

THE UBIQUITOUS NAIL: AN ANNOTATED BIBLIOGRAPHY

For want of a nail the shoe is lost,
for want of a shoe the horse is lost,
for want of a horse the rider is lost,
for want of a rider the kingdom is lost.

George Herbert, *Jacula Prudentum*, 1651: line 499
quoted by B. Franklin in *Poor Richard's Almanac* (1758)

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INTRODUCTION

This annotated bibliography identifies and discusses some of the literature produced on the subject of wrought, cut, and wire nails. It is divided into nine categories, namely: theory, history, fabrication, building technology, dating tools, archaeology, metallurgy, government publications, and the Walnut Street Prison.

Although the literature for wrought and wire nails is well represented, the bibliography is less complete in these areas than it is for cut-nails. The categories were selected as a means of making the bibliography more "user friendly". They are also indicative of the ways in which nails have been studied in the past. Many of the citations cross these artificial lines of categorization. In such instances, the work has been grouped by its most useful area of contribution. In cases where a secondary contribution is also significant, the citation is repeated as "see also".

A previously published bibliography by Peter J. Priess, entitled *An Annotated Bibliography for the Study of Building Hardware* (1978) is a good reference. The section on nails includes a number of the sources considered in the present bibliography. In addition, Priess included notes on general manufacturing histories and several early references to wire nails (in French) not reconsidered here.

The "theory" category includes several works that suggest methodologies for the study of nails. Also included are several authors who address the study of material culture in a more general way. These are also useful when considering nails.

The "history" category is the largest. At one end of the spectrum, a few very broad manufacturing histories contain only a passing reference to nails, while some authors provide wonderful detail and chronology. Several travelogues from foreign and domestic travelers are included. These relate first-hand observations of the nail manufacturing process, the working conditions in a nailery, and, to a lesser extent, the

impact of mechanization on the industry and the worker. Many of the works included in the history category are geography specific. All of these are from the United States, Great Britain, or Canada. From within the U.S., New England, Pennsylvania, New Jersey, Virginia and Louisiana are represented.

"Fabrication" includes those works which focus on the process, rather than the history, of making nails. There is good coverage of wrought and cut nail fabrication, and a little on wire nail production.

The category "building technology" is representative, at best. Several selections which discuss balloon-frame construction methods are included. There are also a number of articles that describe the "penny" system of designating nails.

One of the earliest reasons to study nails stemmed from their use in dating old structures, hence the next category, "dating tools". Also included are several papers which describe the use of x-rays to locate and identify nails within the building fabric.

The ubiquitous nail appears in many archaeological excavations. Examples of good treatment, and not so good treatment, are included in "archaeology".

The section "metallurgy" includes articles which focus specifically on the material characteristics of a nail or many nails. There are also papers which discuss techniques employed to determine the source of the iron and its age.

The "government publications" section includes United States Manufacturing Censuses, patent records, and test reports from the Watertown Arsenal.

The section on the "Walnut Street Prison" is included as a case study. The Prison was in operation from 1773 until 1835, a period of time which saw the introduction of cut nails. The Prison maintained workshops for the inmates who produced wrought and cut nails, among other products.

1. THEORY

James Deetz doesn't specifically mention nails in his *In Small Things Forgotten: The Archaeology of Early American Life* (1977). Nails do, however, satisfy his notion of "the seemingly little and insignificant things that accumulate to create a lifetime" and, in which, "the essence of our existence is captured". Robert Ascher's "Tin*Can Archaeology" (1974) likens the nail to the Coca Cola bottle, the automobile, and Stonehenge as a "superartifact" because of its cultural significance and its ability to tell us the most about our society. Bernard L. Fontana's "The Tale of a Nail: On the Ethnological Interpretation of Historic Artifacts" (Sep. 1965) discusses the cultural significance of nails by applying Ralph Linton's four attributes of every artifact, namely form, meaning, use, and function. Fontana asks his readers to contemplate what our surroundings would be like without nails and suggests that all buildings would literally fall apart without them. This article also includes slightly reduced reproductions of S.D. Kimbark's 1876 catalogue of nails. Edward McM. Larrabee begins his article "Machine Made Nails from a War of 1812 Site at Sackets Harbor, New York" (1967) with the statement "nails are neglected artifacts". Although it starts out as an archaeological site report, Larrabee goes on to pose a series of thoughtful questions that focus on the potential information to be gained from the study of nails. He then returns to his archaeological assessment of the nails he has recovered, but with more detail than is often found in such a report. Donna L. Benson's "A Taxonomy for Square Cut Nails" (1983) uses cut nails to demonstrate the applicability to historic archaeology of a typological method derived from the work of Dunnell and Watson, LeBland, and Redman. The methodology is sound, except perhaps the attempt to define the "ideal" cut nail. The small sample size (41 nails) combined with functional and manufacturing variability of the nails leads to equivocal results. E. McClung Fleming's article "Artifact Study: A Proposed

Model" (1982) offers a clearly delineated methodology for the study of material culture. The five basic properties of an artifact are its history, material, construction, design, and function. The four operations to be performed on each of the basic properties are: identification, evaluation, cultural analysis, and interpretation. See also: Cotter, et. al. (1988).

2. HISTORY

Amos J. Loveday Jr.'s book, *The Rise and Decline of the American Cut Nail Industry: A Study of the Interrelationships of Technology, Business Organization, and Management Techniques* (1983) provides the most complete coverage of any source encountered, to date, on the subject of cut nails. The focus is on the cut-nail manufacturers who congregated in and around Wheeling and on their lack of innovation and foresight. Peter Temin includes statistics for nail-plate production in *Iron and Steel in Nineteenth-Century America: An Economic Inquiry* (1964). Temin discusses the increased use of steel wire in the 1890's due to increased demand for barbed wire and wire nails. He also restates the traditional notions for the increased popularity of wire nails over cut nails.

There have been several travelogues published, in which the writer described the production of nails. In his 1951 article, "A Russian Sketches Philadelphia, 1811-1813", D. Fedotoff White republishes the observations of Pavel Petrovich Svin'in, a Russian diplomat, who commented on the effect American labor shortages had on the mechanization of manufacturing processes. J.R. Chapin's "Among the Nailmakers" (July 1860) is a travelogue describing the author's trip to the iron-works at Boonton, New Jersey via the Morris Canal. Upon his arrival, the author recorded a detailed account of the smelting and puddling of the iron, and the rolling, cutting, heating, and packing of the

nails. The article includes 22 descriptive engravings, several of which have been reproduced elsewhere. Rev. Harold Rylett wrote his article "Nails and Chains" (1890) to elicit sympathy for the women and children employed in the hand-made chain and nail trades of late nineteenth-century England. It is not known if his effort was successful. He included a wonderfully detailed, if somewhat subjective, first-hand account of the manufacturing process and the conditions under which the people worked. Ephriam Ball provided a first-hand account of "The Hand-Made Nail Trade" (1866) in the Midland District of England.

Peter J. Priess' article "Wire Nails in North America" (1973) is a good introduction to the history of wire nails and of their introduction to North America. Greville and Dorothy Bathe (1943) provide a nice history of early cut nail machines in their biography of *Jacob Perkins: His Inventions, His Times, and His Contemporaries*. Also included (in Appendix B) is a list of nail machinery patentees from 1791 to 1815. H.R. Bradley Smith's pamphlet, *Blacksmiths' and Farriers' Tools at Shelburne Museum: A History of their Development from Forge to Factory* (1966) discusses the history of nail manufacturing, from wrought-nails and cut-nails to wire nails. Tools of the trade are illustrated with several photographs. A supplement entitled "Chronological Development of Nails", provides an extensive chronology of nail development starting with references from the Old Testament and ending in the twentieth-century. Unfortunately, most entries are not referenced. Several of Nelson's illustrations are reproduced. An brief article, entitled "Burning Buildings for Nails" and edited by Charles E. Peterson (Oct. 1950), describes the 1691 burning of a courthouse in Kent County, Delaware "to gett the nails". Ursula M. Franklin's "Old Iron Nails" (Sep. 1980) provides an historical overview of nails and their manufacture. The schematics are adapted from Nelson (1968). The article includes one micrograph of a cross-sectioned nail from circa. 1800. Victor S. Clark's *History of Manufactures in the United States, Vol. I (1607-1860)*, published in 1929, does

not emphasis nails, but does contain a good section on rolling mills and the production of nail-plate. Charles E. Edgerton's "The Wire-Nail Association of 1895-96" (June 1897) provides a wonderfully detailed economic assessment of the Wire-Nail Association and their efforts to promote their product.

William N.T. Wylie describes and illustrates the manufacture of wrought nails in *The Blacksmith in Upper Canada, 1784-1850: A Study of Technology, Culture and Power* (1990). Wylie also provides a few facts regarding Canadian cut nails. By 1846 Canadians claimed complete self-sufficiency in the production of nails. Susan Buggie's "Supplying Building Materials to the British Army in the Colonies: An Illustrated Document" (1976) provides full-size reproductions of nails and spikes available to the British Army through its Procurement Office in 1813.

Three references consider nail-making in Virginia. John T. Keene, Jr. contrasts "The Nail Making Industry in Early Virginia" (Mar. 1972) with that of early New England. Virginia nail-making was primarily the product of the local or plantation blacksmith, whereas in New England a cottage industry thrived prior to mechanization. Keene's well-researched article includes a photograph of eighteenth century Virginian nails, schematics from Nelson (1968), and a reproduction of Thomas Jefferson's nailery from Betts (1953). Edwin Morris Betts edited *Thomas Jefferson's Farm Book* (1953) providing a great source of primary information nail manufacturing in turn-of-the-century (18th century) Virginia. The text includes, not only the notations and sketches of the Farm Book, but also excerpts of Jefferson's correspondence regarding his nail manufactory. James A. Bear Jr.'s "Thomas Jefferson - Manufacturer" (autumn 1961) describes nailmaking, blacksmithing, spinning and weaving, and joinery operations at Monticello. The nailery was in operation from 1794 until 1823 and in some years provided sufficient income to cover the operational expenses of the plantation.

In "Spikes, Nails, Tacks, Brads and Pins" (Aug. 1946), Carl Drepperd credits the expansion of American railroads to the introduction of the Burden railroad spike machine. A machine, he says, that was capable of producing 50 spikes a minute. Burden's patents are covered in the Government Documents section. In his essay, "Railroads and the 'Take-Off' Thesis: The American Case" (1964), Robert William Fogel states that the demand for nails (rather than rails) may have triggered a leap in iron production in the period 1845-49. Paul F. Paskoff quotes Fogel's (1964) claim in his 1983 book, *Industrial Evolution: Organization, Structure, and Growth of the Pennsylvania Iron Industry, 1750-1860*. Although Paskoff does not entirely refute Fogel's claim, neither does he total support the notion.

Harry B. and Grace M. Weiss' book *Forgotten Mills of Early New Jersey: Oil, Plaster, Bark, Indigo, Fanning, Tilt, Rolling and Slitting Mills, Nail and Screw Making* (1960) provides a wonderful chronology of nail-making in New Jersey from 1690 until 1863, unfortunately, the citations are not referenced. There are several photographs of wrought nail making tools reproduced from Henry Mercer's *Ancient Carpenter's Tools* (1929), as well as four engravings from Chapin (1860).

Samuel Whitaker Pennypacker's book *Annals of Phoenixville and Its Vicinity* (1872) cites a work of Joseph J. Lewis entitled *History of Chester County* (1824), which stated that (in 1824) the Phoenix works was one of the first nail factories in the United States and "had 54 nail machines manufacturing 40 tons of nails per week". Harrold E. Gillingham reproduces the copper-plate engraving of William P. Israel's business card in "Old Business Cards of Philadelphia" (1929). Israel was the proprietor of the Phoenix Nail Works in the late 1810's. On the card are prices for 2-24 penny nails and brads, the products of the nail-works. In his 1953 dissertation, *Early Manufacturing in Lancaster County, Pennsylvania, 1710-1840*, Carlton O. Wittlinger provides a few details on the nail production capabilities of the county. William A. Sullivan's 1955 book, *The Industrial*

Worker in Pennsylvania, 1800-1840, includes a section on iron workers, including their wages and working conditions. Cut nail manufacturers were often in close proximity to the iron works, their source of materials, as evidenced by the U.S. manufacturing census reports. Ronald L. Michael analyzes the U.S. manufacturing censuses of 1820, 1850, 1860, and 1870 in his article "Cut Nail Manufacture: Southwestern Pennsylvania" (1974) and concludes that the Pittsburgh area was probably one of the national centers of cut nail production.

See also: Edwards and Wells (1993), Gilmour (1976), Lenik (1977), Nelson (1968).

3. FABRICATION

The Adler's *The Story of the Nail* (1961) illustrates steel production by focusing on the fabrication of a nail. A straightforward text aimed at a young audience. *Appletons' Cyclopaedia of Applied Mechanics: A Dictionary of Mechanical Engineering and the Mechanical Arts*, edited by Park Benjamin (1880), provides a good state-of-the-art perspective on the mechanics of nail fabrication in 1880. Discussion includes wrought, cut, wire, and cast nails. Included are a schematic and a description of John Lawrence's self-feeding machine. Also included is a section on the adhesion of nails. Ken Gilmour's article "On the Trail of a Nail" (summer 1976) describes the manufacture of wrought and cut nails with a particular emphasis of four types of nails used most frequently on Nova Scotia in the 18th and 19th centuries. Gordon and Malone include a brief section on the history and manufacture of nails in *The Texture of Industry: An Archaeological View of the Industrialization of North America* (1994). Included is a photograph showing nails being cut at the Tremont Nail Works. Lee H. Nelson's article "How Hand-Wrought Nails Were Made From Bar Iron in the 18th Century" (1991), briefly describes the process of

wrought-nail fabrication and is accompanied by the author's schematics, clearly illustrating the process. Also included is a photograph of a partially slit nail-plate. Leon de Valinger, Jr.'s article, "Nail-Making Device at the Delaware State Museum (June 1960) includes a photograph of an undated nail-header. Kenneth M. Wilson describes the process of making a wrought-nail in his article, "Nailers' Anvils at Old Sturbridge Village" (June 1960). Included are photographs of three nailers' anvils.

See also: Chapin (1860), Fontana, et. al. (1962), Franklin (1980), Geselowitz, et. al. (1991), Loveday (1983), Nelson (1968), Smith (1966), Wylie (1990)

4. BUILDING TECHNOLOGY

An anonymous article, entitled "How to Build a Cheap House" (Oct. 1869), details the materials and methods employed in constructing a 12 X 16 foot house in six days or less. Included in the bill of materials were: 20 lbs. of shingle nails, 50 lbs. of 8 penny nails, and 15 lbs. of 10 penny nails. Total costs for materials was \$141.50. Carl Drepperd's "Industrial Information From Our Colonial Ancestors" (Dec. 1960) provides a useful account from the 1785-87 Jones Family Papers (of Williamsburg, VA). The number of nails required to build a 16 X 12 foot house, a 20 X 16 foot house, and a 16 X 16 foot corn crib are given.

The anonymous "Memoranda Concerning Nails" (Apr. 1869) provides data for the force required to extract an 8 penny "wrought" nail from dry elm, hard pine, deal (fir or pine), dry oak, dry beech, and green sycamore. Although the article refers to "a wrought-iron nail", I believe cut nails are being discussed due, in part, to the date of the article. According to Loveday (1983:20), wrought nails accounted for less than 5% of production by 1870. The purpose of the article is to enable the reader "to determine approximately the number of nails required for any piece of work". As such, a table is included which

details the number of nails per pound. Also included is a brief explanation of the "penny" system of classifying nails.

The anonymous "Nails" (9 Sept. 1876) also describes the history of the penny system of nail designations. E.F. Heite argues against the use of the metric system for determining nail sizes in "A Question of Nail Sizes" (Sept. 1969). He prefers inches and the modern "penny" system. Peter J. Priess' discusses the inaccuracy inherent in describing historic nails with the penny system in "Penny Wise, Penny Foolish: The Description of Nail Sizes" (Oct. 1970). The most precise method of recording the length of a nail, he suggests, would be to use metric or English measurements, rather than the penny system which has change over the course of time. The anonymous "Objection to Wire Nails" (24 Mar. 1900) provides some insight into the concerns of consumers of wire nails, particularly farmers, and of the technological solutions found to appease them. Extra large heads and galvanizing are introduced by the wire nail manufacturers in an effort to stem a revival in the use of cut nails.

Carl W. Condit, in *American Building: Materials and Techniques from the First Colonial Settlements to the Present* (1968), credits much of the success of balloon-frame construction with the mass-production of nails. Walker Field credits the rapid development of balloon-frame construction with the contributory developments of machine-made nails and saw-cut lumber in his article "A Reexamination into the Invention of the Balloon Frame" (Oct. 1942). Paul E. Sprague's article "Chicago Balloon Frame: The Evolution During the 19th Century of George W. Snow's System for Erecting Light Frame Buildings from Dimensional Lumber and Machine-made Nails" (1983), reiterates the importance of dimensional lumber and mass-produced nails, as pointed out by Field (1942). It is a solid addition to the literature because it details many of the mechanics involved in building a balloon-frame structure. Sprague states that "it is really quite remarkable to think that balloon framing was invented by one individual and worked out in

the construction of a single identifiable building" -- yes, it is quite remarkable, and rather unbelievable. Fred W. Peterson's 1992 book, *Homes in the Heartland: Balloon Frame Farmhouses of the Upper Midwest, 1850-1920*, is an excellent study of balloon-frame construction and its widespread use, particularly in the upper midwest. Peterson considers not only the history of this innovation in building technology, but also the skills and methods of construction employed. He reiterates Field's (1942) argument that the widespread use of balloon-framing was dependent on "the mass production of inexpensive nails and the ready availability of lumber cut in standardized dimensions". Peterson also provides a typological analysis of balloon-frame designs, which is very informative. Donna J. Rilling's 1993 thesis *Building Philadelphia: Real Estate Development in the City of Homes, 1790 to 1837*, describes the speculative nature of the building industry in Philadelphia, an industry made possible by the extensive use of ground rents.

See also: Priess (1978)

5. DATING TOOLS

The first of its kind, Henry C. Mercer's article "The Dating of Old Houses" (Apr. 1924) suggested the possibility of using building hardware (nails, hinges, and thumb-latches) and woodwork (door panels and lath) as an aid to the dating of old buildings. Although not entirely accurate in its details, it has served as a guide to much of the subsequent work in this area. John P. Arnold's "How Old is an Old House?" (May 1947) revisits Mercer's earlier work (1924) on building hardware and the use of nails as an aid to dating buildings. Lee H. Nelson's leaflet "Nail Chronology as an Aid to Dating Old Buildings" (Nov. 1968) is the most frequently referenced guide to the use of nails as a

dating tool. The history and manufacture of hand-wrought, cut, and wire nails are discussed. The various nail types and the methods employed in their manufacture are nicely illustrated by the author. Maureen K. Phillips' article "'Mechanic Geniuses and Duckies': A Review of New England's Cut Nail Chronology before 1820" (1994) sheds new light on the accepted chronologies established by Mercer (1924) and later Nelson (1968). Included is a revised chronology based on dated nail samples and corporate, patent, and court records. In *Historic Louisiana Nails: Aids to the Dating of Old Buildings* (1993), Jay D. Edwards and Tom Wells provide a clear assessment of nail types found in Louisiana. This is one of the most recent additions to the literature and one of the very few to address the Deep South. The photography is very good.

In three articles, "X-ray Investigation of Buildings" (1973), "X-ray Analysis of the Narbonne House" (1974), and "X-ray Inspection of Historic Structures: An Aid to Dating & Structural Analyses" (spring 1977), David McLaren Hart details the use of x-rays to non-destructively examine the building fabric of several structures. The location and size of nails, the presence of previous alterations, and other details are clearly shown in the numerous x-rays included in these articles.

See also: Freeman (1979).

6. ARCHAEOLOGY

Fontana, Greenleaf, et. al. published a long report entitled "Johnny Ward's Ranch: A Study in Historic Archaeology" (Oct.-Dec. 1962) describing the excavation of a "typical" ranch house in southern Arizona. This often-cited report contains an extensive discussion of each group of artifacts, including cut and wire nails. There is a good section on the history of nails, although some of Mercer's incorrect statements are repeated. Fifteen of the more usual forms of cut nails are described and illustrated. Finally, Fontana

includes a section on "the function of nails" in which he foreshadows his later article "The Tale of the Nail" (1965).

Angus, Brown, and Cleere describe a cache of 875,000 wrought nails in "The Iron Nails from the Roman Legionary Fortress at Inchtuthil, Perthshire" (Nov. 1962). Six types of nail range in size from 2.5 to 15 inches in length, the smaller ones being more common. Although the nails are not of American origin, the metallographic analysis is very good and could serve as a model for future studies.

Keith Freeman prepared "An Analysis of the Nails from the Wilkinson Mill" (unpub. 1979) as a typological study of the 101 nails excavated from the mill. Typical of archaeological finds, many of the nails are twisted, bent, and corroded beyond exact identification. Photos of all nails and fragments are included. Robert T. Bray's article, "Times and Seasons: An Archaeological Perspective on Early Latter Day Saints Printing" (1979), is a representative example of an archaeological treatment of nails found during the excavation of a site. The nails are typed, measured, and counted. Heldman and Ray describe the excavation of "A Late Historic Burial in Montgomery County, Alabama" (1975). Among the artifacts recovered were five French nails and a reworked spike. The analysis goes no farther than to assign a nail type (rosehead) and a penny classification. Stanley South's article "Santa Elena: Threshold of Conquest" (1988) is a study of "status differentiation as revealed in the artifacts and architecture" they left behind. The discussion includes an assessment of 359 nails recovered from two sites of Spanish settlement in Florida.

See also: Ehrenreich (1991), Frurip, et. al. (1983), Haldane (1970), Hedges and Salter (1979), Larrabee (1967).

7. METALLURGY

Geselowitz, Westcott, and Wang's article "For Want of a Nail: Archaeometallurgy and Dating in Historic Archaeology" (1991), is a nice blend of history, archaeometallurgy, and analysis. It includes one of the more thorough reviews of the literature found, to date. Detailed archaeological drawings are included, as is one photomicrograph of the tip of a wire nail. Steve M. Epstein's article, "A Coffin Nail from the Slave Cemetery at Catocin, Maryland" (June 1981), is one of the best metallurgical analysis of nails reviewed, to date. Broader implications are difficult to assess, however, due too the sample size. Edward J. Lenik is one of the few authors to discuss cast nails and the only one to write a complete article on the subject. His article "A Study of Cast Iron Nails" (1977) includes one micrograph of a cast structure. *Colonial Nails from Michilimackinac: Differentiation by Chemical and Statistical Analysis* (1983), written by Frurip, Malewicki, and Heldman, is a good effort to differentiate between several French and British nails recovered from the site of Fort Michilimackinac. The book includes optical photographs of polished cross-sections and heavily etched nails. Also included is an effort at statistical analysis which is left wanting for lack of data points.

Robert M. Ehrenreich's article, "Archaeometallurgy and Archaeology: Widening the Scope" (1991), identifies several difficulties frequently encountered in the study of iron artifacts. The paper also serves as a call to archaeometallurgists to place their work in a broader context that would be more useful to archaeologists interested in reconstructing past societies. W. Rostoker and J. Dvorak discuss the three methods of producing wrought iron in their article "Wrought Irons: Distinguishing Between Processes" (1990). The three techniques: bloomery, finery, and puddling, leave distinctive traces in the composition of the metal. With sufficiently large slag inclusions, energy dispersive spectrography (EDS) can be used to determine the smelting process employed. J. Warner

Haldane attempts to correlate the composition of iron artifacts with the ore from known mining districts in his article "A Study of the Chemical Composition of Pre-Roman Ironwork from Somerset" (1970). The data set includes one nail and his results are inconclusive. Hedges and Salter's article "Source Determination of Iron Currency Bars Through Analysis of the Slag Inclusions" (Aug. 1979) details their attempt to identify sources of iron in southern England through a microprobe chemical analysis of slag inclusions.

Nikolaas J. van der Merwe's book, *The Carbon-14 Dating of Iron* (1969), held great promise for its potential application to the field of archaeology when it was published. As it turns out, the technique is only useful when the iron in question was produced using the charcoal method and then only when large bits of residual charcoal were entrapped in the finished product. In his article, B.C. Scott describes "The Possible Application of Fission-Track Counting to the Dating of Bloomery Slag and Iron" (1976). This technique, like carbon-14 dating, relies on locating artifacts with large deposits of entrapped slag. Maeda, Matsuo, Sugihara, Momoshima, and Takashima address atmospheric corrosion of nails from different environments in "Mossbauer Studies of First-Stage Corrosion Products on Iron Powder and Corrosion Products on Highly Corroded Nails" (1992). While this article does not address historic nails, per se, it is useful in understanding the composition of corrosion products.

See also: Angus, et. al. (1962).

8. GOVERNMENT PUBLICATIONS

The anonymously authored "Adhesion of Nails, Spikes, and Screws in Various Woods", was an 1886 report issued by the Watertown Arsenal in Massachusetts to justify the expense of maintaining a newly purchased tensile testing machine. The tests included

a comparison of cut nails and wire nails and the force required to extract the nails from various kinds of wood. This influential report has been alluded to in numerous primary and secondary documents.

The *List of Patents for Inventions and Designs: 1790-1847* includes at least 277 patents issued by the U.S. Patent Office that deal with cutting, heading, and manufacture of nail, pins, and spikes. Unfortunately, most of the early patent records were destroyed by a fire in 1836. Three patents by Henry Burden (1825, 1834, 1840) describe the process and the machinery used to manufacture spikes.

The 3rd U. S. Census of Manufacturing (1810) is broken down by national, state, and county statistics. It provides the number of naileries, pounds of nails produced, and the value of the product. The 4th U. S. Census of Manufacturing (1820) is broken down by county. The twelve pages for Pennsylvania include comments from individual companies. All companies are not represented. The McLane Report, also known as Documents Relative to the Manufactures in the United States, U.S. Congress, House of Representatives, Executive Document No. 308 (1833, reprinted in 1969) provides manufacturing data for all significant industries, including the production of nails. Although not all manufacturers responded to the census questions, there is, nevertheless, a wealth of detail not easily found elsewhere. The 6th U. S. Census of Manufacturing (1840) provides aggregate statistics for counties only. Nails are not specified. The 7th U. S. Census of Manufacturing (1850) provides a breakdown by product and state. It provides the number of nail manufacturers, their capitalization, the cost of raw materials, the number of male/female employees, the cost of labor, and the value of the product. The 8th U. S. Census of Manufacturing (1860) provides a breakdown by product, state, county, and nation.

See also: Michael (1974), Phillips (1994).

9. WALNUT STREET PRISON

Negley K. Teeters' 1955 book, *The Cradle of the Penitentiary: The Walnut Street Jail at Philadelphia, 1773-1835*, is the most complete account of this remarkable example of early efforts to reform the penal system. The lessons learned at Walnut Street Prison were incorporated into the operating philosophy of Eastern State Penitentiary, establishing a system that was subsequently known as the Pennsylvania System. LeRoy B. DePuy's article "The Walnut Street Prison: Pennsylvania's First Penitentiary" (April 1951) provides a good overview of the Prison.

Cotter, Moss, Gill, and Kim provide a brief, but very interesting glimpse of early prison activities, including nail manufacturing, in *The Walnut Street Prison Workshop: A Test Study in Historical Archaeology based on Field Investigation in the Garden Area of the Athenaeum of Philadelphia* (1988). Kim's analysis of the artifacts, using Stanley South's Carolina Artifact Pattern methodology, is a highlight. Robert Smith edits the 1799 diary of Hipolito Jose de Costa Pereira Furtado de Mendonsa in his article "A Portuguese in Philadelphia" (1954). During the course of his stay in Philadelphia, de Costa Pereira Furtado de Mendonsa visited the Walnut Street Prison and recorded his observations in a long diary entry. He saw men working at a number of occupations, including "20 who were making the heads for nails and 4 who were cutting the nails". Sol Chaneles' article "Selected Statistical Tables: 1794-1905", *Prisons and Prisoners: Historical Documents*" (1985) provides an incomplete, but nevertheless interesting breakdown of prisoner employment by trade.

Negley K. Teeters' article, "Citizen Concern and Action Over 175 Years" (Spring 1962) was written to commemorate the anniversary of the establishment of the Society for Alleviating the Miseries of Public Prisons, later known as The Pennsylvania Prison Society. Teeters also edited "A Plan for the Punishment of Crime by Benjamin Rush,

M.D., 1746-1813" (reprinted March 1991), which included two essays by Rush in which he espoused a system of punishment which combined solitary confinement and hard labor. Rush was a key figure in the Society for Alleviating the Miseries of Public Prisons. The Minutes of the Society for Alleviating the Miseries of Public Prisons are a great source of information for students of the "Pennsylvania System" of prison reform. Conditions at the Walnut Street Prison and attempts to improve them are detailed in Volumes 1-2 (1787-1835). Many members of this Society were also Prison Inspectors and the Minutes of the Board of Inspectors (1794-1835) are a rich source of information on all aspects of life within Walnut Street Prison. They also provide a unique perspective on life outside the prison, for the men who served as Inspectors were prominent in Philadelphia society. The Cash Books of the Walnut Street Prison (1814-16 and 1821-35), detail the purchases and sales of the Prison on a daily basis. The sale of nails, shoes, carpet, and other items manufactured in the Prison workshops are included. The Cash Books for 1817-1820 are missing.

The Ledgers of John Haviland (1820-1868) are a rich source of architectural intent for Eastern State Prison and other structures. Included is Haviland's proposal for Eastern State, the direct descendent of lessons learned at Walnut Street Prison.

COMPLETE CITATIONS

The bracketed number at the end of each citation refers to the annotated bibliographic section identified below:

1. Theory
2. History
3. Fabrication
4. Building Technology
5. Dating Tools
6. Archaeology
7. Metallurgy
8. Government Publications
9. Walnut Street Prison

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