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Jacob Perkins & Amesbury Industrial Nail Manufacture

1796

(2X)

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Jacob Perkins' Nail Making[1]

Jacob Perkins (1766-1849) was an engraver and die-sinker who had minted coins and made gold medallions at his Newburyport shop. The American Revolution had ended nail imports, England having been the world's largest nail producer, so that Perkins had invented machines for separately shearing nail blanks from sheet and then forming a head onto each nail blank. These were thus "cut" nails rather than wire nails, the latter introduced around 1860. Local investors had opened in 1794 a three-story water powered mill on the Parker River at the Moody family farm in Rowley that had Perkins' first nail factory on the first floor and a textile mill on its top two floors. Bringing Paul Moody with him, Perkins then moved in 1796 to a new mill he and investors built in Amesbury. This provided more power plus river transportation for quality iron incoming from Schuylkill Valley, Pa. and for outgoing product shipments.

Perkins continued to pursue manufacturing improvements after obtaining U. S. Patent Number 92 for his nail machines and setting up Amesbury production, because heading was a slower process than that of shearing nail blanks. His business partner, John Armstrong, was losing patience, intent more on doing business and less on mechanical tinkering. Perkins obtained a second patent in 1799 on a machine that sheared off a nail blank and then hammered a head onto it in a single one-cycle sequence, matching rates of both functions and speeding operations. But it had problems that demanded more attention. Armstrong then called in his mortgage on the factory and both patents (which wedged Perkins out of the company) and then sold the factory to free himself of the venture.

1) Drawn generally from: *Nail Makers and Their Machines,* Maureen K. Phillips, APT Bulletin, Journal of Preservation Technology, 1996, Vol 27, No. ½, pgs. 47-56

2) Illustration from: *Jacob Perkins, His Inventions, His Times, & His contemporaries*, Greville and Dorothy Bathe, 1943, summarized by Ron Klodenski for Amesbury Carriage Museum

Nail Making General Background[1]

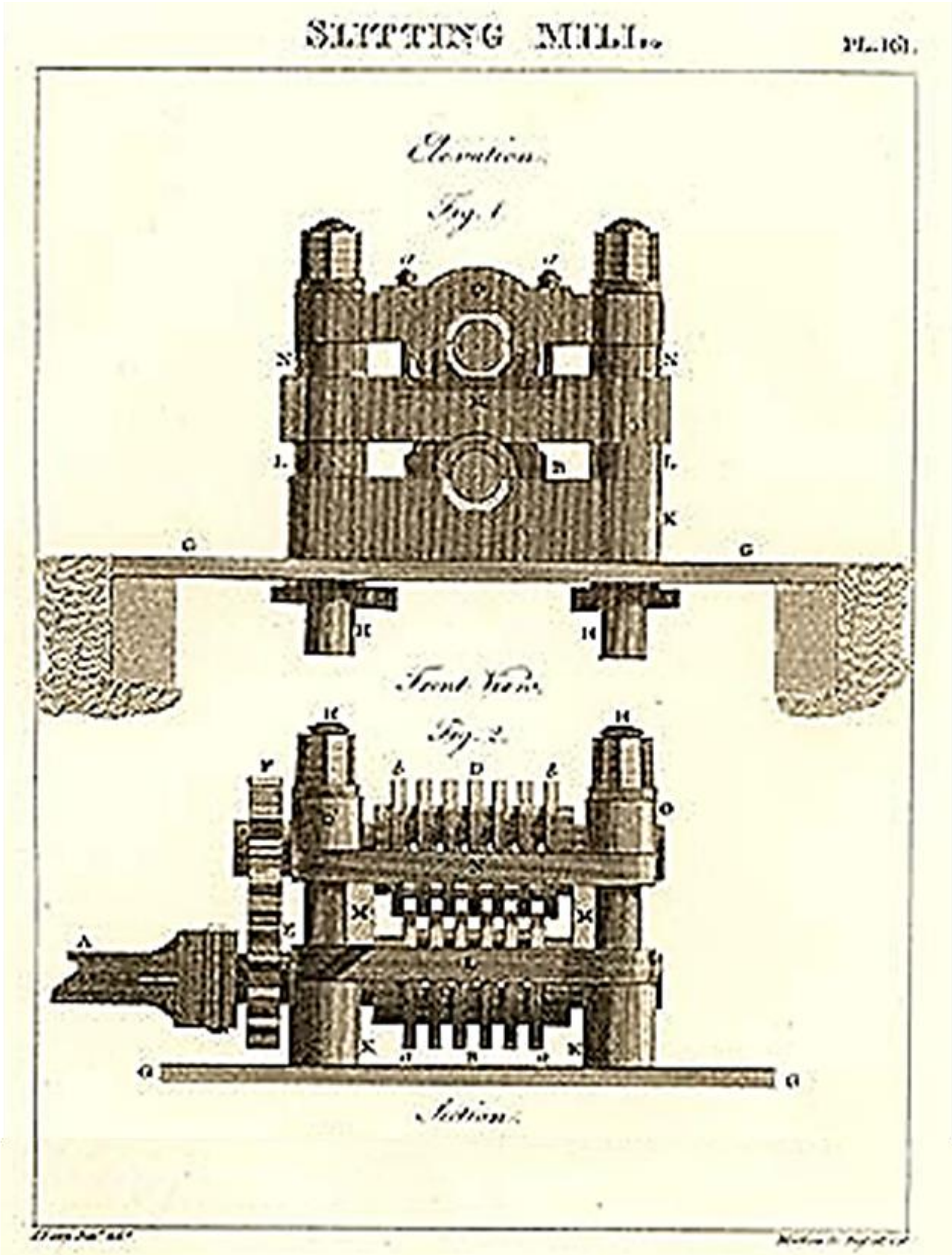
The utility of nails has long been understood, examples going back to bronze nails of ancient Egypt made around 3400 BC. A buried hoard of seven tons containing one million Roman iron nails was discovered near the remains of the Roman fort of Inchtuthil in Perthshire, United Kingdom, dating from 86 or 87 AD. By medieval times in England, “nailors” had established relatively standard methods of making relatively standardized nails (Naylor still being a common surname), and by the late 1500s there were slitting mills that removed much of the labor in cutting slender square-section iron rods for hand-forging nails. The iron was worked in a hot condition and forged with carbon that would create a low-grade steel. The rod end would be hand-forged into a square tapered shank and then cut off to be hand-headed using a hammer. With no more re-heating, the iron would be left in a somewhat work-hardened condition that rendered it harder and stronger.

Slitting mills were thus among early quasi-industrial improvements in nail making that remained an essentially labor-intensive craft. High utility, relatively standard sizes, and high labor input made nails a reasonably known-value barter commodity. Slitting mills were sufficiently valuable tools that England forbade their manufacture and use in the American Colonies (although this was probably difficult to enforce) because the colonies were intended as consumers of English products. Families could spend winters and inclement weather making nails, and Thomas Jefferson declared that this was in indispensable craft that he practiced himself.

Another simple yet important realization was that, rather than hand forging tapered nails from slender bars, nails that were tapered on only two facing sides could be sheared from rolled sheet stock, the other two sides being parallel faces of the sheet. Rolling and slitting equipment formed the basis for more producible cut nails. Combined with the “nail drought” caused by the American Revolution, this set the stage for American industrial nail production, the first such process in the world. As an aside, round wire nails date back to perhaps the 1820s but did not progress much before the 1860s, and did not surpass cut nail production until the early 20th century.

1) Derived mainly from: http://www.edubilla.com/invention/nail-making-machine/

Traditional Craft Nails at Pawtucket, Rhode Island



During the 1780s, Oziel Wilkinson had a water powered slitting and rolling mill (generally as described on the next page), and shear in his shop at Pawtucket, Rhode Island, from which he made nail blanks for hand-crafting cut nails. The shop also produced shovels and several such implements. He eventually abandoned this pursuit and built a stone textile mill for producing cotton thread, to be woven into fabric on home looms as a cottage craft.

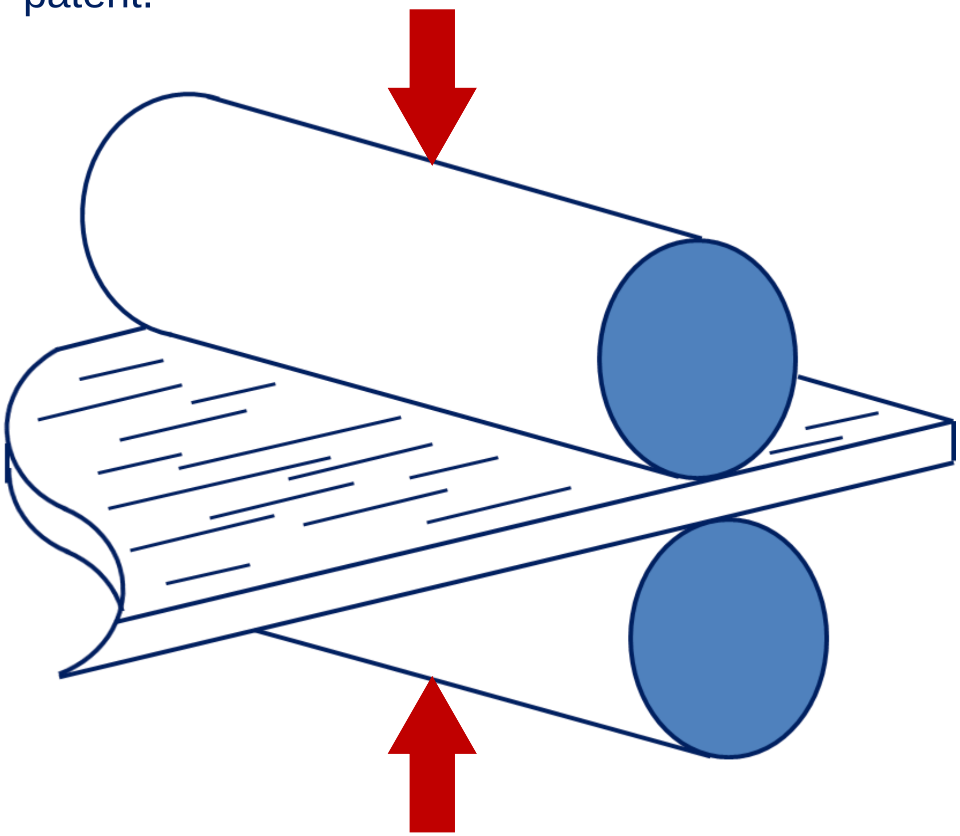
A slitting mill consisted of two parallel cylinders geared to roll together so as to pass an iron sheet between them. Each cylinder consisted of a stack of hard steel disks having sharp edges, with alternate disks being larger in diameter and extending up into valleys between raised disks of the opposite cylinder. As a heated iron sheet was drawn into the set, it was slit into a group of parallel square section rods from which to make nails.

Found at http://oldexeterhouse.blogspot.com/2012/08/nails.html, this was stated as from 1813

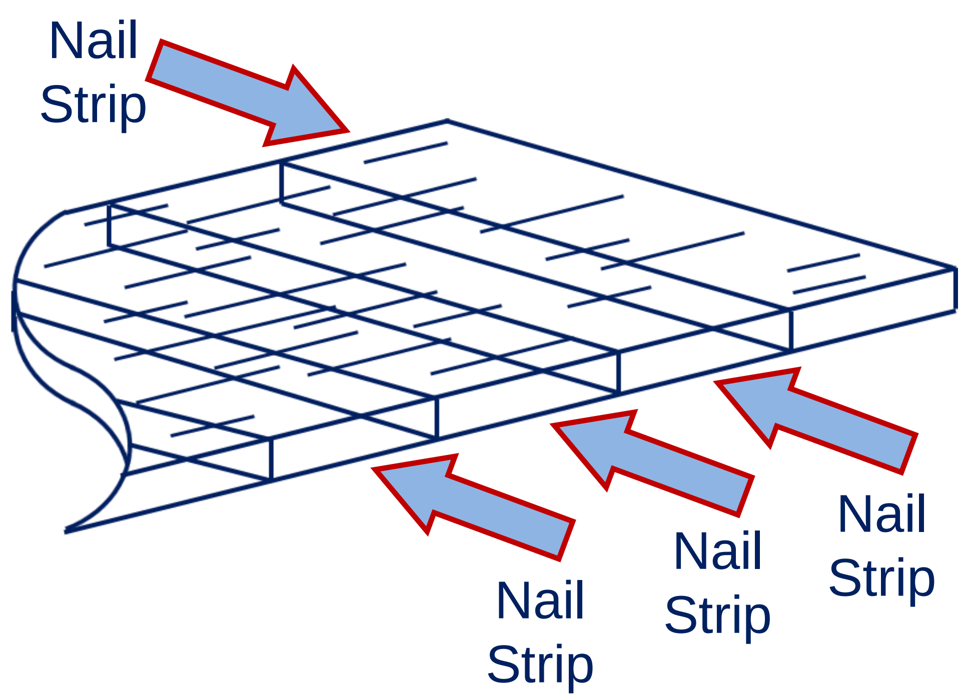
Rolling Metal Strips for Making Cut Nails

rolling and hardening metal sheets, and aligning metal grain with nail axis

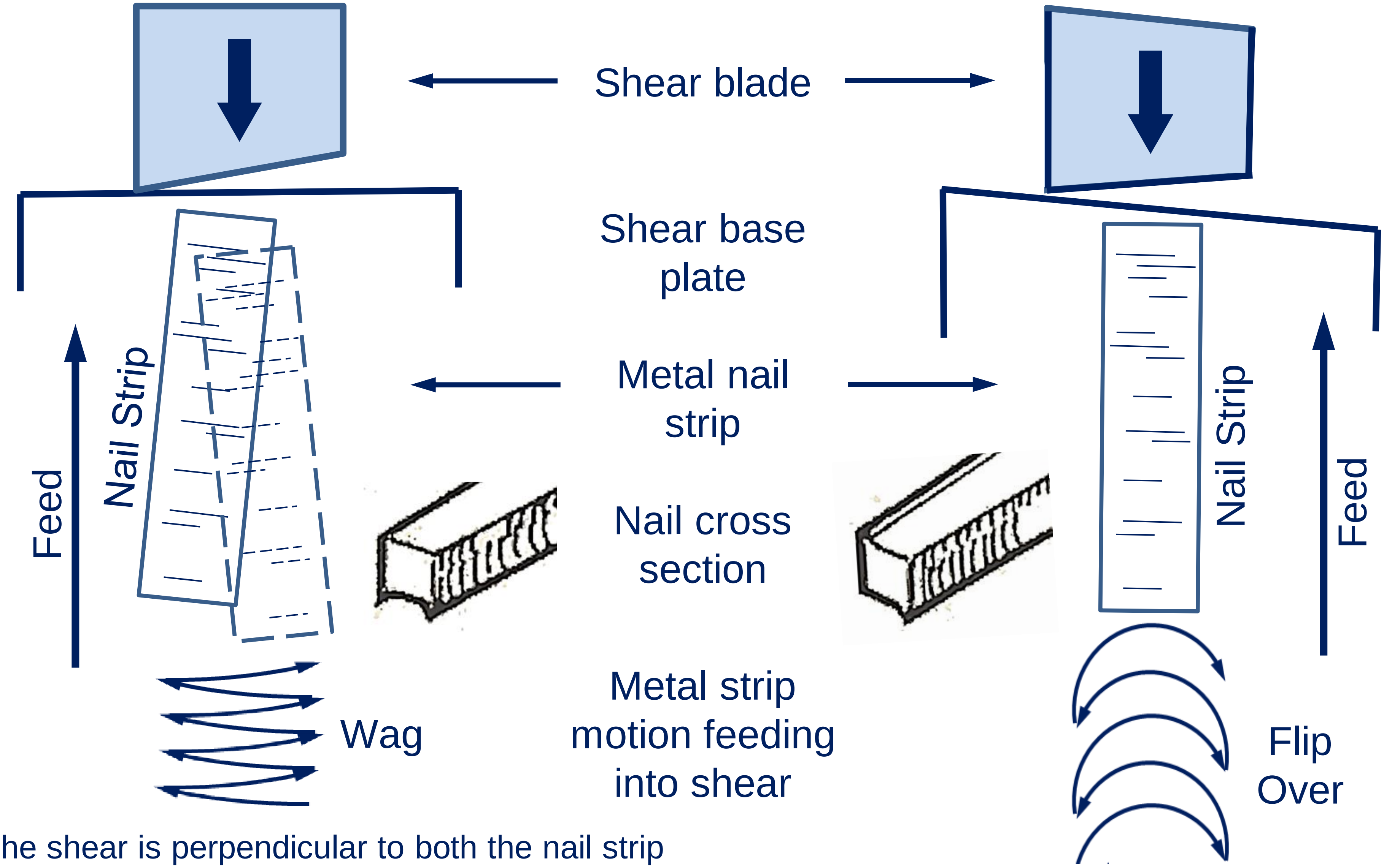
Heated iron sheets are progressively worked down to desired thickness in a rolling mill by multiple passes through rollers under high pressure. In addition to achieving the desired sheet thickness, this “work hardens” sheets to make the iron harder and stiffer, and produces metal “fibers” elongated in the direction of rolling. It is desired that the grain of fibers align with nail length, which Perkins specified in this patent.



Rolled plates are next cut transversely into strips in which the grain runs sideways across the strips. Tapered nail blanks are then cut off the strips in a shearing machine that also automatically grips the cut nail near its top and pounds a head of specific shape onto the nail. For that reason, the righthand method on the next page is preferable for cutting nail blanks, because the lefthand method inconveniently places the head-end of the nail on alternating left-right sides of the shear.



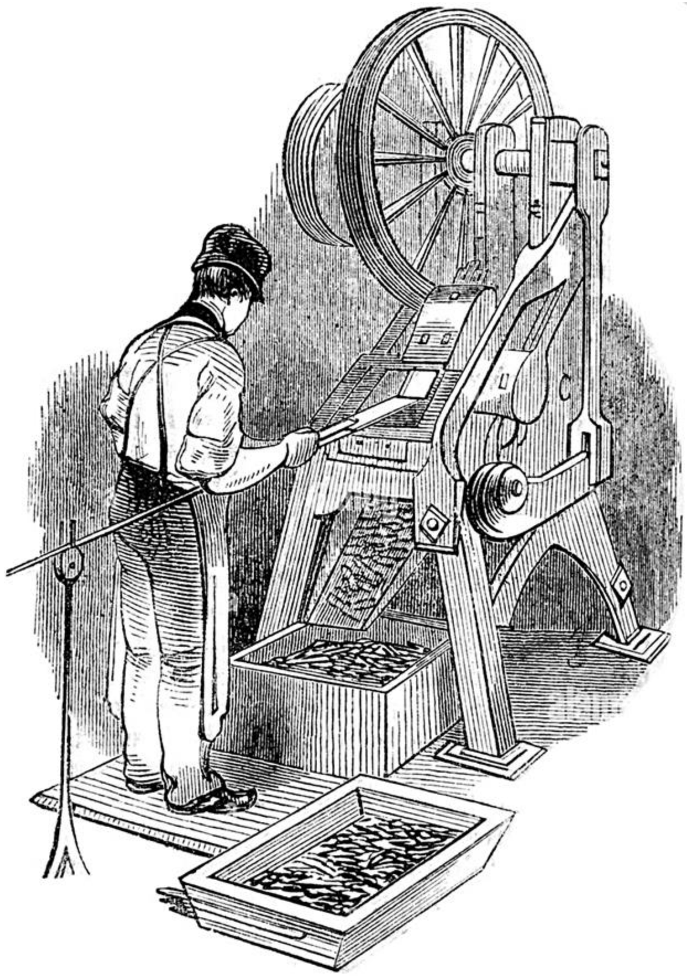
Two Methods for Cutting Tapered Nail Blanks



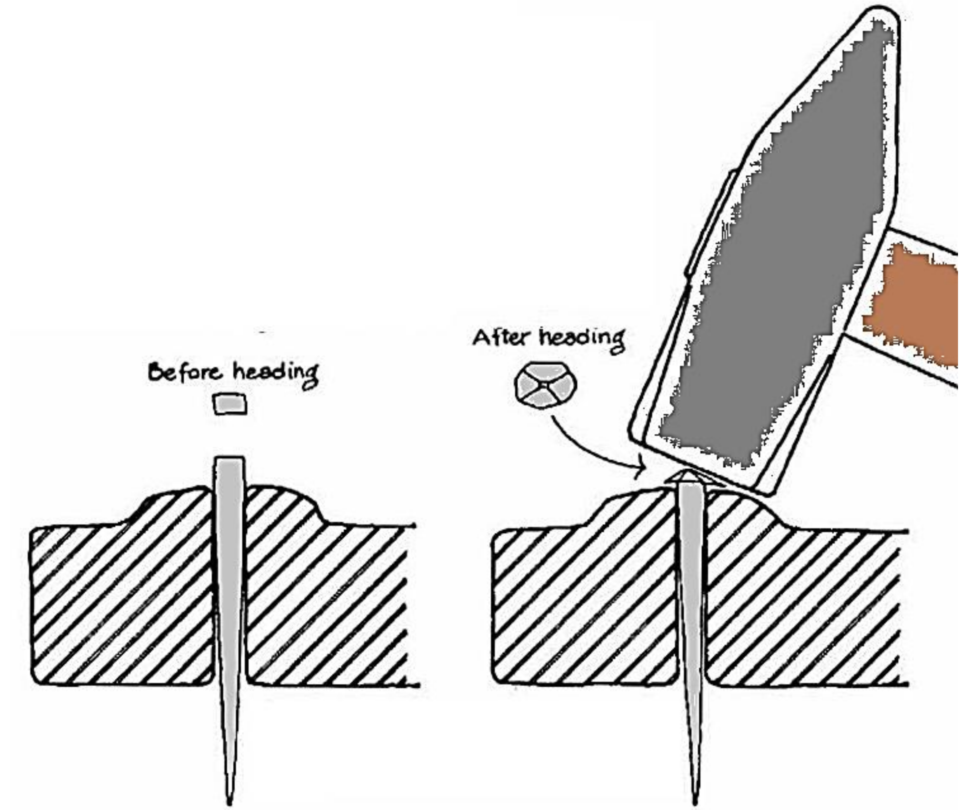
The shear is perpendicular to both the nail strip and its feed direction. By wagging the tail of the strip between cuts, the nail is tapered on its two sides. The head-end of the blank alternates between being on left and right sides, which is inconvenient for an automatic heading process.

The shear is angled at the nail taper angle, and the strip is fed straight in. The strip is flipped upside down between cuts, to taper both sides, and the head-end of the nail blank is always on the righthand side for automatic heading.

Manual Heading of Machine Cut Nails



https://www.alamy.com/stock-photo-cut-nail-nails-woodworking-construction-pin-sharp-hard-metal-alloy-39708566.html



https://inspectapedia.com/interiors/Nail-Heading-Tool-Nelson.jpg

This machine is simply an automatic shear that continues stroking repeatedly to cut nail blanks. The nail strip is fed into the shear against a stop at the back. The operator holds the nail strip using a clamp having a long tail extending through a guide behind the operator. The guide lets the clamp tail wag side-to-side by a fixed amount, thus cutting tapered nail blanks.

Cut nail blanks have a roughly rectangular cross section down their length. Blanks can then be held in a tool having a square or rectangular hole that prevents the blank from passing through (The hole can be in the faces of a foot-operated vise for tight grip and easy release.) Thus gripped, the blank can be manually headed, the “mound” shape on the top of the tool allowing a hammer to be angled against the head. Gripping may leave marks and indents on the nail blank.

Development of Massachusetts Industrial Nail Making[1]

The World's 1st industrial nail factory

Byfield - 1794
Perkins nail factory
Paul Moody family farm
Newburyport Woolen Co.

Amesbury - 1796
Amesbury Nail Co.
Perkins' 1795 Patent
Paul Moody there

Perkins' 1799 Patent
to both cut & head nails, but not assembled until 1805 by Briggs Reed

Amesbury Nail sold 1802
Moody had been running mill, leaves in 1804 to enter textiles with Ezra Worthen

Salem Iron Factory - 1796
Nathan Read & investors at Danversport, Mass. chain, anchors, ship products

Nathan Read – 1798 Patent
1st nail machine to cut a nail blank & then head it in a single continuous cycle

Purchase Amesbury Nail
1802, sold to Salisbury Mills in 1825 to use as weaving mill

Perkins ousted from company, 1799, improves machine, starts Dedham Mass. nail factory in 1810, and another in Birmingham, England. Moves to Philadelphia 1816, moves to London 1818, dies there in 1849.

Reed had perfected a means of dependably transferring nail blanks to the heading apparatus, avoiding jamming that had plagued both himself and Jacob Perkins.

Jesse Reed - 1807
brother of Briggs Reed joins with Thomas Odiorne, patents machine to both cut & head nail in single cycle.

Reed-Odiorne Nail Mill 1807
in Malden, Mass.
Soon open 2nd factory in Schuylkill Valley, Pa.

Reed-Odiorne Success
The 1807 Reed machine becomes the most widely used nail machine of the early 19th century

The Reed brothers were from an experienced Bridgewater, Mass. community of nail makers and inventive mechanics.

Thomas Odiorne was a wealthy Boston merchant and investor who purchased Jesse Reed's 1807 patent for $42,000.

1) Drawn generally from: *Nail Makers and Their Machines*, Maureen K. Phillips, APT Bulletin, Journal of Preservation Technology, 1996, Vol 27, No. ½, pgs. 47-56

The Perkins Nail

Cut nails have great clinching power, still used in flooring. The Perkins nail had an elongated head, not uncommon, that could be driven flush, as with a finishing nail. A rounded area of the shank, just below the head, was formed by the gripping device that held the cut nail blank for heading. Ultimately, the chief benefit was that the rapidly produced industrial nail was far less expensive than handmade nails.

There was ample demand, and thus competition, to achieve industrial nail production. It will never be known to what extent Briggs Reed's familiarity with Perkins' 1799 design contributed to brother Jesse Reed's device. Perkins felt that his own design had been usurped, and admitted "borrowing" the latter Reed's design for transferring nail blanks from shearing to heading. Perkins' wide-ranging mind was destined to eventually seek new fields, while Reed's financial horsepower from Thomas Odiorne provided a potent impetus for nail making success.

Despite devastating fires in 1805 and 1811, the Amesbury nail factory operated until being sold to the textile mill company in 1825. Jacob Perkins eventually went to Boston, New York, and Philadelphia, building his reputation for engraving counterfeit-resistant printing plates for banks and governments. In 1818 he moved to England where he worked with partners to produce currency and postage stamps, also continuing to work on side-projects. He was granted 40 patents during his lifetime in the U.S. and England, dying in London in 1849 and being buried there. Outside of Amesbury, Perkins is best remembered as the father of refrigeration. He identified that ammonia possesses physical properties for a refrigeration fluid (still used today in commercial installations) and patented in 1834 a mechanical refrigeration system with a vapor compression cycle, the principle still universally employed.

Illustration from: *Jacob Perkins, His Inventions, His Times, & His contemporaries*, Greville and Dorothy Bathe, 1943, summarized by Ron Klodenski for Amesbury Carriage Museum. Nail shown from ACM Collection, gift of Steve Klomps.