.	2½ lb.	3 lb.

Instantly adjustable to any size. When the pin is in alignment with the slot, press down button and slide frame into desired position. Release to lock.

INSTANT ADJUSTMENT ACTION

SECTIONS

A. On depression flat of pin "A" aligns with slot in frame "C".

B. Coil spring provides return action fitting under head of pin "A".

C. Wrench hook with holes and slot.

D. Section of wrench frame across pin.

Figure 28. T.R. Ellin's 1957 catalog entry for the 1912 patent slip-joint Footprint.

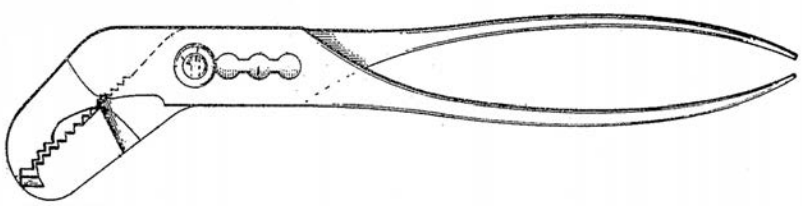


Figure 29 (above). Schlehr's patent drawing from 1913 of his 45-degree angled pliers; they have identically shaped jaws to the 90-degree precursor pliers.

Figure 30 (below). Schlehr's 7½-inch, 45-degree pliers incised "EAGLE CLAW WRENCH CO. CHICAGO. U.S.A. PAT'D FEB 6. 1912" (note date).

10-inch pliers with five sockets. We believe that this is the first tool now known as water pump pliers (or multigrip in Australia). These pliers were the culmination of more than fifty years of efforts by many to develop successful, angled, adjustable pliers.

The Eagle Claw pliers are now relatively uncommon despite the fact that they were well promoted in the growing automobile market before World War I. For example, an article entitled "New Things for the Motorist" that appeared the October 1913 issue of *Motoring Magazine* noted:

> The Eagle Claw Wrench is a new boon to the automobilist, designed to do the work of all wrenches and yet work which no other tool can do. This wrench will easily hold a round-headed bolt, by the head, to prevent it from turning while unscrewing the nut. It will act as pliers, and does work more effectively, such as holding round, square, oblong, hexagon or other shaped objects firmly. The wrench is one of the handiest tools to have around the car. It will not slip on oily, slippery grease cups, and gets a firm grip on set or lag screws, no matter how round or worn the corners are.
>
> For taking hold of spring bolts in case a spring leaf breaks, the Eagle Claw wrench is unexcelled. It is designed and constructed for use in difficult places where it is impossible to use any other wrench. The wrench comes to San Francisco through the Lathan Auto Supply Company.[17]

The Eagle Claw pliers were the first relatively light, adjustable pliers compared with precursor tongs. As noted, the production tool was marked either "Eagle Claw Wrench Co." or "Mechanics Tool Co.," usually of "Rockford Ill." Some Eagle Claw 45-degree pliers were marked "Chicago, Ill." In this instance as well, it is apparent that there was very little variation from the patent design. In essence, the concept was simply that of the "bolt holder" with its jaws at 45-degrees instead of 90-degrees. This superficially minor change, however, increased the tool's utility vastly.

Oddly enough, another 7½-inch sample (Figure 31), with identical marking is much lighter (6 ounces versus 9 ounces) than the above. It has three sockets rather than four, and its jaws are one-third narrower than its sibling (⅜ inch versus 9/16 inch). Obviously, this smaller version was intended for much more delicate tasks than the sturdier tool. Perhaps it was intended as bicycle pliers? On the other hand, it could have been developed to allow access to confined spaces such as automobile electrical parts.

Literature Confusion over Schlehr Patent Dates

The second edition of Cope lists only the February 1912 patent for Eagle Claw Wrench Co., which covers the 90-degree parrot-jaw pliers.[18] Under Eagle Claw Wrench Co., Cope shows both types (90 degrees and 45 degrees), and again refers to

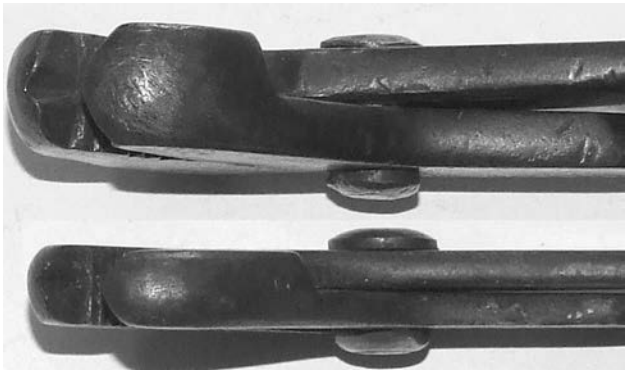


Figure 31. Contrasting two 7½-inch Eagle Claw models of the first water pump pliers.

the February 1912 patent only. He cites Schulz no. 1061. Schulz shows both the 90-degree and the 45-degree jaws, and lumps them together under the first patent. It might appear, then, that the origin of the error lies with Schultz.[19]

However, on all 90-degree pliers seen, both tools and illustrations, the correct patent date, 1912, is marked. Whereas some tools and illustrations of the 45-degree jaws give the correct 1913 date, others give the wrong 1912 date. Thus, by lack of cooperation (probably by the two companies), some of the first true water pump pliers are likely to be marked with a date that is a year earlier than the patent that covered their invention. Of course, both patents claimed the use of specific jaw designs. It may well be that the Eagle Claw Wrench Company's own registered design

Figure 32. A reconstruction of the Eagle Claw Wrench registered trademark, filed September 1913.

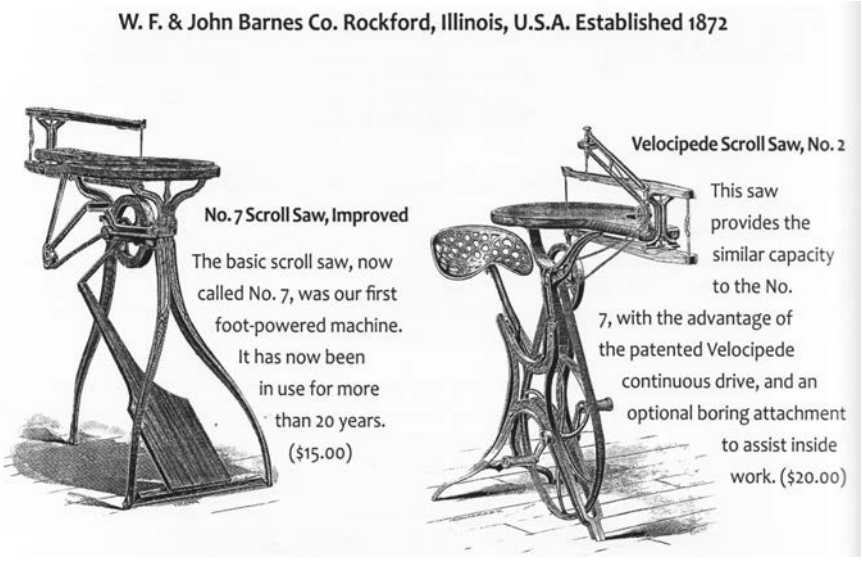


Figure 33. An illustration from the Barnes Catalog No. *56, 1901.*

used as advertising material (Figure 32) gave the wrong impression that the 1912 patent applied to the whole range of pliers with jaws at 45-degrees sand 90-degrees. Certainly, the error is of the manufacturers' making evidenced by tool markings (see later discussion).

The Chicago-Rockford Story

DATAMP lists two manufacturers for the Eagle Claw wrench—the Eagle Claw Wrench Co. and the Mechanics Tool Co. The names and places of manufacture stamped on the pliers that we have examined seem somewhat haphazard. These facts, together with the patent dates discussed in the preceding section, warranted investigation. The W.F. & John Barnes Co. was Rockford's largest employer of skilled mechanics in the late-nineteenth century (Figure 33). One of its most successful inventors, Levin Faust, was joined by three other Barnes craftsmen in a new venture in 1890. They were Carl J. Forsberg, Gustav A. Dalin, and Frank W. Lindgren. All were of Swedish origin. The Mechanics Machine Company (M.M.Co.) was organized in 1891 with $10,000 in capital. M.M.Co. carried out engineering repair work for local companies for more than three years. Its initial machine shop was in the basement of Mr. Forsberg's house. The partners must have built up a solid reputation since they survived the financial panic that struck Rockford in 1893; in March of that year, twenty-seven companies fell into receivership in a single day.[20] During this time, M.M.Co. invented the bench friction drill press, which was slow to be adopted until 1897, when it became a very successful machine. In 1906, P.A. Peterson joined the company as president. He had loaned fledgling companies, including M.M.Co., start-up funds. The company moved from 13th Street and 18th Avenue to Mill Street. In 1912, M.M.Co. began manufacturing truck transmissions, and in 1915, universal joints of its own design. By 1916 it employed 800 men at a new factory at 9th Street and 20th Avenue in Rockford.[21]

The pliers venture began in the midst of this rapid expansion. It was serendipitous rather than by design.[22] A new neighbor, the Rockford Drop Forge Company (R.D.F.C), also supported by Peterson, was struggling to make headway. The M.M.Co. directors instructed its best salesman to drum up business to keep the forge hammers hammering. One prospect had a patent application pending for a small wrench, and he placed an initial order for 100,000 units. However, this tool needed considerable machining after forging. M.M.Co. undertook this work for R.D.F.C. The customer was Eagle Claw Wrench Co. of Chicago. The first batch was

followed by repeat orders, and business boomed with Eagle Claw's sales campaign. However, after some months, payments didn't keep up with dispatches. It transpired that recent batches had been sent on consignment to a large warehouse in Chicago where they remained piled up. M.M.Co. acted swiftly to salvage the situation by acquiring Eagle Claw and returning the tools to Rockford. One of the original founders, F. W. Lindgren, was put in charge of the new factory of Mechanics Tool Co. (M.T.Co.), the company that was mentioned in extract from the history of GKN Rockford cited above. The Eagle Claw Wrench name was retained as a valuable marketing device. The pliers were produced until the early 1920s by M.T.Co., who with three others went on to become a founding member of the Borg Warner Corporation in the automotive business in 1928.

A very recent (2013) DATAMP entry lists yet another name as a manufacturer of the 90-degree pliers—Ambler, Holman & Co., Chicago. An Internet search led to an address of 571 West Washington Street. It also unearthed an advertisement in two issues (1912 and 1913) by Ambler, Holman & Co., in *Popular Mechanics* magazines.[23] This advertisement used the Eagle Claw Wrench registered trademark and name on both the 90-degree and 45-degree tools. Examples offered were 7 inches (45 degrees), 10 inches (45 degrees), and 13 inches (90 degrees). Whether Ambler, Holman & Co. was actually a manufacturer is doubtful in view of the dates. The company is more likely to have been a factor arranged either by Schlehr before the takeover, or M.T.Co. after it.

A curious aspect of this saga is that according to the GKN Rockford history, the above changes apparently took place during 1911. Thus, all water pump pliers mentioned in this article were made after the Mechanics Tool subsumed the Eagle Claw Wrench Co. This must be the case, since the tools are marked with either the 1912 or 1913 patent dates. Further, M.T.Co. (not M.M.Co.) is frequently stamped on the pliers. Those pliers, made before M.M.Co. acquired Eagle Claw, presumably carried a "Patent Pending" mark. The respective patent application dates were October 17, 1910, and January 8, 1912. We have not encountered "Patent Pending" examples. Presumably, the company continued using manufactured stamps until the new plant had rationalized production. If the 1911 date is correct, the unanswered question is why did M.T.Co. continue to use both the 1913 Rockford and Chicago stamps more than two years after the takeover and move to Rockford? The Damascus Steel Corporation (DASCO) was incorporated in Rockford in 1922. Its main product range was knives and butcher's hardware. Also listed in its range in 1927 were pliers.[24] Eagle Claw Wrench pliers bearing a new trade mark (Figure 34) on one side and "DASCO" stamped on the other have been sighted. Whether these were made for M.T.Co. or whether DASCO acquired rights from M.T.Co. is not known. The pliers produced are identical in size and shape to the originals. A company, DASCO PRO now exists; its products include cold chisels, punches, and levering bars. The Eagle Claw brand range was being offered in a British catalog as late as circa 1930.[25]

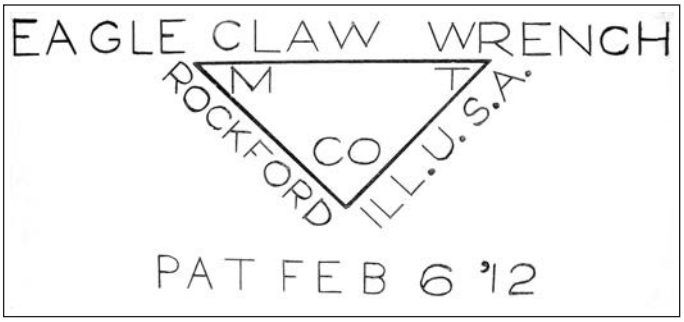


Figure 34. Reproduction of a new incised mark on a 10 -inch Eagle Claw Wrench. Other side neatly stamped "DASCO." Pliers with these stamps were made after 1922.
Drawing by Graeme Plaw

Finally, P.A. Peterson and Levin Faust are recognized amongst many Swedish Americans in Rockford for their commercial and civic achievements. The Hotel Faust was opened in 1929. Little, however, is known of Joseph Schlehr, apart from the fact that he obtained a patent for a new pipe wrench in 1913. It was a clever variant of the Stillson, consisting of only three parts (U.S. patent no. 1,075,945; October. 14, 1913). Manufacturers are listed (DATAMP) as Como Wrench Co., Chicago, and Mechanics Tool Co., Rockford. This patent (application January 13, 1913) is quite separate from the pliers's intellectual property. This indicates that M.T.Co. made an astute settlement with Schlehr in 1911.

Other Slip-Joint Pliers

As often happens following a ground-breaking invention, many are spurred into action, sometimes on ideas that have been gestating for some time. The slip-joint water pump pliers are the most common type by far, presumably due to their ease of manufacture and patent freedom to operate—since the majority of design approaches had been disclosed by the turn of the last century.

Four years after the invention of Schlehr's 45-degree pliers, for example, Vancy M. Bledsoe of Bonham, Texas, was granted a patent (U.S. patent no. 1,227,372; May 22, 1917) for two-position adjustable pliers. These had a jaw angle of about 30 degrees to the axis of the lever handles. These pliers were produced by Bledsoe himself. The sockets were enclosed in a U-shaped slot. The positions were secured by a plate holding the fulcrum firmly (Figure 35). Two jaw types have been noted, coarse and fine—both have serrated pipe jaws. An in-line, three-socket slip-joint by Bledsoe has also been sighted. This carried the Bledsoe trademark, "Minneapolis," and "Pat. Pending" all embossed.[26] But it is questionable, from the

Figure 35 (right). An example of 8-inch Bledsoe pliers with two-position adjusting plate. This patented version does not show manufacturer's location.
MVWC Newsletter

illustrations, whether there was sufficient novelty to be granted a patent.

A key advance in mechanic's tool production was the introduction of various alloy steels. By the 1920s, Herbrand, of Freemont, Ohio, had obtained a significant portion of the toolkit supply market for new automobiles. Much of Herband's success could be traced to its use of vanadium/chromium steels. These alloys allowed considerable weight reduction whilst also increasing toughness (see box "Van Chrome").

Herbrand coined the description "Van Chrome" for its range in 1919. A clever brand name—Multigrip—was chosen for its slip-joint pliers (U.S. trademark registration no. 0517113; 1930). This tool was extremely successful; it was exported worldwide, mainly for use in the automotive and agricultural machinery industries. The earliest catalog reference in Australia is dated 1935 (Figure 36).[27] Herbrand's entry into the tool market was just before the end of the horse-drawn vehicle's zenith. In 1881, Herbrand was making drop forgings for carriage suspension systems.

Van Chrome

Vanadium (V, element no. 23) was first discovered in 1801 as an impurity in a Mexican lead ore. However, it was not isolated as a pure metal until 1867. Its next-door neighbor in the periodic table of the elements is chromium (Cr, element no. 24). Although vanadium is quite abundant, it is sparsely distributed with few concentrated ore deposits. It is obtained industrially as a by-product of other metals. It was only during World War II that it became readily available in the United States. It is a component of one uranium ore—carnotite. The U.S. went quickly from being the world's biggest importer of vanadium to a major exporter.

Very stable carbides (called interstitial carbides) are formed by metals with large radii. A carbon atom (small radius) occupies holes between the spheres of metal atoms—hence interstitial. This has an incredible effect on increasing the hardness of the metals. The elements in question are shown in the chart below. Iron carbide (cementite) is extremely important in steels—but it is relatively weak and reacts (slowly) with water. It will not have escaped notice that some of these carbides are well known in cutting tools, tungsten (W–wolfram) and tantalum (Ta) in particular.

Experimental work on alloying various metals with steels began in 1868. Robert Forester Mushet, whose work was essential to the operation of the Bessemer process, was the first to demonstrate the importance of manganese. He showed also that tungsten had a pronounced effect on steel. By 1900, various alloys had attracted the attention of toolmakers and the developing steam and internal combustion engine industries. Armour plating with vanadium (with and without chromium and nickel) was another goal. High speed steel (W 18%, Cr 4%, V 1%, Co 75%) was shown to an amazed public at the 1900 Paris Exhibition. In the same year in England, John Kent Smith demonstrated that extremely small additions of vanadium to plain carbon steels increased strength to allow their use in high-speed steam engines. Leon Guillet in France reported a similar impressive result in shock resistance (1903). Various vanadium steel automotive components were developed in the United States after Henry Ford recovered a damaged part from a crashed French racing car. He engaged Kent Smith to investigate the use of vanadium (and chromium) in crankshafts, springs, *etc.* The first Model-T Ford in 1908 was claimed by Ford to owe much of its success to weight reduction by the use of vanadium steel alloys. Some parts allowed 50 percent weight reduction from manganese steel, and a doubling of strength with as little as 0.5% V.

22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni
40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd
72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt

Strong interstitial carbide forming elements (shown in the chart to the left of heavy lines).

It is now known that vanadium, as carbide, has the remarkable effect of giving rise to fine grains in steel at extremely low concentrations. The vanadium carbide is distributed in the grain boundaries. Increased hardness results from reducing slippage between grains. Also, the finer the grain, the area of boundaries increases exponentially. A conventional hand saw with 0.18% V was reported in 1907 to be rolled into a full circle. It was able to cut large nails and soft iron gas pipe.

Chromium also forms carbides readily. However, these are not quite as effective as vanadium carbides in hardening steel. The major effect of chromium—at concentrations over 1 percent—is to impart corrosion resistance. Of course, stainless steel contains high levels, above 15 percent, of chromium and about half that amount of nickel (e.g. 18:8 stainless).

Early use of chromium and vanadium in wrench steels had been associated with the Bonney Forge & Tool Works, Allentown, Pennsylvania. Bonney introduced the "CV" engineer's wrench in July, 1923. It was hugely successful. Herbrand's 1919 use of "VAN CHROME" may have edged Bonney out of first place. Other names, Cornwell, Plomb, have been mentioned. Woodworking plane blades were made with chromium/vanadium alloy steels by the 1920s.

See Harry Chandler, *Metallurgy for the Non Metallurgist* (Materials Park, Ohio: ASM International, 1999) and the "Herbrand" section at http://alloy-artefacts.com (accessed September 12, 2013).

LEADERS SINCE 1860 — McPherson's Proprietary Limited — PRICES MAY BE CHANGED WITHOUT NOTICE

"VAN-CHROME" MULTIGRIP PLIERS

Drop-Forged from Chrome Vanadium Steel.

Herbrand created these versatile Pliers to equip the mechanic completely for a wide range of service. Their thin jaws and unique construction make it easy to reach into almost inaccessible, or cramped quarters. The precisely machined teeth and positive bull-dog grip permit either the fine, close adjustment or the strong, hard pull. Balanced perfectly for easy handling.

Drop-forged from the finest Chrome Vanadium Steel, they are expertly heat treated, giving them invincible strength. Herbrand originated these Pliers, and there are no substitutes. Be sure to get the genuine.

R304—"MULTIGRIP" JUNIOR, No. 168

Multigrip Junior is unmatched as a general utility Plier in the maintenance shop. Made in a very convenient size for reaching into cramped quarters, yet retains its powerful bull-dog grip. It has the range of jaw opening to fit the popular sizes of S.A.E. nuts, and replaces the conventional type of Pliers, fitting handily into the hip pocket.

Range, 0 in. to ¾ in. Length, 7½ in. Price, 4/6.

R305 — "MULTIGRIP" WATER PUMP PLIER, No. 166

Here is the Plier that fits the water pump nuts on most cars. It also serves on extremely wide variety of other important uses, and has proved itself the most versatile Plier in the mechanic's kit for general service work.

Range, 7/16 in. to 1⅜ in. Length, 9½ in. Weight, 8 oz. Price, 5/-.

R306—"MULTIGRIP" MIDGET, No. 167

A little giant of capacity and utility. Small enough to slip into the vest pocket, yet strong and thin enough to reach easily the smallest, most awkwardly-placed nuts on motor, distributor, generator, magneto, timer, dash panel, radio, switchboard—in fact, elusive nuts wherever delicate electrical connections and adjustments are necessary.

Range, 0 in. to 7/16 in. Length, 4½ in. Weight, 2 oz. Price, 3/3.

Figure 36. A page from the 1935 catalog of McPherson's Engineering Supply Company of Melbourne, Australia, showing the listing for Herbrand's Multigrip pliers.

From bicycle tools, the company moved quickly into the automotive tool market in the early-twentieth century. Its first step into the use of "Van Chrome" was in the manufacture of tappet wrenches; these required strength and a thin profile. The company established itself as supplier to big retailers such as Montgomery Ward and Western Auto Supply. It is assumed that Herbrand developed its Multigrip range in the late 1920s. Although some models marked "patent pending" are reported, it is unlikely that Herbrand had patentable property other than the use of alloy steel; patents have not been sighted, nor have their Multigrips been found with patent details marked. The company combined excellent design with their superior alloys and existing knowledge. By the turn of the century, extremely low concentrations of vanadium were known to produce a remarkable hardening effect on low carbon steels (see box, "Van Chrome," page 67). Herbrand's adjustable pliers probably outsold all of their competition in North America, Europe, and Asia, before what is now known as the Channellock company entered the market in the mid 1930s with its groove-joint design (see later). "Multigrip" water pump pliers, because of their superior alloys, allowed reduction of jaw widths to almost one-third of the original Eagle Claw's. The true worth of the Multigrip as a tool for use in awkward places was demonstrated by its market acceptance. In Australia and New Zealand, the name "multigrip" became generic for angled-adjustable pliers.

A minor modification used in some Herbrand slip-joint pliers were to have the slotted handle plain on one side and socketed on the other. This simplified the design and manufacture of the pivot. It now had only one flat—so that it became a "D" shape. The result is that, in these slip joints, manoeuvring the handles to change positions becomes relatively smooth. Examples with the sockets on either the bottom or the top of the jaw are encountered (Figure 37).

By 1937, Herbrand produced five sizes and styles in its Multigrip range: the 9½-inch no. 166 with five sockets, the 9¾-inch no. 166½ with seven sockets, the 4½-inch no. 167 with four sockets; the 4½-inch no. 167½ with wide handles, and the 7½-inch no. 168 with four sockets (called the Junior). Different finishes were also available, such as nickel plating.[28] One telling model, no. C66 in carbon steel, was one-third of the price (85¢) of the plated Van Chrome model, which cost $2.50. Thus, the considerable cost of the alloy model must have been deemed worthwhile by the customer; the carbon steel model is extremely uncommon. The Multigrip range seems to have been confined to flat, serrated jaws.

In the 1960s, Herbrand was acquired by the Utica Tool Division of Kelsey-Hayes, which, in turn, was taken over in 1967 by the Triangle Corporation, and later, by Cooper Industries.

In 1937, the famous German tool manufacturer, Heinrich Böker (Remscheid and Solingen), illustrated a 9½-inch "adjustable motor wrench plyer," which differed from the Multigrip in two minor details.[29] Firstly, it reverted to a symmetrical socketed slot, and secondly, the fixed pivot was in the upper handle (Figure 38). It is not known whether Böker featured this tool before 1937. (This is the earliest catalog available to us.)

*Figure 37. Two pairs of circa 9½-inch Herbrand "*MULTIGRIP*" pliers. The sockets in the no. 166 model (top) were milled out of the slot front. The no. 166½ model's sockets were milled out of the slot rear.*
Alloy Artefacts

Figure 38 (above). An example of the 9½-inch Böker pliers with trademark and embossed "CHROME VANADIUM." It was available in three finishes, but just one size.

Figure 39 (below). Boker's 1939 listing for its slip-joint "adjustable motor wrench pliers" range. The prices are in Australian shillings and pence per dozen wholesale.

TOOL MAKERS HENRY BÖKER SINCE 1786

Cat. Page	Article No.					Price per
	5334 CV	ADJUSTABLE MOTOR WRENCH PLIERS - Warranted Quality. Chrome-Vanadium steel, knurled handles. With square shaped burner hole.	4½	7½	9½ Ins.	
	B	Black japanned, polished head, red tipped handles.	11/8	17/3	18/9	dozen
	P	Polished allover.	14/5	20/2	21/7	"
	BB	Gunmetal finish.	17/3	23/-	24/6	"
	NP	Polished nickel plated	18/9	24/6	28/10	"
	CH	Chromium plated.	21/7	28/10	31/8	"

It is interesting that "Chrome" was used rather than the German "Chrom," which confirms that the tool was intended for the export market. Böker was well known in North America, particularly for hunting knives. In fact, Böker had a United States company that became U.S. government property at the outbreak of World War II. It was acquired by Wiss, and later by a division of Cooper Tools Inc. By the end of the Great Depression and before World War II, the market reception for the Böker pliers must have been impressive since, in 1939, the company listed three sizes, each in five finishes, in an English language export catalog (Figure 39).[30]

In 1944, Böker's Solingen factory was destroyed by Allied bombing. But by 1951, it was largely rebuilt and making a limited range of tools, including only one model of the pliers, catalog no. 5334A (chromium/vanadium). By the 1970s, a new slip joint was among five designs in Böker's range now named Multigrip Pliers (Figure 40).[31] However, the usual European name for the tool was water pump pliers in the respective language, e.g. *wasserpumpenzange.* After World War II, Böker used the name Henry Boker outside Germany.

The new boxed slip-joint pliers (second from the top in Figure 40) could be considered to be a hybrid of the original Footprint and Schlehr's slip-joint pliers. The slotted handle has a channel at right angles, allowing the pivot-carrying handle to be boxed. The assembly was completed by sliding the upper handle through the channel and fixing by inserting and spreading the pivot. Figure 41 shows an example of this mechanism by another German manufacturer, Rothenberger, who, in fact, produced three different ranges of jaw designs, straight, V, and pipe—all of which were serrated. Boker is known as both a manufacturer and factor of tools—usually of high quality. Whether these boxed slip-joint pliers were of Rothenberger's output is an interesting question. Boker also produced slip-joint brake-bleeding pliers; the date is uncertain.

These elegant pliers had seven sockets, allowing use from ⅛ inch to 1¾ inches. The "D" pivot, as can be clearly seen, gave good clearance for adjustment, and virtually no "play" in operation. Since the jaw was slightly wider than the boxing channel, the latter was probably splayed

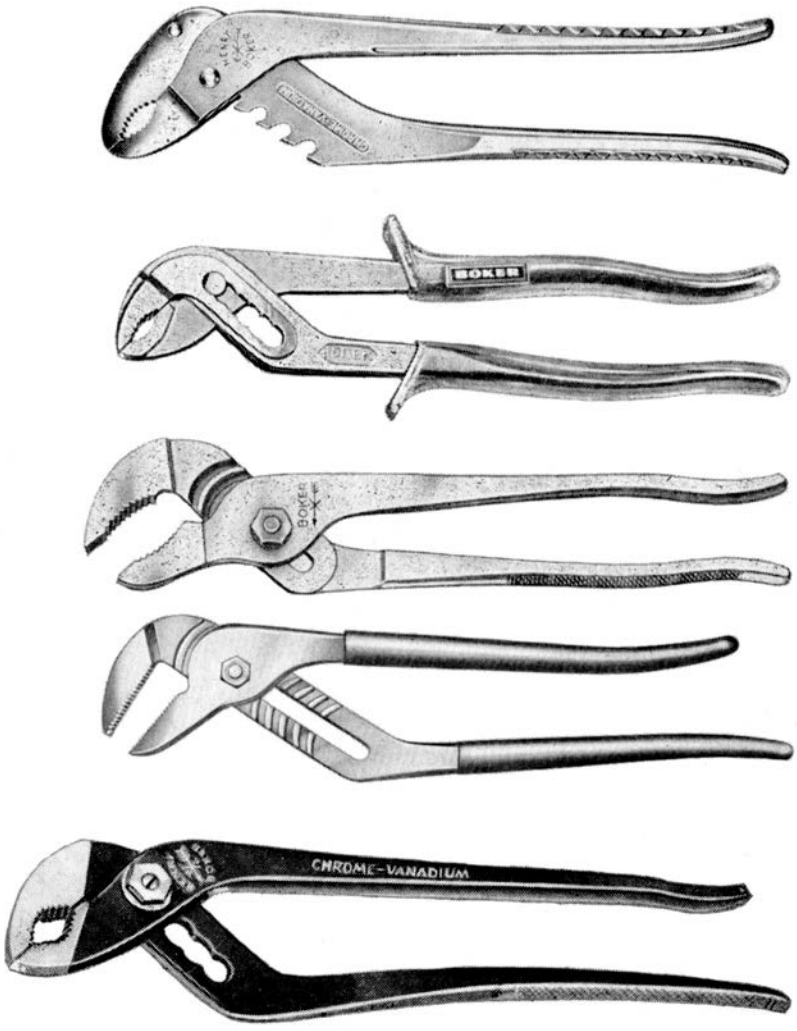


Figure 40. Henry Böker's 1975 English language catalog entry for a range of types of water pump pliers. Second from the top is an example of boxed, slip-joint pliers.

Figure 41 (left, top). A 10-inch Rothenberger model Nr.7.0528, boxed, slip-joint pliers with obtuse V jaws. Unlike the Footprint, this tool is entirely drop-forged.

Figure 42 (left, bottom). The unpatented, 9½-inch Elliot-Lucas "ELECTALLOY" pliers (circa 1970). Note the jaws designed for both nut and pipe applications.

before threading inside the lever handle. An interesting, simple detail is the slight swelling of the upper handle (left of embossed ROTHENBERGER mark in Figure 41) that acts as an opening and closing stop. The maker turned part of its name, (*Rot* = red), into a pun; most of their pliers are painted bright red. Perhaps a hundred makers of water pump pliers are known. The vast majority produce the slip joint. A couple more examples only are mentioned because of their peculiarity.

Elliot-Lucas, of Cannock, United Kingdom, was a maker of pliers, pincers, snips, etc. for many years until circa 1980. The pliers shown in Figure 42 look like a familiar slip joint from one side. However, when the pliers are turned over, the pivot attached to a sprung metal strip can be found. The user would choose the opening, press the pivot clear of the slot using the thumb, and move it to the required socket—simplicity itself; it is an elegant variation of the Footprint 2147 concept. Elliot-Lucas was part of the Spear & Jackson Group of Sheffield.

Herbrand, it appears, did not register its trademark, Multigrip, outside North America. As pointed out earlier, the generic name for these tools in Australia has been adopted from Herbrand of Fremont, Ohio. In fact, the earliest Australian made water pump pliers (1945–1950) look, in outline, remarkably similar to Herbrand's pliers.

Figure 43. Normal Falcon marked slip-joint pliers, and "Multigrip" sibling.

The only difference lies in the jaw design; the Australian versions were mainly serrated "V" jaws rather than the serrated flat type. At least four early manufacturers fitted this category—Miller-Cyclone, (Melbourne, Victoria), Pope-Falcon (Adelaide, South Australia), Fairfax (Sydney, New South Wales), and Conrik (Brisbane, Queensland). The examples, all 9½ inches, could well have been forged in the same plant. Whereas Falcon branded pliers are normally marked " MADE IN FALCON AUST," an example has been found embossed "MULTIGRIP" (Figure 43). Another tool, this time French, also employs the name "Multigrip" on SAM brand straight four position adjustable pliers.[32]

Rack-and-Dog Mechanisms

Prior to the 1912 Eagle Claw Wrench and Footprint 2142, two or three pliers or pipe wrenches employed an approach involving a rack in one jaw, and a dog, or pawl, in the other. This concept is another way of achieving discrete fulcrum alterations. W.B. Risdon, for example, obtained a patent (U.S. patent no. 362,661; May 10, 1887) for a quick adjusting pipe wrench. This one-handled tool was made by the American Saw Co., Trenton, New Jersey. Two footprint styles deserve mention here. Hartridge *et al.* (see "Precursors" page 62) actually employ both rack-and-dog and slip-joint mechanisms (Figure 44). Adjustment required moving the lever handles to allow correct opening, then engaging the pawl (f) to a rack position on the back of the captive handle. J.F.B. Nicholson improved the design of this tool (Australian registered design no. 22573, September 20, 1945). However, no examples of this wrench have been found.

BAHCO manufactured a further novel Footprint style that could be considered to be in this class (Figure 45). This wrench was patented by Hannes Brynge (Swedish patent no.

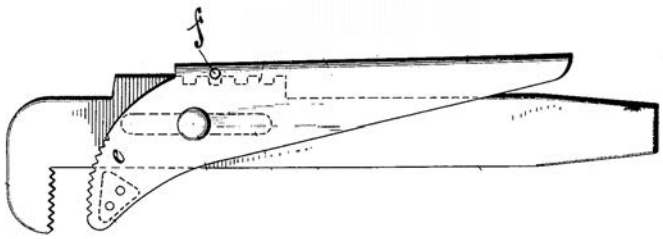


Figure 44 (above, left). The Hartridge et al. *1907 rack-and-dog, slip-joint pliers patent drawing.*

Figure 45 (above, right). A 12-inch BAHCO model 134 swinging rack-and-dog footprint pliers (1914 patent) marked "SWE 4159.

Figure 46 (below). A 1930s BAHCO advertisement for its "barracuda" footprint pipe wrenches."

41591; April 29,1914), a couple of years after the slip-joint Footprint model 2142 was launched.

The solid arcs forged in either side of the captive handle predated a series of equal radius grooves used twenty years later in groove-joint pliers. (See Figures 56-62 to follow.) The dogs were formed by upsetting the housing jaw. Apparently Hannes Brynge was a son of J.P. Johannson, inventor of the Swedish plumbers wrench (see Figure 12) and of the modification of the Clyburn adjustable spanner. The design of the rugged, swivel rack-and-dog allowed rapid positional change without dismantling. A range of four sizes (Figure 46) was produced from 1917 to the late 1940s. BAHCO, like Thomas Ellin, produced both versions of the original Footprint and its modified tool for a considerable period.

The future direction of rack-and-dog joint pliers was initiated by the design (Figure 47) of Lewis D. Fowler of Oklahoma City (U.S. patent no. 1,344,629; June 29, 1920). The concept was really an extension of the slip-joint style. He utilized a saw-tooth, internally racked slot in one handle, and a D-shaped dog that doubled as the pivot. However, the production model of the Parrot Head pliers resembled Schlehr's 1912 patent without the complex jaws (see Figure 24).

Two examples reverting to external rack approaches are worthy of mention. W.T. Long of Puyallup, Washington, patented a wrench that relied on a pivoted rack in the upper handle engaging with the back of a fixed rack on the lower handle (U.S. patent no. 1,408,524; March 7, 1922). This wrench was produced by two Washington state companies, Usona and Winner. A similar idea, this time with a rack on the lower side of the bottom handle, was patented by Joseph Eifel (U.S. patent no. 1,181,653; May 2, 1915). This invention is not to be confused with that of Eifel's 1916 extremely successful "PlieRench." (The latter falls outside the water pump pliers class, but it is discussed later.)

In Australia until 1952, published prior art was defined for documents existing only in that country. As a result, J.H. Howard was able to obtain an Australian patent in 1924 for an internal rack-and-pinion modified Footprint (Figure 48). In essence, Howard adopted Williams's (see page 62) patent design, but dispensed with a spring action. Examples are uncommon; thus, they are very collectable. The maker is unknown.

During the years of the Great Depression, there seems to

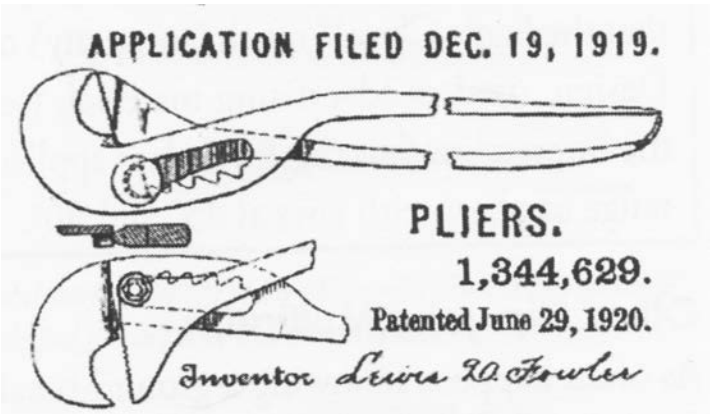


Figure 47. Fowler's patent drawing and pliers stamp of the Parrot Head ratchet-and-dog pliers.

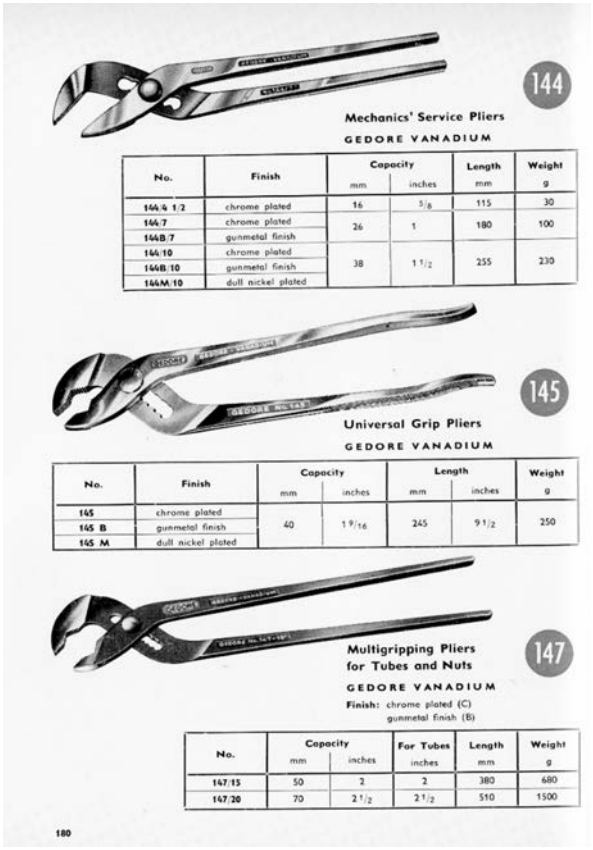
M.V.W.C. Newsletter, June 2009, 18.

Figure 48 (above, left). J.H. Howard's patented modified footprint. Only marks found are stamped patent number and date, i.e. "21176/24."

*Figure 49 (above, right). A 9½-inch Gordon Tools nine-position rack-and-dog joint pliers. Embossed with maker's name (on top jaw), "*SHEFFIELD, ENGLAND*" (bottom jaw), and "*CHROME VANADIUM*" (obverse). It weighs 8 ounces.*

have been little in the way of new examples of rack-and-dog pliers. Certainly, the major European initiatives of this class were post World War II. Gordon Tools of Sheffield produced drop-forged, very strong but light, chromium/vanadium pliers, probably in the late 1940s (Figure 49). The back of the slot carries machined arcs that give some support to the dog.

Many post-war German water pump pliers championed the rack-and-dog principle possibly because of the strength that could be achieved over the slip-joint. However, the patent position surrounding the style of the groove-joint could also have been a factor (see "Groove-Joint Pliers," page 73). The Gedore-Dowidat group's pliers illustrate well the adoption of this mechanism. Figure 50, from a 1950s export catalog, shows an extensive range (4½ to 20 inches) of Gedore brand pliers. The 144 series is slip-joint; the 145 and 147 are rack-and-dog mechanisms.



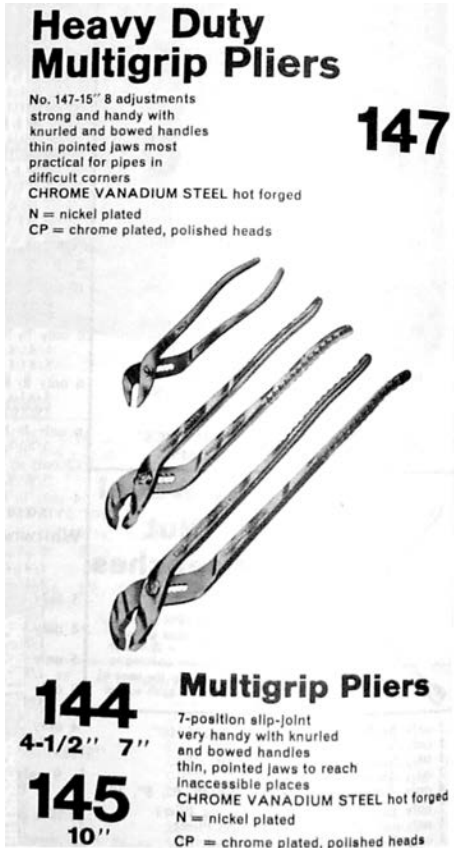


*Figure 50 (top, left). "*Gedore werkzeug-fabrik Remsheid*" entry in post-World War II catalog (952 EE) for water pump pliers. Note the range of finishes.*

Figure 51 (above). The 10-inch Dowidat Australia 145 rack-and-dog pliers with embossed handles.

Figure 52 (top, right). A Repco advertisement from 1970 showing some Dowidat multigrips available in Australia.

The Dowidat range of pliers is produced with a characteristic style of handle—deeply indented "joined diamond" shaped grips. The pivot/dog must, of course, be held in a fixed position in the simple jaw to allow it to move smoothly in the slot of the other jaw. In these pliers, this is achieved by employing a D-shaped bolt in a D-punched socket and securing the nut by upsetting the head of the bolt and nut together.

The numbering system for the range is the same as for the Gedore, but because of the design differences, the forgings must have been carried out using different equipment. Dowidat pliers are well plated; examples of the model, which were made by Dowidat Coffey Proprietary Limited in Australia from 1959 to 1972, have a pristine appearance today (Figure 51).

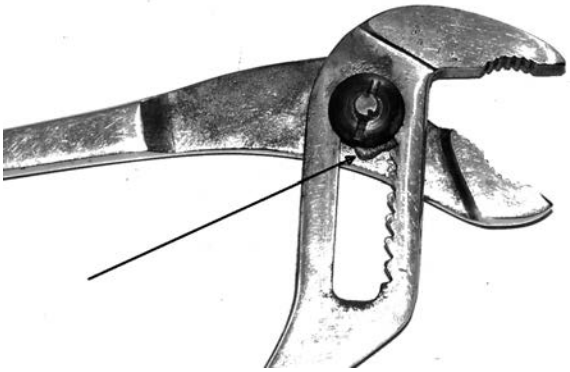


Figure 53 (left). Sidchrome's 9¾-inch sprung-dog pliers, circa 1975.

Figure 54 (below). Stahlwille's 7-inch, chrome-plated, boxed water pump pliers with deep rack notches cut in front of captive handle. There were also 10-inch and 15-inch models produced beginning in the 1980s.

The advertisement (Figure 52) indicates the smaller slip-joint range, and the larger no. 147, 15-inch model as available in Australia. A 20-inch model was offered in Europe.

Most Australian "multigrips," made from the mid 1940s to 2000, were local versions of American designs. However, a unique specimen is the Sidchrome brand pliers sprung dog version (Figure 53). The rack has pronounced teeth, and the internal dog has the advantage that it can be seen to be engaged during adjustment. (In conventional pliers, the dog is usually covered by the retaining head). Of course when at rest, the handles are open. All Sidchrome tools are chromium plated. Siddons & Lock Tool Company, which was Melbourne based, was acquired by Stanley Tools in 1991.

A pair of very sturdy little pliers by Stahlwille of Germany (Figure 54) looks identical to that in the Henry Boker 1975 catalog example (Figure 40). It is a sprung boxed-jointed pliers with very deep cut notches for the rack. It requires some effort to change positions—thus it is a strong, well engineered, tool. Again, it is possible that Boker was acting as a factor for the Stahlwille-made pliers.

Another very positive tool by Henry Boker look like a variant on a theme (Figure 55). These pliers relied on a deep rack in the back of a semi-captive lever handle. The holding device is more like an unsymmetrical saddle than a box. The racked handle carries a guide that ensures that the pipe jaws move in parallel. This tool is a further example of a designer reverting to first principles to achieve a particular outcome. The only markings are "BOKER," the arrow trademark, and "GERMANY."

Figure 55. An 8-inch Boker "semi-boxed" lever rack -and-dog pliers. The date is unknown, but it is possibly 1980s.
John Daniel

Groove-Joint Pliers

In 1886, George DeArment, a blacksmith from a village near Meadville, Pennsylvania, redesigned and produced farrier's tools, and eventually formed Champion Bolt and Clipper Company. Within twenty years, his success at home and abroad led to an order for a set from the British royal household. With the demise of horse-drawn transportation, the next generation had to cope with the rise of mechanical road vehicles. Champion Bolt's chief engineer, Howard H. Manning, developed an entirely new water pump pliers joint that greatly increased its strength. Pliers with a circular tongue-and-groove to support the stress on the fixed pivot had been patented earlier. Manning turned this concept into an adjustable version by using two series of constant radius, not concentric, grooves in one lever handle and two single curved ridges (identical radius) in the other. The first patent (U.S. patent no. 1,950,362) was granted March 6, 1934; it is shown in Figure 56. An example of an early production model is seen in Figure 57. The brand name Channellock was chosen for the new tool.

This invention—the world's strongest water pump pliers—changed the direction of the company. It transpired

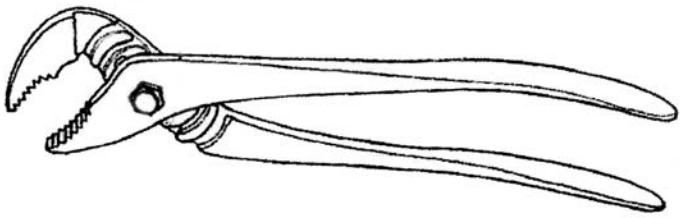
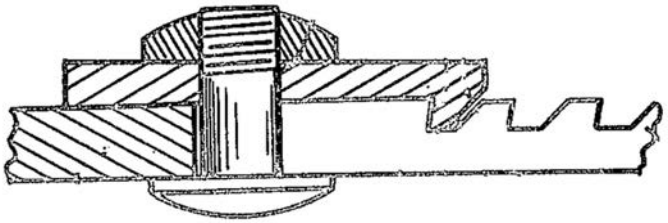


Figure 56 (above). Manning's 1934 patent drawing for the original groove joint water pump pliers.
DATAMP

Figure 57 (below). Champion DeArment's 10-inch double-groove joint pliers.

Figure 58 (above). The Champion DeArment second design of pliers circa 1950.

Figure 59 (below). Manning's patent undercut groove design.



that the design was, in fact, over-engineered for all but the most demanding of tasks. A single series of arcs was quite sufficient for the purpose, and this was adopted. Of course, it produced the additional advantage of allowing a doubling of the range of any one size of pliers (Figure 58).

With the expiry of early patents looming, Manning introduced further improvements. Firstly, making the arcs stop short of the joint edge reduced the incidence of stress-cracking (U.S. patent no. 2,592,927; April 15, 1952). The most important invention was the undercutting of the arcs to provide interlocking of the lever handles and to hold the jaws in alignment (Figure 59). It is also claimed that the pliers can thus be kept lightweight while increasing rigidity in use (U.S. patent no. 2,640,381; June 2, 1953). Manning was listed as vice president of engineering of the company in 1953.[33] His patents can be said to have made Channellock the premium water pump pliers producer for at least sixty years.

In the 1950s, the company reorganized its product line, abandoning hammers and some other non-pliers tools. In the 1930s, it had carefully avoided becoming tied exclusively to a large retailers' home-brand products. However, almost 50 percent of its current pliers output is factored by other manufacturers or suppliers.[34] The company adopted its trade name for the company name, Channellock Inc., in 1964. In the late 1960s, when fitted comfort grips were introduced, Channellock adopted its characteristic pale blue color for its range of pliers. Today, Channellock has some of its export market pliers made in Spain, probably by Irega. The evolution of Manning's design to a "D.I.Y." range involving undercut half arcs in front of the slot demonstrates its fundamental strength (Figure 60).

Manufacturers often used unsolicited testimonials for their tools in advertisements; this practice has fallen by the wayside of late, perhaps due to misuse and cynicism. Nonetheless, there can be few more genuine than the letter received by the grandson of George DeArment, Bill, in February 1954. It was from a British sailor regarding a find on a Normandy beach on the day after D-Day.[35]

33 Coltsfoot Road,
Chantry Estates
Ipswich, England
February 16, 1954

Dear Sirs,

Seeing enclosed advert in an American *Popular Science* magazine made me think about a pair of Channellock pliers I once owned.

I found a muddy pair on D + 1 on the beach at Arromanche (Normandy) while serving in the Navy in 1944. I cleaned them up and put them in my tool kit. I did not think much about them until I began to use them to get me out of several jams. I was amazed at the gripping power they had!

When I was demobbed, I brought them home and used them in my civvy employment for many years. One day I was called out to work on a broken down lorry loaded with about 9 tons of stuff. I had to jack it up but could not find the jack handle. So I grabbed my Channellock. It did the job fine, but a few days later I found they were finally broken. I have often tried to get another Channellock but haven't seen a pair since. There are plenty of tools that resemble them over here, but nothing quite like the little tool I found on the Normandy beach. When I saw your advert I felt I had to write and tell you about it.

Yours sincerely,

George H. Perkins

Some of the most familiar firms in the pliers field (e.g. Crescent, Dowidat, Rigid, and J.H. Williams) produced imitations of Channellock's designs manufactured when the patents lapsed. It has been said that imitation is the sincerest form of flattery. There were few better tool manufacturers than Proto; the advertisement (Figure 61) attests to the importance of Manning's work. Proto Tools, originally Plomb

Figure 60 (right). A 9½-inch "Grip Lock" from Channellock's lightweight range circa 1970 to date.

Figure 61 (above). Proto Tool Division, Ingersoll-Rand advertisement, circa 1970 for Power-Track®, groove-joint pliers.

Figure 62 (right). Some heavyweight groove-joint pliers. A 12¼-inch Minimax 583 with seven settings, Japan; a 12½-inch Rigid 732 with seven settings, USA; a 16-inch Minimax 359 with ten settings, Japan; and a 16½-inch Fuller 117 with ten settings, Japan. They weigh between 1.1 and 2.6 pounds. The Rigid and the large Minimax models are undercut like later Channellock examples.

Tool Company, was acquired by Ingersoll Rand whose tool division is now part of Stanley, Black & Decker.

There can be no doubt that the groove-joint construction is the strongest type. With few exceptions, the very large models involve this pattern (Figure 62). Obviously, with tools ranging up to 20¼ inches—the Channellock 480 Big AZZ®—two-handed operation is essential. These tools are almost the size of a blacksmith's tong.

Unusual Adjustment Mechanisms

The three styles of pliers discussed above—the slip joint, the rack-and-dog joint, and the grove joint—probably represent over 90 percent of the water pump pliers in existence. However, some of the most imaginative mechanisms have been introduced since the end of World War II. The majority of them are uncommon—presumably because of manufacturing cost and little perceived advantage over the well-established models. The great majority appear to have been German patents. From the foregoing, it is obvious that there were scarcely any extant patents to be avoided. Possibly inventors believed that improvements to existing know-how were being presented, and an underlying trend to automatic adjustment is readily detected.

Sears, Roebuck launched its Craftsman brand of tools in the 1930s. A few water pump pliers, mainly slip-joint, were introduced to this range. An interesting departure was Sears's adoption of the old Pease "T stud" from the early Billings & Spenser straight pliers, which reverted to the concept of dismantling to adjust (Figure 63).

Fritz Schulte of Remscheid (German patent no. 806,779; June 18, 1951) returned to the concept of incremental adjustment used by two of the Massachusetts inventors of 1858. His approach could be described as a combination of the Stillson and the Footprint. He employed the bolt and knurled nut of the former, with a saddle and-the boxing of one leg inside a channel, of the other (Figure 64). The

Figure 63 (above). Sears, Roebuck Craftsman brand water pump pliers using T stud connections. MVWC

Figure 64 (below). 10¼ inch pliers embossed "CHROM-VANADIUM," "ROTFUB," the patent number, and "GERMANY" on the handles. It is stamped "AMAZONA" below the bolt of the captive leg.

Figure 65 (left). A Henry Boker stamped, roll-nut offset footprint. The inner handle is embossed "9"—230m/m." It probably dates from the 1960s. The 1975 as well as current catalogs show 7-, 9-, and 12½-inch models.

*Figure 66 (below). A 9-inch chromium/vanadium steel "*ADACK" *"*PATENTED*" (no numbers) external rack-and-dog pliers. It is marked "*MADE IN GERMANY.*"*

Rod Thomas collection

manufactured tool is branded Rotfuß (rotfuss=red foot). The ends of the legs are painted red. Two sizes are known, 10¼ inch and 13 inch.

An interesting feature of these pliers is that, unlike footprints, they cannot be dismantled. Thus, the question arises—how was it fabricated? A clue lies in the detail of the housing of the roll nut. This is a ⅝-inch indented bush. The boxing leg has been hot splayed, and the internal leg fitted with the roll nut assembly and bolt by swaging. It is inserted into the slot and the housing reforged to sink the bushes round the roll nut.

The most commonly encountered example of this class is the roll-nut modified footprint; 90-degree jaw models have been on the market since the early 1950s. Manufacturers are European, mainly German. They include Bleckman, Blosta, Boker, Footprint, and Rothenberger. None is marked with a patent number, and the dating is based on three German catalogs. The inventor of this style is unknown. The concept is both simple and elegant. It also borrows from the Stillson knurled nut and bolt continuous adjustment. The 45-degree offset model is less common (Figure 65).Unlike the Rotfuß, this pipe wrench can be dismantled into four parts—the jaws/handles, a saddle, and the nut.

An ingenious and rare design is the Adack. It has an external rack on the back of the upper jaw/lower leg that has a plain slot. A sprung pawl is fitted to the pivot-carrying handle. The jaws can be opened fully, and the pawl simply clicks down to the required setting with one hand. It is a good example of automatic adjustment. The load on the fulcrum is shared with the pawl (Figure 66). This rugged elegant tool is very slender and chrome plated.

The ingenuity of engineering designers is brought out in the Belzer Polymatic. This is a box joint variant on the Adack style. In this case, the box channel and the smooth fulcrum groove are at right angles in the lower lever handle. The ratchet is attached to the sprung floating fulcrum pin, and engages with the acute end of the cavity, that acts as the dog (Figure 67).

Probably the most sophisticated water pump pliers of all are the rack-and-dog Rothenberger Rogrip. This is a beautifully engineered box-jointed tool with a sprung arm connecting the handles (Figure 68). This arm forms an adjustable quadrangle that allows excellent control in reducing the jaw opening from fully open to eight other positions. Like the Adack, this tool permits the operator to "click down" one setting at a time. A big advantage, though, is that the tool can be put down and picked up and it will have remained in the correct setting. Like the larger pliers, two hands are needed to open the jaws wide. There is a knack to this type; it requires pushing the upper handle up and outwards, whilst levering the other down.

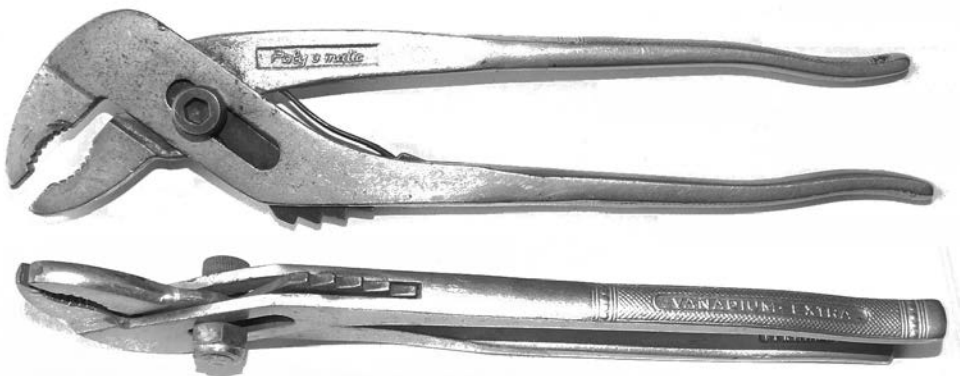


Figure 67. The Belzer Polymatic, no. 2620, from Germany. Lateral thinking fixes the pivot to the ratchet mounting to adjust the jaw opening against the inner lever. Note the return spring.

A simplified utility version of these pliers, (Warheit U.S. patent no. 4,651,598, March 24,1987) is constructed so that the jaws move in a parallel motion. These pliers can be stored neatly by squeezing the lever arms together between the fulcrum and the connecting sprung arm. They tend to be made using very light, pressed-metal construction with hardened infill jaws. Sears, Roebuck (Figure 69) and Vermont American offer 6½-inch and 9¼-inch versions. This design is fully automatic; the dog locks as the jaws tighten on the work piece and retracts on release of pressure.

A well engineered, but heavy, German tool that fits into this category resembles a cross between the Swedish plumbers wrench and rack-and-dog joint pliers. These are not water pump pliers, but it is, in fact, a double-rack tool with three limbs rather than the normal pair (Figure 70). We have no knowledge of its vintage, but it is obviously an early self-adjust design to fit any nut head up to 1¾ inches. By modern standards, it looks over engineered for purpose, but it is unlikely that the manufacturer was troubled by complaints! It weighs 2 pounds, 14 ounces—well over twice the weight of the 12-inch, groove-lock pliers.

Figure 68. A 10-inch Rothenberger 70558 Rogrip Cr.V steel box-joint, drop-forged pliers. It's a robust, elegant tool with a 1½ inch capacity, polished jaw faces, red body, black comfort grips. It is made in both Germany and the United States.

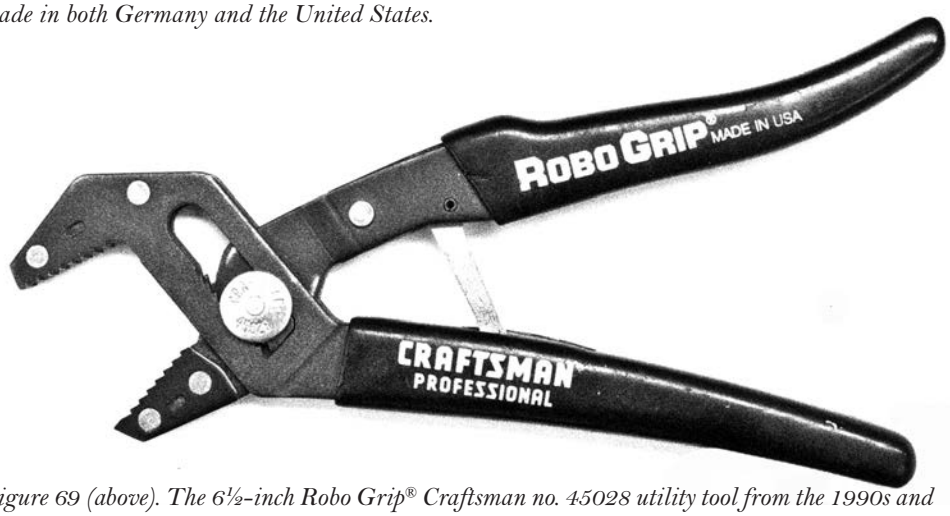


Figure 69 (above). The 6½-inch Robo Grip® Craftsman no. 45028 utility tool from the 1990s and sold through Sears, Roebuck.

Figure 70 (below) The 12¼-inch VBW Nr. 120 "Griff-Eck" (corner grasp) wrench. It has a 1-inch Whitworth capacity with parallel jaws. The middle leg floats and the racks lock when jaws engage with the nut. It is marked "Crom Vanadium" and "DGDM."

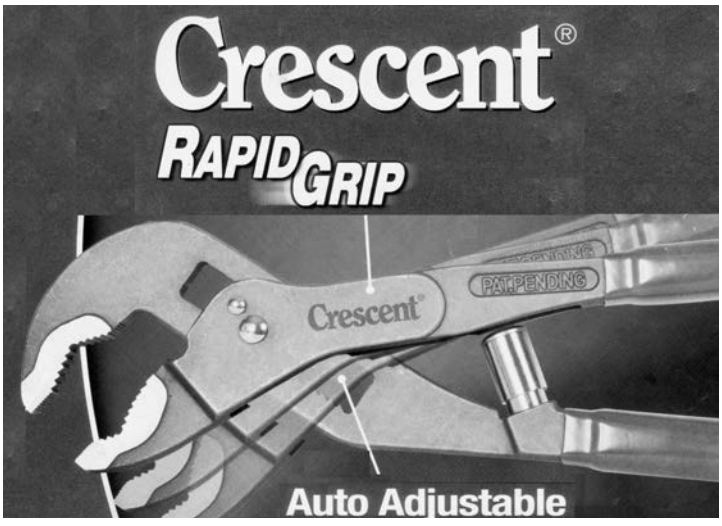


Figure 71. A 2012 advertisement from an Australian magazine for Crescent's one-handed ratchet-and-dog pliers. Note the use of "Multi-Grip."

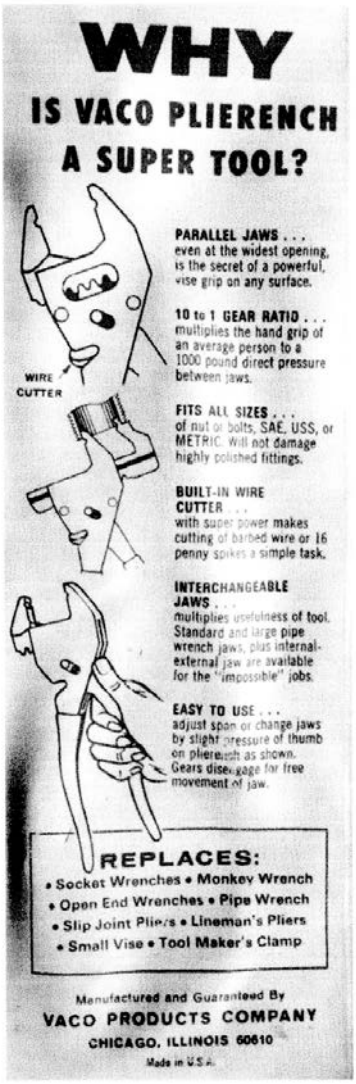
The most recent developments, are from the United States; they involve developing mechanisms with many integral steps and allowing self adjustment. Crescent, for example, introduced its "Rapid Grip" system that employs an internal rack-and-dog design. In this case, a spring between the pivot and back of the slot allows the jaws to move from fully open to engage when resistance from a work piece is encountered (Figure 71). Three sizes are available, 7 inches, 10 inches, and 12 inches.

The PlieRench

Joseph Eifel of Chicago patented (U.S. patent nos. 1,181,653, May 2, 1916, and 1,181,654, May 2, 1916) pliers fitting the definition we have used in this article, and his superb engineering achievements with various designs of the straight PlieRench warrant a mention here. The construction of the PlieRench is the boxed-joint type using forgings. Like the later European pliers, the production was

Figure 72 (above). The 8-inch Eifel Flash PlieRench (1920s). Embossed with company name, "Pat.5.2.16," and "FLASH SLS CHICAGO."

Figure 73 (below). A Vaco advertisement, probably circa 1930s.



probably achieved by hot splaying the outer leg to accommodate the captive leg. Changing jaws is a very simple operation; the driving pair of teeth is disengaged by easing the inside handle downwards. The sprung pivot slides in the oblong slots. A new jaw is inserted and the internal spring re-engages the gears.

Eifel's water pump pliers, however, were never manufactured, but, Eifel was an enthusiastic marketing exponent as well as an inventor. He sold his PlieRench as a kit comprising the tool, three sets of jaws, and a sixty-four page booklet, all in a canvas pouch. The price, $5, remained fixed for some years. In the late 1920s, the American Plierench Corporation was formed. Eifel was granted further patents, (one being U.S. patent no. 1,862,817; June 14, 1932.) This design utilized diagonal gearing of the jaws and had the feature of "hands-free" operation once ratcheted onto the work piece. Almost forty years after his first patent, he obtained a further patent on improvement (U.S. patent no. 2,727,417; December 20, 1955).

An advertisement by Vaco Products, also of Chicago, used the name Plierench; it could be that the similarities between claims and those of the Flash SLS company indicate that Vaco was simply an Eifel brand.

Eifel's company business prospered in the 1920s. Came the depression, it was obviously a different story. A measure of his frustration can be seen from his notorious "Is There NO Way of Getting a Sign of Life from You!" letter. This was sent in 1932 to a non-performing regional agent together with a request for the return of the company's demonstration outfit.[36] A similar pair of pliers was introduced by Schultz & Hill in 1946.

Conclusions

From the standpoint of today's virtually immediate transmission of ideas and knowledge, it might seem amazing that it took over fifty years from the first tentative steps to evolve the water pump pliers. Apart from contributions from Britain, Germany, and Sweden, the major developments originated in the United States in the first third of last century. The tendency of manufacturing to move from the Northeast of the United States to the Midwest, and further, is reflected in the development of the water pump pliers.

The move from simple carbon steels to chromium/vanadium alloys has benefited the design of water pump pliers, just as it has in other applications, including wrenches, edge tools, and mechanical parts for vehicles. From the third quarter of the twentieth century, German inventive and manufacturing skills extended the array of mechanisms dramatically. Of particular interest is the range of concepts that have been brought to bear in manufacturing a useful tool. In the hundred years from Schlehr's first water pump pliers, the trend to automatic adjustment has progressed substantially.

Few tools have made such an impact that their trade names have entered the language. This field has thrown up three—footprint, multigrip, and channellock. This approaches the recognition in the wrench area of the eponymous Stillson. The importance of adjustable wrenches and pliers to two companies is reflected in the fact that they have replaced their family founders' names with company names of their trademarks; these are Channellock Inc. and Footprint, Sheffield Ltd.

Although low-cost country manufacture of many tools has made massive inroads into the amateur market, the demand for top quality water pump pliers in professional areas remains high. By and large, this demand is being met by American, European, and Japanese manufacturers. It may be claimed that adjustable wrenches and pliers were the first completely new, wide application, tools for at least a millennium.

Notes

1. About ten articles on water pump pliers (or Multigrips) have appeared in publications of the Hand Tool Preservation Association of Australia (HTPAA). The major papers are: Warren Hewertson, "A Short History of Multigrip Pliers, *The Tool Chest*, 88 (2008):1; Warren Hewertson and George Radion, "The First True Multigrip Pliers," *The Tool Chest*, 98 (2010): 7; Warren Hewertson, John Hawking, and George Radion, "Multigrips in Australia," *Hand Tools – Our Heritage Celebrating the Twenty-fifth Anniversary of the HTPAA* (Victoria, Australia: HTPAA, 2008), 67-75.
2. Alfred and Lucile Schulz, *Antique & Unusual Wrenches* (Malcolm, Neb.: Alfred and Lucile Schulz, Publishers, 1988, 1992, and 2009) and Kenneth L. Cope, *American Wrench Makers, 1830-1915* (Mendham, N.J.: Astragal Press,1999) and *American Wrench Makers 1830-1930* (Mendham, N.J.: Astragal Press, 2002).
3. John Hawking and Ron Geesing, *The Tool Chest*, 87 (2008):1-14.
4. J.S. Milne, *Surgical Instruments in Greek and Roman Times* (Oxford, U.K.: Clarendon Press, 1907), 144-5.
5. Herbert E. Page, *The Brothers Coes & Their Legacy of Wrenches*, (Davenport, Iowa: Sunset Mercantile Enterprises, 2005).
6. "Price List of Jackson & Tyler: Tools and Supplies of All Kinds: for Machinists, Blacksmiths, Model Makers, Etc.; Foot Lathes, Drills, etc." (Baltimore, Maryland: Jackson & Tyler, 1880, reprinted by the Mid-West Tool Collectors Association, 1993), 94-95.
7. *A Pattern Book of Tools and Household Goods*, (Birmingham, England, circa 1830s. Reprinted by Early American Industries Association and the Peabody Museum, 2006, with an introduction by Jane Rees and Elton Hall.
8. R.A. Salaman, *Dictionary of Leather-Working Tools, c. 1700-1950*, 2nd ed.(Mendham, N.J.: Astragal Press, 1986), 147.
9. *Missouri Valley Wrench Club Newsletter* (March 2004): 23.
10. The Peck, Stow, & Wilcox Co., Catalog, Southington, Conn., 1923, 63-64. The catalog is available as a download at www.roseantiquetools.com (accessed September 12, 2013).
11. *Directory of American Tool and Machinery* (DATAMP) www.datamp.org (accessed September 12, 2013).
12. Willard S. Stuart, U.S. patent no. 1,799,622; February 15, 1931, *Missouri Valley Wrench Club Newsletter* (March, 2012): 15.
13. S. Tyzack, *Catalogue*, London, U.K., 1908.
14. A brand of the Keystone Manufacturing Company, Buffalo, New York.
15. "GKN Rockford Company History," unpublished history of the company prepared by GKN Rockford copy in authors' collection.
16. McPhersons, *Catalogue* for the Farm & Home Workshop, Melbourne, Australia (circa 1913) 220.
17. *Motoring Magazine*, San Francisco (October 1913):18.
18. See *American Wrench Makers 1830-1930*, "Patent Dates & Makers," 18, 123.
19. Schulz, *Antique & Unusual Wrenches*, 87.
20. "Chronological History of Rockford, 1818-1900," www.rockfordillinois.com/chron.htm (accessed August 2013).
21. Jon. W. Lundin, *Rockford: An Illustrated History* (Tarzana, California: American Historical Press, 1996), 35.
22. Howard H. Russell, *The History of the Universal Joint Division of Borg-Warner, 1890-1950*, unpublished manuscript Rockford Illinois, Public Library, Local History Section, undated.
23. *Popular Mechanics*, Chicago, June 1912 and May 1913. Coincidentally, the magazine's address is listed in the same street as Ambler Holman.
24. *The Rockford Morning Star*, June 1, 1927, 16.
25. George Adams, Engineer, *Catalogue*, High Holborn, London, UK, circa 1930, 316.
26. *Missouri Valley Wrench Club Newsletter* (June 2009): 12.
27. McPhersons *Catalogue*, Melbourne, Australia, 1935. 68
28. Herbrand, *Catalogue* no. 50 M, Freemont, Ohio, 1937, 56-7.
29. Heinrich Böker, *Price List, Hardware*, Remscheid, Germany, 1937, 113.
30. Henry Boker, *Price List*, Sydney, Australia, 1939, 16.
31. Boker, *Hand Tools Catalogue*, Remscheid, Germany,1975, 9.
32. Warren Hewertson, "A Straight Multigrip," *The Tool Chest*, 94 (2009): 25.
33. *Missouri Valley Wrench Club Newsletter* (June 2005): 6.
34. Channellock Inc., *The First Hundred Years*, 1986.
35. *The First Hundred Years.*
36. "Old-time correspondence – rudeness" www.practicalmachinist.com (accessed July 28, 2013).

Acknowledgements

We thank Stan Shultze for permission to use material from the Missouri Valley Wrench Club's Newsletters. Unravelling the complex situation of the Eagle Claw Wrench Co./M.T.Co. could not have been achieved without the generous efforts of Jean Lithgoe, Rockford Public Library. We acknowledge the volunteers of DATAMP and Alloy Artefacts for their untiring work in providing valuable data on a whole range of tools. We appreciate the help of Ron Geesin and John Hawking on British and Australian pliers respectively. We are obliged to David Yandell for information on Bauer's patents. The United States Patent Office is recognized for setting up its user friendly search system. We are grateful to Channellock Inc. and Footprint Sheffield Ltd. for responding to queries.

Authors

EAIA member Warren Hewertson is a retired research chemist. He worked in the United Kingdom chemical industry for more than twenty-five years, and the Australian forest products field for almost twenty years. He is especially interested in the working principles of hand tools, and has written widely for the HTPAA and occasionally for The Tools & Trades History Society (UK).

George Radion has retired from the Australian rail and tram transport industry. His many published articles on spanners, wrenches, and pliers used in both civil and military provinces have benefited from his comprehensive collection. He is secretary of the HTPAA and editor of its *Spanner & Wrench Collector* magazine.

Who Is Christian Bodmer? Part I

by Walter W. Jacob

The Stanley Rule & Level Company of New Britain, Connecticut, over the years employed many interesting, inventive, and intelligent individuals, who contributed immensely to the evolution of tool design and construction. Christian Bodmer was one of those employees. Over the course of the fifty years that he worked with Stanley, he patented or shared patents with others for more than forty innovations for the company—from his first, for block plane adjustment levers and spirit levels later ones for butt gauges and scrapers. This series of articles will explore the life of Bodmer and the profound affect he had on Stanley Tools.

Christian Bodmer was born on April 9, 1865, in Deerfield, Massachusetts, of German immigrant parents Andreas (Andrew) and Maria (Mary) Wurzberger Bodmer.[1] The Bodmer family apparently moved to New Britain, Connecticut, before 1870.[2] Andrew (the father) was employed in a cuttery shop. The family lived at 17 John Street, New Britain, Connecticut. By the 1880 Census, both Christian—aged fifteen —and his father worked in a "cutting shop," where parts are machined down to spec.[3]

From 1885 through 1890, Christian was living with his parents at 17 John Street and was employed by the Stanley Rule and Level Company. Andrew, Christian's father, worked at Landers, Frary, and Clark, a manufacturer of housewares in New Britain. In 1891, Andrew was listed in the New Britain directory with no employment.[4]

Whether at this time—1890— Christian Bodmer was an employee or one of Stanley's contract workers is not known. In 1894, however, Bodmer must have been working for Justus A. Traut, one of the contractors working at Stanley, since he and Traut filed letters patents jointly for several styles of block plane throat adjustment levers. (A "letters patent" granted exclusive rights to the invention, thereby prohibiting another individual's infringement of the idea/concept. In this case, Bodmer and Traut were granted exclusive rights to produce these styles of levers.)

The patent (Figure 1) was granted February 20, 1894, and was assigned to Traut. Figure 2 shows the patent applied on a no. 60 block plane with adjustable throat.

The contract system under which Traut worked was operated by Stanley from 1870 to 1900. The company began phasing the system out in the early 1900s, and by 1908, the system was abolished by Stanley. In the contract system, the contractor (in this case, Justus Traut) paid very well trained machine operators and skilled craftsmen high per-piece rates for finished goods. It was like a company within a company. And, although Traut and Bodmer are both listed as employees of Stanley Rule and Level in

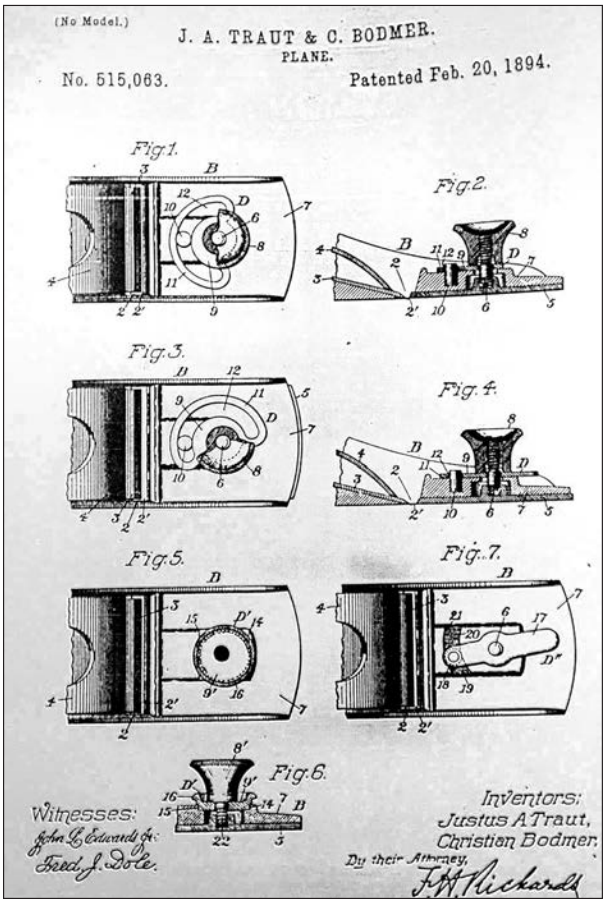
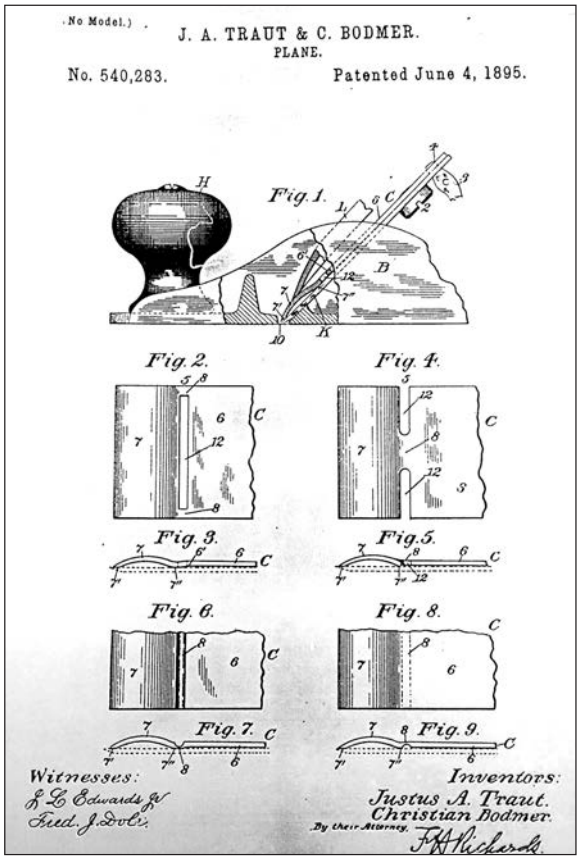

(No Model.)
J. A. TRAUT & C. BODMER.
PLANE.
No. 515,063. Patented Feb. 20, 1894.
Fig.1.
Fig.2.
Fig.3.
Fig.4.
Fig.5.
Fig.7.
Fig.6.
Witnesses:
John L. Edwards Jr.
Fred. J. Dole.
Inventors:
Justus A Traut,
Christian Bodmer
By their Attorney,
F. A. Richards

Figure 1 (left). Bodmer's first patent.
Figure 2 (above). Stanley's no. 60 block plane using Bodmer and Traut's 1894 patent.


(No Model.)

J. A. TRAUT & C. BODMER.

PLANE.

No. 540,283. Patented June 4, 1895.

Fig. 1.

Fig. 2.

Fig. 4.

Fig. 3.

Fig. 5.

Fig. 6.

Fig. 8.

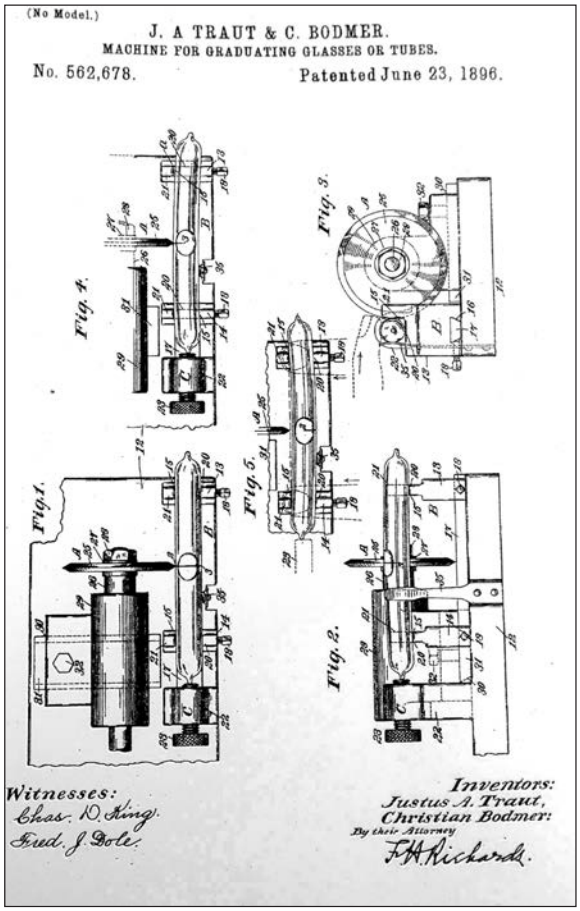
Fig. 7.

Fig. 9.

Witnesses:
S. E. Edwards Jr.
Fred. J. Dole.

Inventors:
Justus A. Traut.
Christian Bodmer.
By their Attorney.
F. A. Richards.

Figure 3 (above). Bodmer's second patent for an improvement in cap irons.


(No Model.)

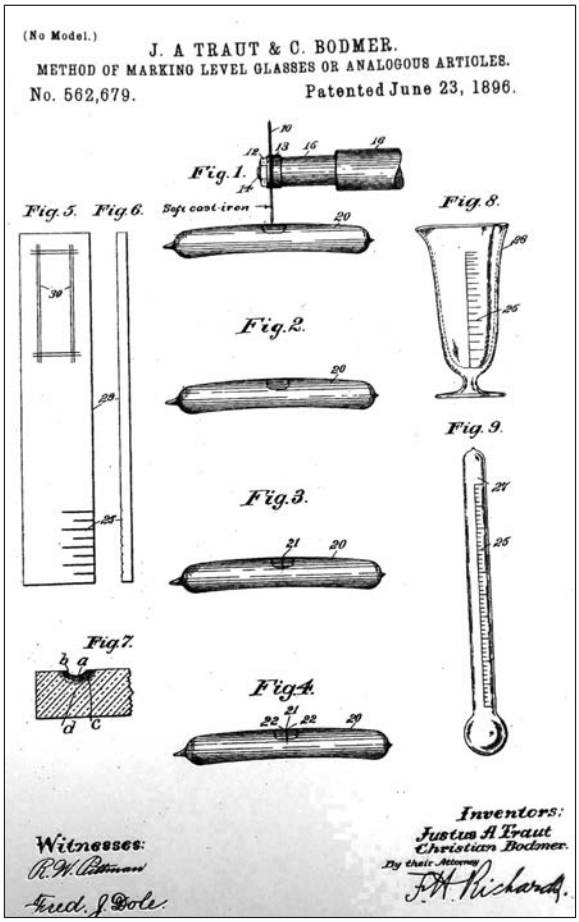
J. A TRAUT & C. BODMER.

MACHINE FOR GRADUATING GLASSES OR TUBES.

No. 562,678. Patented June 23, 1896.

Witnesses:
Chas. D. King.
Fred. J. Dole.

Inventors:
Justus A. Traut,
Christian Bodmer:
By their Attorney
F. A. Richards.


(No Model.)

J. A TRAUT & C. BODMER.

METHOD OF MARKING LEVEL GLASSES OR ANALOGOUS ARTICLES.

No. 562,679. Patented June 23, 1896.

Fig. 1.

Fig. 5. Fig. 6.

Soft cast-iron

Fig. 8.

Fig. 2.

Fig. 9.

Fig. 3.

Fig. 7.

Fig. 4.

Witnesses:
R. W. Pittman
Fred. J. Dole.

Inventors:
Justus A Traut
Christian Bodmer.
By their Attorney
F. A. Richards.

Figures 4 (left) and 5 (right). Bodmer and Traut letters patents for marking level glasses. Figure 4 is the patent for the mechanism and Figure 5 shows the patent for the process.

the city directories, Bodmer, in fact, worked for Traut at Stanley. The idea of the system was that employees could produce as much or as little as they wanted. The advantage of the system was that it encouraged high quality, high efficiency, and improved new products.

The New Britain city directories of 1895 and 1896 confirm that Christian was employed by "SR&L Co." with his brother Frank and that they resided at 17 John Street with their father and, presumably, their mother.[5]

Christian Bodmer and Justus Traut filed another letters patent on January 12, 1895, for an improvement in cap irons used on standard bench planes. The patent was granted on June 4, 1895 (Figure 3). The objective of this patent was to make a cap iron with the curved bottom flexible so that it lies perfectly tight against the cutting iron. It was a novel idea but one that, apparently, never made it to production as no existing examples of its use have appeared to date.

Up to this time, level glasses were marked by hand. It was a labor intensive job as the proper location for the vial's line or lines required a good eye and a steady hand, as well as a light touch with the file that was used to mark the line on the level vial. Bodmer's machine had a rest that supported the spirit-level glass. The rest could be

Figure 6. Stanley level glasses, with wood shipping boxes, showing 1896 marking line.

adjusted so that the level vial could be marked in a pre-production type process. The spirit-level glasses were usually marked by making a nick using a file in the center of the vial. This nick marked the glass, but in doing so it created a weak spot in the glass which was then prone to breakage.

On January 13, 1896, Bodmer and Traut filed two joint letters patents concerning a machine for graduating spirit-level glasses and the other for the actual method for marking the same.

The patent in Figure 4 is a drawing of a graduating machine that could be used to mark fine lines onto spirit-level glasses. This device had a high velocity, cast-iron wheel against which a level glass could be rotated at a set distance from the ends, thereby marking the center of the level glass.

Patent no. 562,678, "Machine for Graduating Glasses or Tubes" (Figure 4) was only for a machine that could accurately mark spirit-level glasses; patent no. 562,679, "Method of Marking Level Glasses or Analogous Articles" (Figure 5) illustrates the patent that was for the marking process itself. (Today's equivalent would be like a patent for a "smart phone" and one for the software that makes it work.) Bodmer and Traut's process used a cast-

Figures 7 a and b (right). A Stanley no. 102 cherry level (two views) with original glass vial showing the Bodmer and Traut's patent on the level plate.

iron rotating wheel of high velocity that would soften the glass and, in a sense, burn a line into the spirit level. As the spirit-filled level glass cooled, the burned line created a fusion action that tempered the glass at the line. The tempering rendered the glass materially stronger and eliminated the problem of weakening the glass that occurred when using the old method. Both patents were granted on June 23, 1896 (Figures 4 and 5). The same principle was used for mechanisms for marking other types of graduated tubes and vials.

Initially, Bodmer's design for the machine had only one wheel to mark the level glass, so levels were marked with only one line. Stanley quickly decided that two lines marking the center of the vial would make a more accurate level. Adding another rotating wheel to the power mandrel solved the problem.

Thus, Christian Bodmer and Justus Traut in these two significant patents vastly improved the most important part of a level—the spirit-level glass—by making it substantially stronger.

Figure 6 shows some early wooden Stanley level-glass boxes, which contained level glasses packed in sawdust with examples of some level glasses showing the two marked lines. Notice the label states the patent dates.

Stanley not only sold spirit levels for replacing broken vials but also used them on their various models of carpenter levels. An example of a Stanley no. 102 (Figures 7a and b) level shows the marked level glass together with the patent dates stamped into the cover plate. This level is marked "PAT 6-2-91 6-23-1896." The first patent date is for the groove on the side of the level, making it easier to grasp and hold, and the second date is for the spirit-level marking.

On June 21, 1897, Christian Bodmer's mother, Mary Bodmer, died. She was buried at Fairview Cemetery in New Britain, Connecticut.

The New Britain city directories of 1898 and 1899 find Christian residing at 19 Pleasant Street with his brother Frank and their father, Andrew. Christian was listed as a contractor at Stanley Rule & Level Co., and Frank was still employed at Stanley.[6]

On April 25, 1900, Andrew Bodmer died. He was buried at Fairview Cemetery with his wife, Mary.[7]

In 1900, the New Britain city directories listed Christian as still residing at 19 Pleasant Street with his sister, Margaret and brother-in-law Samuel F. Hall, who operated a "notion store."[8] Frank Bodmer, Christian and Margaret's brother, also lived at 19 Pleasant. Frank was listed as a "machine fixer" at Stanley Rule & Level Co. Christian was a contractor at Stanley in the city directory[9] and a "master mechanic" in the 1900 U.S. Census.[10]

As the new century came in, Christian Bodmer's inventive talent took off. The next article will explore Bodmer's life and many more of his ingenious patents.

Notes

1. *Massachusetts, Town and Vital Records, 1620 - 1988.* Ancestory.com on-line database (Provo, Utah: Ancestry.com Operations, Inc., 2011). Christian was "registered" in Deerfield, Massachusetts.
2. *1870 United States Federal Census.* Census Place: New Britain, Hartford, Connecticut; Roll: M593_103; Page: 137A; Image: 476; Family History Library Film: 545602 (accessed online at Ancestry.com).
3. *1880 New Britain, Hartford, Connecticut Federal Census.*
4. *U.S. City Directories, 1821-1989. New Britain Directory, 1886-7 Containing a General Directory of the Citizens, Classified Business Directory, Street Directory, New Map and Officers of the City Government, Churches, Societies, etc.*, Price, Lee & Co., New Britain, Connecticut (accessed at Ancestory.com on-line database). Each year's title is the same except for the year date. The copyright date, also, changes accordingly. *New Britain Directory, 1887-8...*, *New Britain Directory, 1888-9...*, *New Britain Directory, 1889-90...*, *New Britain Directory, 1890-1...*, *New Britain Directory, 1891-2...*
5. *New Britain Directory, 1895-6* (New Britain, Connecticut: The Price & Lee Co., 1896) and *New Britain Directory, 1896-7* (New Britain, Connecticut: The Price & Lee Co., 1897)
6. *New Britain Directory, 1898-1899* (New Britain, Connecticut: The Price & Lee Co., 1899) *New Britain Directory, 1899-1900* (New Britain, Connecticut: The Price & Lee Co., 1900).
7. *Connecticut, Deaths and Burials Index, 1650-1934.* Original data: "Connecticut Deaths and Burials, 1772–1934." Index. FamilySearch, Salt Lake City, Utah, 2009, 2010. Index entries derived from digital copies of original and compiled records (accessed at Ancestory.com on-line database).
8. *New Britain Directory, 1900-1901* (New Britain, Connecticut: The Price & Lee Co., 1901).
9. *New Britain Directory, 1900-1901.*
10. *1900 U.S. Federal Census*, Census Place: *New Britain, Hartford, Connecticut*; Roll: 138; Page: 4A; Enumeration district: *0205*; FHL microfilm: *1240138* (accessed online at Ancestry.com).

Walter Jacob writes a regular column on Stanley tools for The Chronicle. *Sue Jacob assisted Walt with the research for this article. A collection of Walt's columns from* The Chronicle *was published in October 2011 and is available at* WWW.EARLYAMERICANINDUSTRIES.org.

A Unique Tongue Plane

by Willard Anderson

I teach a workshop on restoring wooden planes at the Woodwright's School in Pittsboro, North Carolina. One of the students at the school brought in a tongue plane (one half of a tongue-and-groove pair, for larger scale work), shown in Figure 1. The plane had been purchased in central Ohio about thirty years ago in Amish country. This plane had a wedged-arm fence, and was 13½ inches long, 2⅜ inches wide and about 2⅝ inches thick. There was no maker's mark, owner's mark, or layout marks on the

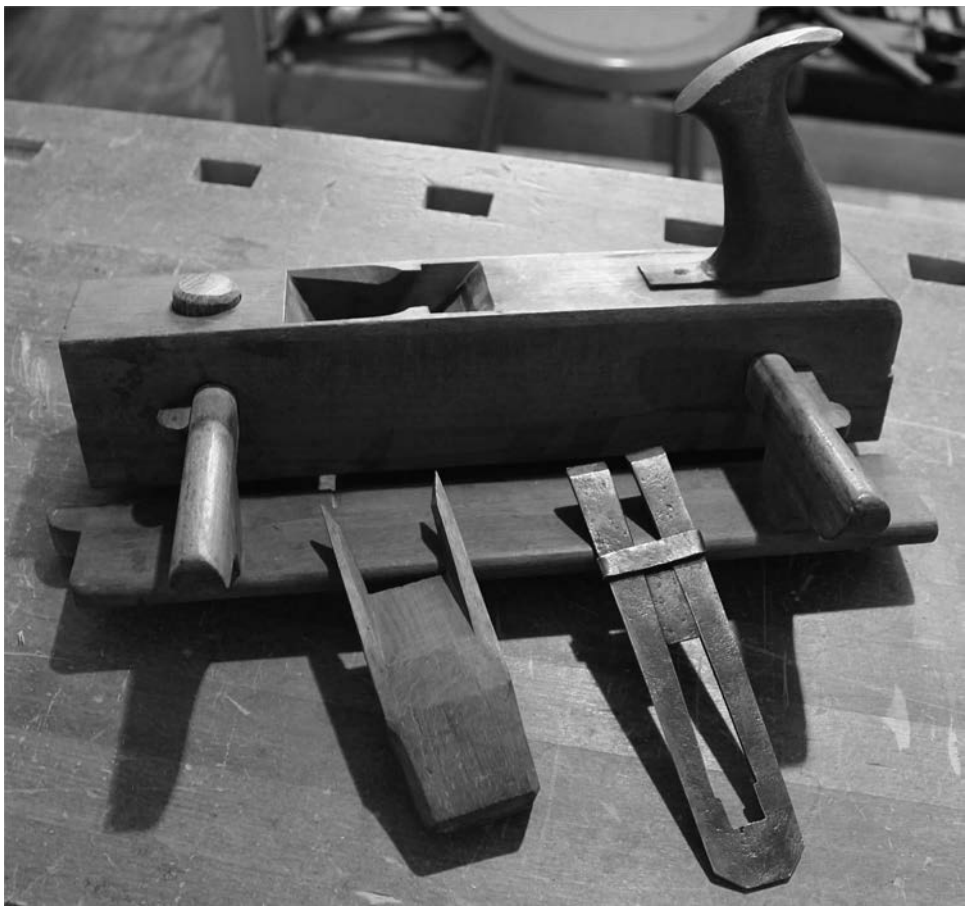
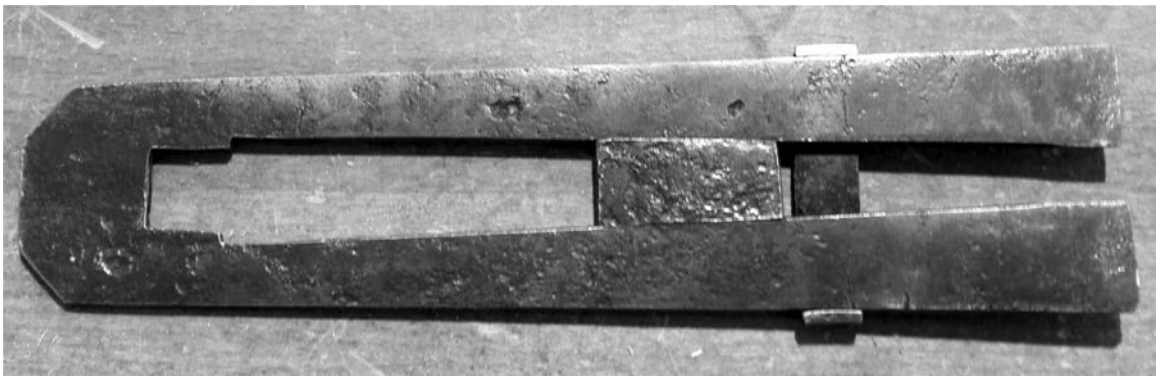
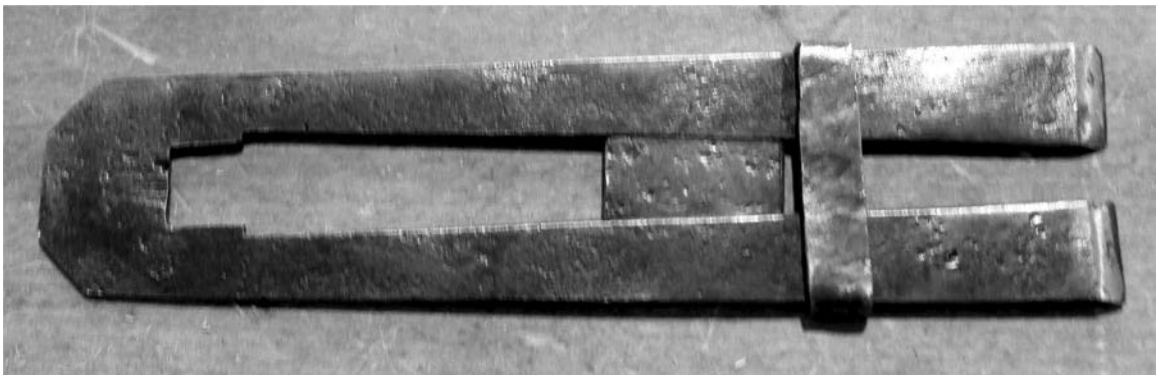


Figure 1 (right). A unique tongue plane purchased in Ohio. One the most interesting parts of the plane is the iron.

Figure 2 (below). The underside of the plane showing repairs. The "nails" that hold the inserts in place appear to be shoe pegs.





Figures 3 (above) and 4 (below). The iron. The tines are tapered and the metal wedge could be moved up and down in order to change the distance between the cutters.

plane. The style of the handle suggests a late-eighteenth or early-nineteenth century date for construction. The plane appeared to be professionally made, but possibly modified by the owner.

The sole and the fence had wear strips inserted along the length (Figure 2). The fence at some time in the past was dovetailed to accept three inserts, presumably of rosewood, but these are missing. The sole of the plane had two long sections of rosewood inserted into each shoulder of the profile. On first inspection, these inserts appeared to be nailed on. A closer look revealed that the "nails" were similar, if not identical to shoe pegs

In the plane, the iron appeared to be a cut iron, but when it was removed, it was shown to be a very clever user-made iron (Figures 3 and 4). There was no maker's marks on the iron, which was of laminated construction. The iron was considerably narrower than the throat opening (1½ inches compared to over 1¾ inches). The bed of the plane had been roughly excavated to accommodate the plane iron architecture. The iron overall was tapered in width along its length, being widest at the cutting edge. The inside edges of the tines of the iron were tapered back from the cutting edge. The two tines could be tweaked together or apart by moving a tapered metal wedge up or down the length of the iron. The setting could be locked in place by means of a sliding clasping collar. This wedge did not run in a track, but was fixed in position by pressure.

Possibly the woodworker had lost the original iron. Possibly the plane was modified for another purpose altogether (making tongues of variable thickness?). Alternatively, it is possible that the original irons in the tongue-and-groove pair did not match closely enough. This is not an uncommon problem with match planes. The simplest approach is to attempt to move the tongue iron tines in or out to match the groove iron. The iron in this plane appears to be a blacksmith-inspired solution, similar in some ways to the joinery in a leg vise. From a woodworking perspective, it is not a completely satisfactory solution. The user would have to not only tweak the spacing of the cutter tines, but also have to adjust the iron right or left to put the tongue in the correct orientation relative to the fence.

The iron is a very clever solution and represents the epitome of "thinking outside of the box." I can just imagine the house joiner coming to the local blacksmith, desperate for a fix to get back to work, and then the blacksmith has an inspiration.

Author

EAIA member and woodworker Willard "Bill" Anderson is the owner of Edwards Mountain Woodworks in Chapel Hill, North Carolina. He has made several appearances on Roy Underhill's The Woodwright's Shop. He is particularly interested in sash-making planes and the nineteenth-century toolmaker Josiah King of New York City.

"Plane Chatter" will return in the September issue.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