LABELLE IRON WORKS
(LaBelle Cut Nail Plant)
30th & Wood Streets
Wheeling
Ohio County
West Virginia

HAER NO. WV-47

HAER
WVA,
35-WHEEL,
38-

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HISTORIC AMERICAN ENGINEERING RECORD

LA BELLE IRON WORKS
(La Belle Cut Nail Works)

HAER NO. WV-47

Location: 30th & Wood Streets, Wheeling, Ohio County, West Virginia.

Quadrangle: Wheeling, West Virginia-Ohio. UTM: A. 17.525260.4433240 B. 17.523670.4432920 C. 17.523590.4432980 D. 17.523620.4433280

Date of Construction: 1852 with additions circa 1870, 1890 and 1920.

Present Owner: Wheeling-Pittsburgh Steel Corporation Wheeling, West Virginia.

Present Use: Still in operation.

Significance: La Belle is the largest American cut nail factory and one of two remaining United States cut nail manufacturers. La Belle has been in business for almost 140 years and still uses the same equipment and processes to make cut nails. La Belle helped make Wheeling the "Nail City" during the late 19th century.

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Historian
Historic American
Engineering Record
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Introduction

The La Belle Iron Works began making cut nails in 1852 and continues to this day making nails, using the same process begun nearly 140 years ago. La Belle is one of two remaining cut nail factories in the United States and the process involved in making nails is a dying art form. This narrative focuses on two broadly important aspects of La Belle's long history: the history of La Belle and the La Belle nail making process.

The first part of this narrative entitled "The History of the La Belle Nail Works" will examine early nail making (from ancient times to the rise of mechanized nail manufacture) and its importance to colonial America, Wheeling's rise as a center for making nails, and this narrative will give a detailed account of La Belle's history. This history will concentrate not only on the corporate history, that is, the expansion and survival of the iron works; but will trace the technological innovations that have taken place in the course of La Belle's history. This section of the narrative is meant to give the reader an overview of the history of nail making as well as the history of the La Belle works.

The second part of this narrative entitled "Nail Making Processes" will explore two phases of the nail making process: the historic production of iron plate and La Belle's probable method of manufacture; and the La Belle cut nail process used today with discussions of the changes in production. The nail making process used today is almost the same used over one hundred years ago. The chief difference between today's process and yesterday's, is steel plate has replaced wrought iron plate in the nail making process. This section is intended to familiarize the reader with actual processes involved in making iron plate and to give a detailed description of how La Belle manufactures cut nails.

An appendix is included to document three aspects of La Belle which do not directly relate to the making of cut nails, but are also important to the history of the site. The first section documents the changes occurring to the transmission of power to the nail machine, the second section examines how raw and finished materials were transported within and outside the nail works, and the last section documents evolution of the La Belle nail works site.

A glossary is added for the readers benefit, to define and clarify terms used in this narrative. This narrative tends to be rather technical and it is hoped this glossary will be of help in understanding the processes discussed.

Finally, thanks must be given to Lutz Albrecht of the Wheeling-Pittsburgh Steel Corporation; and Dave Del Guzzo and Pete Pashalis of the La Belle plant for all their help in the creation of this document.

History of the La Belle Nail Works

Early Nail Making

Historically the origins of nail making can be traced back to the Roman domination of Europe. Excavated Roman settlements in Germany and Great Britain have revealed nail making tools, dating from the third century A.D.[1]

In America, nails were an important product of the colonial era, because of the American reliance on wood as a construction material. Wood was the chief product available for the construction of houses, barns and other structures on the American frontier. Nails were so important that buildings were often burned to retrieve the nails used in their construction. However nail making was not a difficult task. All it required was time, patience, an anvil, chisel, hammer, a heat source, and wrought iron. This lead to the rise of nail making as a cottage industry. With the advent in the 1400s, of the slitting mill, anyone with simple tools such as a hammer, etc. could make nails. Iron nail rod was imported into North American mainly because it was cheaper to ship nail rod than finished nails.[2]

The earliest colonial nail manufacturers were located in Massachusetts, Connecticut, and Pennsylvania. Parliament banned the colonial manufacture of nails to force the colonists to buy English nails and remain dependent on English manufacture of goods. This prohibition was generally ignored and domestic nail production continued. Some iron was domestically manufactured, but most was imported from Great Britain, Sweden and Russia.[3]

Nail making was an easy task, but labor intensive and time-consuming. The wrought iron nail rod was heated and then hammered until it was tapered. The next step was to cut the rod to the proper length. Heading the nail was the final step. Commonly a header die, a nail clamping device, was used to hold the nail while the nail maker formed the head with a series of hammer blows.[4] This process was repeated each time a nail was made. Consequently nail production could not meet the needs of the expanding frontier. Further, the scarcity of American labor seriously hampered domestic nail production. So it is not surprising that labor saving nail making machines evolved. Also, Americans, unlike their British cousins, welcomed the mechanization of labor intensive chores. Historically, British workers destroyed labor saving devices.

Jeremiah Wilkinson is recognized with developing the technology behind making cut nails. In 1775, Wilkinson developed a process to make tacks, by shearing iron slivers from iron plate. This was the basic technology used in most common nail machines and it was adopted very quickly with blacksmiths and other mechanics developing many machines. These early machines were essentially a blacksmith's shear with the iron plate being hand fed into the shear and manually being flipped, cutting tapered nails. By 1800 this technology was well established and greatly sped up nail making, but the head still had to be hand formed. Machines which could cut and head nails during the manufacturing process were perfected in the 1820s. The last major improvement to the machine was the automatic feeder. Invented early on, it did not come into common use until the 1870s, because its adoption would have reduced the number of men needed to feed the machines. Traditionally, the nailery work force exerted tremendous power over management and kept automatic feeders out of the shop.[5]

This simple nail cutting process truly revolutionized the American nail making industry. It took nail making out of cottages and blacksmiths shops and into the factory system. In 1810, the United States produced 15.7 million pounds of machine made cut nails. In 1850, American production of cut nails had reached 206.5 million pounds. Further in 1810, there were 410 cut nail makers in the United States, but by 1850 this number had fallen to eighty-seven manufacturers. This clearly indicates a shift toward nail making in a centralized factory system.[6]

The mass production of cut nails found a market in expanding construction trade. The advent of the balloon framing during the 1830s created a cheap and easy method of construction. Balloon or western framing used precut lumber, eliminating the need for masons and other skilled artisans during construction. Construction time was minimal and these buildings required enormous amounts of nails. Balloon framing revolutionized the construction industry and was adaptable to different construction needs. Further, precut lumber and nails could be shipped by railroad to virtually any town or city in the west that had a depot; and this mass accessibility of construction materials helped create a construction boom in the west. Thus the Wheeling and eastern cut nail manufactures had an almost unlimited market for their product.[7]

The new nail markets in the west caused the growth of the nail making industry and this growth was stimulated by the adaptability of the nail making machine. The nail making machinery was adaptable for use with all power sources including hand, animal, water, and steam. The machines were easily constructed by mechanics, and thus they were readily available to all who wanted to make nails. The mechanization of nail making reflects the scarcity of labor and high wages in America during the post revolutionary period. Great Britain on the other hand had no problem with the scarcity of labor and in fact had an overabundance of workers. Therefore, they were able to keep wages low and charge less for cut nails.

The only other major drawback to the expanding nail industry was the lack of wrought iron, but the increasing domestic manufacture of pig and wrought iron soon supplied the needed iron.[8] The production of iron was spurred by the War of 1812. There was a shortage of iron during the war, and thus the urgent need resulted in the increased production of iron following the War of 1812.[9]

Early Iron Manufacturing in Wheeling

The first of Wheeling's iron mills was established in 1832 or 1834 (depending on the source). This mill was begun by a pair of Pittsburgh ironmasters: Dr. Peter Schoenberger[10] and David Agnew. Both of these men were experienced iron manufacturers. Agnew was the mill manager for Schoenberger's Juniata Iron Works near Pittsburgh. Schoenberger and Agnew were attracted to Wheeling because of the abundance of inexpensive bituminous or "soft" coal (for puddling furnaces and steam engines), limestone, timber and the Ohio River's deep water navigation to western and southern markets. (These characteristics made Wheeling a very attractive city for the establishment of iron and nail mills. This is reflected in the number of mills erected here in the next few years.) While this mill under Schoenberger and Agnew's management ultimately failed, both men remained involved in the flourishing iron industry and would be successful in other ventures. This mill would later reopen and be known locally as Top Mill.[11] The Schoenberger and Agnew mill made sheet and bar iron as well as wrought iron cut nails.[12]

By the mid 1840s, Top Mill was being leased from Schoenberger by E.W. Stevens. Stevens hired two Pittsburgh nailers, brothers E.M. and George W. Norton, to operate the mills nail works.[13] E.M. Norton was a pivotal figure in Wheeling's later development as the "Nail City." Norton had a hand in the construction and operation of many of Wheeling's earliest mills.

In 1847, Stevens, E.M. Norton, John Hunter, William Fleming and Robert Morrison formed the firm of Hunter, Morrison and Company. This firm erected the Virginia Mill at the confluence of Wheeling Creek and the Ohio River. The mill was moved to McMechans Farm in 1851 and was renamed the Benwood Iron Works. The Virginia Mill was razed in 1852 to make way for the original terminus of the Baltimore and Ohio Railroad. The Virginia Mill was the first western mill expressly established for the manufacture of nails.[14]

E.M. Norton's involvement in the Virginia Mill was short lived, because in 1849 he withdrew from the partnership of Hunter, Morrison and Company to form a new firm: Norton, Bailey and Company. The Belmont Mill established by this firm was composed of iron workers from Virginia Mill and perhaps Top Mill. The nucleus of this group would form the future Bailey,Woodward and Company.[15]

La Belle Iron Works

The Belmont partnership did not last long because several of its founding members left in 1851 to form Bailey, Woodward and Company. Twenty-two men founded the iron works: nailers-S.H. Woodward (Belmont), Calvin B. Doty (Belmont), William Bailey (Belmont), William E. Bailey (probably the son of William Bailey), Dennis McCoy, Richard Savery, Holsten Harden (Belmont), John McClinton, Joseph Hersey, Noah Remick, and Robert Caswell; boilers or puddlers-James Burk and W.R.E. Elliott; heaters-Isaac Freese and William Lynch; feeder- Andrew Glass; nail plate roller-Henry Wallace (Belmont); blacksmith-William Hay (Belmont); stationary engineer-John Wright (Belmont); bookkeeper-R.S. Irwin; bricklayer-William Dean; and storekeeper-David Spaulding. The founders of Bailey, Woodward and Company named their mill the La Belle Iron Works (pronounced LAY BELL) after the French name for the Ohio River: La Belle Riviere, the beautiful river.[16] Richard Savery was mill manager and S.H. Woodward was managing partner.[17] Interestingly, most of the founding company members were workmen from the various Wheeling iron works. The puddlers and nailers were the upper class of all iron mill workers and as such were paid higher wages. (The puddlers and nailer were the elite of the Wheeling nail workers and received the highest salary.) Thus they could afford to invest in nail mills. All of Wheeling's early nail factories were founded by nailers, puddlers and other skilled mechanics. This was not only based on financial capabilities, but also because mechanics understood the nail making process; and mechanics could cheaply and easily construct, operate and maintain nail making machinery.[18]

The Bailey, Woodward and Company in 1852 purchased four acres of land south of Wheeling from Joseph Caldwell for the cost of $4,000. Two acres were for the mill property and two acres for company housing.[19] Bailey, Woodward and Co. chose to locate their mill outside of Wheeling proper because of cheaper land prices and easier access to the Baltimore and Ohio Railroad. The town which grew up around the La Belle mill was the Wheeling district's original company town.[20] The nail works property was owned by Bailey, Woodward and Company until 1875 when the La Belle Iron Company was incorporated. (The name change is probably because both Bailey and Woodward were no longer involved with running the firm.) Heirs of the original firm members maintained interests in both the town and the mill until 1920s, when Wheeling Steel Corporation was formed.[21]

This enduring interest in the firm can be traced to La Belle's establishment. Earlier Wheeling nail works were short term speculative investments with the investors selling their interest soon after their investments became profitable. For example, the owners of the Virginia mill sold their interests in the company only a year or two after its founding, to form the

Belmont mill. Seven of the La Belle founders had also founded Belmont, but these founding partners had formed an unique partnership that ensured long-term stablity. The original partners agreed that if any partner desired to sell his interest in the firm, that interest first had to be offered for sale to the partner with the least interest in the company. If this partner could not afford to buy or refused to buy the interest, it was then offered to the next partner and so forth until the interest had been offered to all the partners. If none of the partners wanted to buy the interest, it was then offered for sale on the open market. La Belle's founding partners established a common partnership and not a joint stock company. This meant the partners were legally liable for the company's debts. The company was run by the managing partner and had no board of directors or company president. Thus from the beginning La Belle's partnership was designed to last and endure.[22] This partnership arrangement (now defunct) is one of the underlying reasons La Belle has survived to today, while almost all other American naileries have not.

From the beginning, La Belle chose to use an integrated approach to nail making, that is, incorporating rolling mills, furnaces, and nail machines under one management; and only making one product: cut nails. This type of approach was a unique characteristic of the other Wheeling nail makers, too. Many eastern mills only made nails as part of a larger diversified product line.[23] The Bailey, Woodward and Co. erected a rolling mill building 50 feet wide by 132 feet long and 28 feet high; and a nail machinery building 40 feet wide by 128 feet long.[24] When La Belle went on line in the fall of 1852, it was a state of the art modern mill featuring: twenty-five nail machines (the nail machine manufacturers are unknown, but the machines were probably made locally in Wheeling or in Pittsburgh), eight puddling or boiling furnaces, two heating furnaces, one muck mill, one squeezer, one bull head roller, and one nail plate or skelp mill. The total cost for the La Belle plant was $60,000.[25]

In 1859 La Belle began backwards vertical integration, by purchasing the old Jefferson Iron Works located at Steubenville, Ohio. The Jefferson Iron Works were built in 1855 by Frazier, Kilgore and Company, but soon failed. For $75,000 La Belle acquired forty more nail machines and two tracts of land with substantial woodlot and coal holdings. Spaulding, Doty and Company was organized to operate the iron works under the La Belle name. David Spaulding was named general managing partner and C.B. Doty mill manager. La Belle continued to expand its control over raw materials during the Civil War by constructing two blast furnaces at Stuebenville. The first one was erected in 1862-63 and the second in 1864. Both furnaces furnished pig iron for the Wheeling La Belle works.[26] The wartime scarcity of pig iron and its fluctuating price was the reason for LaBelle to erect its own blast furnaces. LaBelle also sunk a deep mine to tap its coal reserves (probably in the hills east of the mill, see appendix II). This trend started by La Belle of controlling raw materials was taken up by the other Wheeling nail works in the years immediately following the Civil War.

The Civil War's wartime economy caused a period of growth for Wheeling's iron and nail industries. For example, Top Mill was awarded a government contract for manufacturing rolled iron plate used to armor plate naval vessels (i.e. "iron clad" gunboats, such as the Monitor). The war was a tremendous stimulus for the nail industry, due to the need for nails used in the construction of fortifications, military quarters, ships, etc. La Belle must have benefitted greatly from the Civil War economy, because in 1866 they showed a profit of almost $165,000. Profits varied with the nail maker, but in general, nails that sold for $3.13 a keg in 1860 cost $7.08 a keg in 1865. Clearly a boom time for Wheeling naileries. The La Belle wartime profits were in turn used to capitalize the erection of the blast furnace at Steubenville.[27]

In addition, new management techniques were adopted following the Civil War to meet changing business needs. La Belle began a intensive program of cost accounting; tracking production costs, profits and losses, etc. This was an unique management approach, well ahead of its time, a harbinger of management styles used today. La Belle's Board of Directors was established at some point in the years after the war.)

By 1874, La Belle's Wheeling works had increased its nail machines from twenty-five to eighty-three, added thirteen more puddling furnaces, and one additional heating furnace. The nail factory had expanded to include warehouses, a coopers shop and a stock shed. At that time La Belle was working two turns or shifts of ten hours each, and employing approximately 400 hands or workers. The Jefferson works employed about 500 men and eighty-four nail machines. The combined La Belle and Jefferson operations had a total of 167 nail machines, reportedly more machines than any other nail works in the entire United States.[28] Nail production figures for 1871-73 indicate a total of 625 nail machines (including La Belle's 167) in the Wheeling district, being operated by seven nail works (La Belle, Riverside, Belmont, Benwood, Top Mill, Bellaire, and Jefferson), compared to the Pittsburgh district which had a total of 380 machines. Wheeling's total production for this time period was 2,995,509 kegs. Pittsburgh's 1871-73 total nail production was 1,312,911 kegs. National nail production for 1871-73 was 12,426,075 kegs, made by fifty-two naileries.[29] Undoubtedly, by the mid-1870s Wheeling was indeed the "Nail City." La Belle, with 167 machines, was clearly a leading "Nail City" manufacturer in total nail production. During the 1870s times were good for the Wheeling nail makers, but trouble was on the horizon. The technology of nail making was changing and this would result in a climatic strike known as the "Great Nail Strike."

The Great Nail Strike of 1885-86 was the result of this dramatic technological change in the manufacturing of nails in Wheeling. This change was the introduction of the Bessemer converter and process to the Wheeling district. The Bessemer process converted pig iron into steel. This process spelled the end of the occupation of iron puddler. It also meant the material change from iron plate to steel plate in the nail making process. Equally important the strike allowed wire nail manufacturers a market for their product, due to the unavailability of the cut nail. Finally, the nail strike would mark the decline of the power of the nailers previously had over management.

The Bessemer process was invented by Sir Henry Bessemer of England in 1856. Basically the Bessemer process converts pig iron into steel by blowing hot air through the molten iron, thus oxidizing the carbon and other impurities in the iron. The advantages of the Bessemer converter were the amount of steel which could be made in one heat and the superiority of the product over wrought iron; steel could be worked easier, it was not full of slag, and it was temperable.[30] A skilled puddler could convert between 2-1/2 and 3 tons of pig iron in a nine hour shift,[31] whereas the Bessemer converter could convert ten to fifteen tons in twenty minutes. This process was adopted slowly in the Wheeling district, but when it was, it changed the face of nail making in Wheeling.

In 1882 the Riverside Nail Company proposed that a cooperative Bessemer steel plant be built to furnish Wheeling nail factories with steel. The Union Steel Plant, as the cooperative was to be known, never became a reality due to the refusal of stockholders to agree to the plan. Instead, Riverside Nail Company and the Bellaire Nail Works began construction of Bessemer plants during 1883. These plants were completed in the spring of 1884. La Belle opted to use a process similar to the Bessemer process based on the Clapp-Griffiths patent.[32] La Belle built their steel plant in 1886 at the Jefferson works. The two Clapp-Griffith converters were of three-ton capacity. These converters were problematic (presumably not very cost or manufacturing efficient) and resulted in the bankruptcy of the Jefferson Iron Works.[33] Nevertheless, the Bessemer process was an overall successful. Its adoption in the Wheeling district, however, meant the end of the puddler, puddling furnace and the general use of wrought iron for cut nails.[34] Steel plate rapidly replaced iron plate. This change resulted in the Great Nail Strike.

The Great Nail Strike lasted for thirteen months, from June 1885 to July 1886. The puddlers, who were already out of work, convinced the nailers to go out on strike. The final result was that both the puddlers and the nailers lost their jobs, as well as their power over management. The nailers were replaced by the feeders, who quickly learned the skills necessary to become nailers. (Feeders were often trained by Pittsburgh nailers imported for the job. Many former nailers who had become mill managers, refused to train the feeders and were fired. The former nailers refusal to train feeders was a throw back to the guild system and the guarding of trade secrets. Management clearly recognized that the nailers job was not that difficult and they could easily be replaced.)[35] Even more important, the strike gave the wire nail industry a foot hold in the nail market, because of the lack of availability of the cut nail. The wire nail was cheaper to produce because of the increased production of steel wire during the 1880s.[36] Further, the wire nail gained popularity because it was more easily driven and removed, unlike the cut nail which could not be easily removed. In the end, the puddlers and nailers not only lost their jobs but they also helped kill the cut nail industry. Ironically, the nail makers were willing to phase out the use of iron over time and ease the transition into steel. The Great Nail Strike also caused the introduction of automatic feeders in the Wheeling district on a wide scale. The adoption of the automatic feeder meant less skill and training were required to learn how to feed the nail machines, because the nail plate was no longer manually flipped. It also meant less men were needed to operate the machines. This was clearly an advantage to management. In the end, the Great Nail Strike had many more long term effects.

The Wheeling nail industry rebounded from the Great Nail Strike with the all time record year for cut nail production in 1886. But this was only a short lived period of renewed growth for the industry, because by 1887 nail prices began to decline due to the popularity of the wire nail. In 1889 La Belle showed no profit for cut nails and in 1890 La Belle made a net profit of $269.79, for the sale of 184,000 kegs.[37]

One by one the nail mills began to shut down. Benwood was the first to close in 1890, followed by Bellaire and Belmont. By 1914, La Belle was the only Wheeling mill still making cut nails.[38] These mills needed to change their product line if they were to stay in the iron and steel business and specialized iron and steel products were the answer. For example Riverside began making welded tube for the expanding natural gas industry.[39] By diversifying, Wheeling district steel and iron mills remained in operation.

La Belle on the other hand diversified in a different way. La Belle initially investigated the possibility of making wire nails, but this would have required a complete retooling of rolling equipment and nail making machinery. La Belle rejected this idea in favor of manufacturing tin plate.[40]

In 1890, the McKinley Tariff on tin plate was enacted to encourage the growth of the American tin plate industry. Previously, virtually all tin plate used in America came from Great Britain. In 1889 there was only one tin plate mill in the United States, by 1891 there were twenty tin plate mills. Consequently in 1894, La Belle chose to erect a tin plate mill. In 1895, La Belle erected four hot mills, four stands of cold mills, and six tinning stacks adjacent to the nail mill. Later in 1897, the plant was expanded with the addition of four more hot mills. The plant produced terne tin plate for roofing. The mills estimated construction cost was $84,000.[41]

La Belle was a conservatively operated company. It rarely offered dividends and consequently had a ready cash reserve. This cash reserve enabled La Belle to weather the period of declining nail production and to later capitalize the construction of the tin plate mill. However, during the construction of the tin plate mill La Belle was forced to borrow money to pay for construction costs. This was a short term loss of capital because after six months of operations, La Belle tin plate showed a profit of almost $7,000. In the one year period from August 1896 to July 1897, La Belle's tin plate mill showed a profit of almost $59,000.

The late 1890s was a period when specialty iron and steel mills were bought out and then consolidated under one corporate name and management. This was also true for the tin plate business. In 1898, the American Tin Plate Company (later the American Sheet and Tin Plate Company and subsequently United States Steel Corporation) was organized by Judge William H. Moore, Daniel Reid and William B. Leeds. This trust bought up tin plate mills with a unique procedure. First an option on a mill property was offered at a specific price. Then, as the deal was being closed it was proposed by Judge Moore that instead of a cash payment, American Tin Plate preferred stock and an equal share of common stock be offered in place of a cash settlement. This method of acquiring plants was apparently quite successful, because ultimately American Tin Plate owned thirty-eight mills.[42]

La Belle's tin plate mill was purchased by the American Tin Plate Company in 1898. La Belle's Board of Directors agreed to American's offer of $500,000 of preferred stock and $500,000 of common stock. La Belle also sold its spare parts and products inventory for $92,000. Then La Belle sold off $250,000 of the preferred stock. A rare, but immediate dividend was declared for the stockholders. With this cash reserve, La Belle was able to buy back the bankrupted Jefferson Iron Works. La Belle further invested $127,000 on the construction of a universal continuous plate mill at Steubenville.[43] American Tin Plate's acquisition of La Belle's tin plate mill was a key factor in enabling La Belle to remain in the cut nail business, at least as a secondary product.

One of the interesting consequences of the sale of La Belle's mill was that for many years American Tin Plate and La Belle shared services because the businesses were both on the same lot. La Belle's tin plate mill was originally one department of the larger mill. Thus, American and La Belle shared many of the services, such things as steam boilers, shops and railroad sidings. Expenses were tracked through a complicated accounting system. However, many other tin plate mills owned by American Tin Plate had similar working arrangements.[44]

New steel products and steel making techniques were becoming common during the late nineteenth century. By the 1890s, the Bessemer process was being superseded by the open hearth furnace. Open hearth furnaces are reverbatory furnaces, which reflect heat onto the hearth and melt the iron (much like the puddling furnace).[45] The steel making process takes longer with the open hearth method, but the quality of steel made is by far superior to the Bessemer steel. La Belle began the construction of six 50 ton capacity open hearth furnaces at Steubenville in 1901.[46]

La Belle continued to make improvements at the Steubenville works during the early 1900s. For instance, La Belle modernized the 1860s blast furnaces. Other improvements included a tube mill and a shear plate mill. To capitalize these improvements La Belle sold off the American Tin Plate stock and issued bonds. In 1900, La Belle capital worth was $2.5 million; by 1902, it was worth $7.5 million.[47] By 1912, La Belle Iron Works capital value was at $20 million.[48]

Prior to World War I, La Belle's Wheeling works had two nail plate mills, the cut nail factory and miscellaneous outbuildings; not very much different than fifty years before at the time of La Belle's founding. The Steubenville works was much more extensive. It included two blast furnaces, the open hearth steel works, a universal continuous plate mill, sheared plate mills, a tube works, and sheet-bar mill. The company headquarters was then located at Steubenville.[49] Certainly, La Belle had diversified with the creation of new, more marketable products, but they also continued making cut nails. Steel produced at Steubenville was being used to make cut nails in Wheeling. As stated before, by 1914, La Belle was the only remaining Wheeling district company still manufacturing cut nails.

In 1920, the three remaining independent Wheeling iron and steel makers merged. The Wheeling Steel Corporation was formed from the consolidation of the Wheeling Steel and Iron Company, the Whitaker-Glessner Company, and the La Belle Iron Works. This amalgamation was formed to the mutual benefit of the three companies involved, with each company contributing particular products and facilities needed by the others. For example, both Whitaker-Glessner and Wheeling Steel and Iron needed a local source for steel sheet and bar products. La Belle's antiquated continuous universal plate mill made both sheet and bar stock and could easily be modernized to meet the three companies needs. Further, La Belle was much more diversified than either Whitaker-Glessner or Wheeling Steel and Iron. La Belle Iron Works was the crown jewel of the three companies and this is reflected in the exchanging of stock that created Wheeling Steel Corporation. La Belle stock was exchanged share for share for Wheeling Steel Corporation stock, while Wheeling Steel and Iron and Whitaker-Glessner stock was not exchanged share for share but at fractional values.[50] The formation of the Wheeling Steel Corporation reflects a larger trend in the United States, the formation of a large corporation from many smaller companies. The major example of this trend was the formation of the United States Steel Corporation at the turn of the century and to a lesser degree, the formation of the American Tin Plate Company. These large corporations were formed to gain better control of the market place and to undersell their competition.

The Wheeling Steel Corporation became the Wheeling-

Pittsburgh Steel Corporation when it merged with the Pittsburgh Steel Corporation in 1967. La Belle is now a subsidiary of Wheeling Corrugating Company, a division of Wheeling-Pittsburgh Steel Corporation.

Presently the La Belle employs forty-one workers and three managers. Nail production for 1989 was 300,777 tons of cut nails. Production for the first half of 1990 was 22,870 tons of nails. Nail production varies depending on what nails are being cut. For example, production of 4d common nails would produce millions of nails and use many machines, but would not have a large tonnage. Whereas, 60d spikes would have high tonnage and low production output.[51]

Wheeling-Pittsburgh Steel Corporation and the other major American steel makers have fallen on hard times since the early 1980s (Wheeling-Pittsburgh Steel has filed for bankruptcy under Chapter 11 laws). While the decline of the American steel industry was the result of multiple factors, it is interesting that La Belle is still making cut nails and has no future plans to stop manufacturing cut nails. La Belle primarily manufactures masonry nails (used for fastening wood and other materials to masonry products, such as stone or concrete block), flooring nails (for hardwood flooring), and common nails (for wood to wood or other applications were the cut nail's greater holding power is needed). La Belle is capable of producing almost any cut nail, by retooling the nail machines. The only nails La Belle is unable to make are the spikes larger than 60d. La Belle is the worlds largest cut nail manufacturer and one of two remaining cut nail factories in the United States (the other being Tremont Nail Company in Wareham, Massachusetts).

Nail Making Processes

Historic Process of Nail Plate Production

Historically, the process of making nails has not changed, though the materials have. Wrought iron was originally used instead of steel. The wrought iron was made on site in the puddling or boiling furnaces. In puddling iron, pig iron was converted into wrought iron by the oxidation of carbon and other impurities in the pig iron by boiling it with oxygen. As the iron was stirred, it would "come to nature," or be converted to a spongy ball. Once in this state, the wrought iron was ready to be shaped.[52]

Wrought iron could be shaped in several different ways. The first method required the wrought iron ball to be forged into rough plate using a tilt hammer. Forging was required not only to shape the wrought iron but also to drive the slag (glass like impurities from the smelting process) from the iron. A later improvement was the Burden Rotary Squeezer[53], which squeezed the slag from the wrought iron and formed it into blooms (a large square or rectangular bar). The second stage of this process was to roll the wrought iron into muck bar. The reheated blooms were offered into the rolls and through successive rolling the iron was reduced in thickness and increased in length. The muck bar was then cut into short lengths, stacked together to form a square approximately four inches by four inches and bound together with wire. Since muck bar varied in quality from batch to batch, there was much skill required in selecting which muck bar was used. Typically, better quality muck bar was encased with poorer quality iron. Once the stack or pile was made, it was heated until it reached welding temperature and offered into the rolling mill. The plate was rolled, then reheated and rolled again. This process was repeated until the plate size was reached.[54]

The final operation was making nail plate from the wrought iron plate. The nail plate could be made in several ways. One way was to shear the larger wrought iron plate to whatever width required. However, this meant the nails would be cut across the grain of the iron, making the nail more likely to break. Another way to make nail plate was to use the bull head roller. This roller produced narrow plate which allowed the nail to be cut with the grain. This meant the nail would bend but not break. Clinching (securing the nail by bending or flattening the exposed end) of nails was important in some construction practices, such as nailing hinges to doors. Before the advent of the bull head roller hand wrought nails had to be used for this type of application. A third way to make plate was with the skelp mill, which rolled nail plate that was later sheared to the correct size.[55]

La Belle puddled pig iron, converting it into wrought iron at the mill site. This is clear, and how La Belle made nail plate is also clear. The literature states that La Belle had a rotary squeezer, bull head roller, and rolling mills on site at the time it began operations. The 1884 Sanborn Fire Insurance Map shows both plate and muck rolls and this corroborates the methods discussed above.[56] The 1890 Sanborn Map shows rolls and squeezers and this is more evidence that iron plate was manufactured at the La Belle site in these ways.[57] La Belle no longer makes iron plate or even uses iron for cut nails, but the actual operation of cutting the nails is practically the same today as it was when La Belle began its operations over a hundred years ago.

<u>Modern Nail Making at La Belle</u>

1. **Pickling:** High Carbon (.35 carbon) hot rolled sheet steel (furnished by Wheeling-Pittsburgh's Steubenville works) measuring 24" x 135", are hand loaded into vertical racks or "cradles". The cradles are mounted on trucks, with "lazy

susans" allowing the cradles to be rotated. Following the loading process, the cradles are wheeled to the pickling line and are attached with chains to one of the four arms (one arm for each of the baths and one for loading and unloading) of the "Mesta Machine Company Carousel Pickler". The carousel raises and lowers the cradles by compressed air. The sheet steel is pickled by immersion in a 5% solution of sulfuric acid at 175 degrees F. This removes any oxidation and mill scale from the steel. The carousel is then rotated and the sheet steel is rinsed in clean water. The carousel is rotated a third time and the steel is immersed into a lime slurry at 165 to 175 degrees F. During this stage of the process, the rack is lifted from the lime slurry and the sheet steel blown with air to dry the metal surface. This process is repeated two or three times, until the metal is sufficiently coated with lime. The lime slurry acts as a lubricant when the metal is sheared. Each step of the pickling process lasts from seven to fifteen minutes. The surface condition of the sheet metal determines how long the steel is immersed. For example, new steel with less surface rust would be immersed in each bath for about seven minutes. The opposite is true for older steel. Following the picking process, the sheet steel is unloaded from the cradle by hand.

Note: The Carousel Pickler (circa 1902) is being replaced during the summer of 1990. The replacement for the pickler will be coiled cold rolled steel, that will be cleaned by shot blasting. The coiled steel with be straightened and then sheared into nail plate. The pickler is being replaced not only as a cost reduction move, but also because the sulfuric acid used in the pickling process poses a serious environmental hazard.

2. **Shearing:** The next step is to shear the pickled sheet steel into nail plate. The size of the nail determines the width of the plate. For example, a 3d nail plate is 1-1/4 inches wide or 8d nail plate is 2-17/32 inches wide. The width of the plate also includes material for heading the nail. The pickled plate is transported from the pickling line area to the shear, by a radio controlled floor crane. It takes approximately fifteen seconds to completely shear one 135" piece of sheet steel into nail plate.

3. **Wheeling:** This is the process of manually transporting or "wheeling" the sheared nail plate in buggies to the nail machines. The "wheelers" are responsible for stacking the nail plate in the bins adjacent to the nail machines.

Similarly, the catch bins beneath the nail machine are hand wheeled to and dumped into tote boxes. The tote boxes are transported by fork lift to the hardener or the packing line.

4. **Nail cutting:** This process has changed very little in the course of the almost one-hundred and fifty years that La Belle has been in operation. The major difference is steel nail plate is cold cut and wrought iron nail plate was heated before cutting. The feeder loads a piece of nail plate in the nipper of the feeder rod, by prying it open with a pry bar. When the rod is reloaded, the feeder pries open the nipper, removes the scrap piece and inserts a new piece of plate. This is done in one swift motion. Following the removal of the empty feeder rod, the new feeder rod is offered into the barrel of the machine. Since the barrel is always rotating, there is skill involved in timing the inserting of the rod. All machines, except for machines cutting the larger nail sizes have automatic feeding devices which advance the nail plate into the machine. Along with the automatic feeder is the rotating barrel which flip flops the nail plate, thus cutting the tapered nail. This process is repeated for each machine, at the rate of about six rods per minute per four machines.

Once the feeder rod has been properly inserted, the nail is sheared from the plate. The nail head is formed by the combination of a moving die and a stationary die, which holds the nail while the header heads the nail. The same process is used in cutting the larger sized nails, however, there are two significant differences. First the nail plate is heated in a reheating furnace. Secondly, the nail plate is manually flip- flopped by the feeder as it is fed into the machine.

Each feeder is responsible for four nail machines. Each of the feeders is overseen by a nailer. The nailer's job is to maintain and repair the nail machines, to grind and sharpen the nail cutting knives, and to make the dies associated with the nail machine. The knives are sharpened daily and the die blocks, which form the nail heads, are reground as needed.

Also important to the maintenance of the nail cutting machines is the blacksmith. The importance of the blacksmith can not be overstated. If a nail machine breaks down and the broken part can not be repaired, then the replacement part has to be cannibalized from other machines, recast using patterns (in La Belle's possession) and machined, or fabricated in the blacksmith shop. For example, gauges used to determine the width of the cut nail are hand forged in the blacksmith shop. The pry bars used to open the nipper of the feeder rod are made from used coil springs (often these springs are brought to the shop by La Belle employees). Replacement parts are made by using the old part as a pattern. In addition to La Belle, there is one other blacksmith in the Wheeling-Pittsburgh Steel Corporation. This blacksmith works at the Steubenville Works and makes parts for obsolete machines, much like La Belle's smith. The La Belle plant has complete machine and weld shops to weld and machine parts as required.

5. **Heat treatment:** Once the nails have been cut they are ready for hardening and tempering, to increase their resistance to breakage. The hardening process require the nails to be heated to 1,800 degrees F and then quenched in water. The nails are then tempered by being reheated or drawn at a temperature varying between 400 and 800 degrees F. Industrial temperature controls have been added to the furnace for both improved quality control and for safety reasons. Nails are tested for hardness and ductility by a torsional test designed to bend and break the nail. If the nail breaks too easily, then the temperature in the draw

back tube is raised. If the nail is too difficult to break, then the temperature in the draw back tube is lowered.

6. **Packing:** Once the nails have been cut, hardened, and tempered they are ready for packing. La Belle has two packing lines: a mini packer (for one and five pound boxes) and a heavy duty packer (for fifty-pound boxes). Both are automated machines which fold, glue, fill, and seal boxes of nails. Nails are boxed in one pound, five pound, and fifty pound boxes.

7. **Shipping:** The last phase of the process is the shipping of the boxes of nails. La Belle nails are sold as retail products, mostly to domestic USA customers and to customers in Puerto Rico.[58]

Appendices

I. Power transmission

Historically the original nail mill was probably powered by a steam engine with the power transmitted through a system of lineshafts. Some overhead lineshafting is still extant in what is believed to be an early but not original structure, but this may be from a later tack factory. It was later powered by a steam engine located in the powerhouse, which was belted to a giant pulley located in the center of factory floor. Power was transmitted to the nail machines through a lineshaft system beneath the factory floor. Each machine was then individually belted from the lineshaft. The lineshaft was also belted by the use of tunnels to the grind stones. This steam engine was later replaced with two large electric mill motors probably sometime after the turn of the century. The motors were placed at the end and in the middle of the lineshaft. This arrangement was superseded in the early 1970s when the central lineshaft was replaced by individual electric motors, which power each nail machine. However, some nail machinery and grinders are still powered using overhead lineshafts belted to electric motors.[59]

II. Transportation

Historically, La Belle had a narrow gauge edgeway tram system within the plant. These mule drawn trams connected the cooper shop, the nail machines, and other areas of the plant together. The tramway was first replaced with electric trucks and now materials are transported with fork lifts.[60] Reportedly, La Belle had a tramway which connected the plant with a wharf on the Ohio River. This tramway was used to transport pig iron and other raw materials that were shipped on the Ohio River.[61]

Nails were originally shipped via the Baltimore and Ohio Railroad and the Pennsylvania Railroad. La Belle had a spur connecting the plant with the mainline. Presently nails are shipped using motor freight carriers.

La Belle was connected by a series of tunnels to their coal mine in the hills east of the factory. There were also tunnels connecting other parts of the plant, but they are not used today.[62]

III. La Belle Site Development

The La Belle Iron Works began as a two building mill site, with only a rolling mill and nail factory. If these two buildings are still extant, they are impossible to discern from the rambling structures which make up the site today. Apparently, the oldest buildings at La Belle are the building housing the blacksmith, machine and weld shop, the building housing the office and the attached powerhouse (now housing an air compressor). These three structures are constructed of red brick. The architectural details such as the drooping acorn spandrels, are keys to dating these buildings. The key to dating the other structures are with the roof truss systems. The truss systems are unchanged while the original roofs and walls have been replaced with corrugated steel. For example, the truss system used in the main nail factory is very much different than the truss system used in the remaining part of the old tin plate mill.

The 1884 Sanborn Map, the earliest available map, shows La Belle mill site bounded by 31st Street to the south, 30th Street to the north, Alley G to the east and Woods Street to the west. The plant was laid out in an upside down "L" shape, (apparently the building was constructed in several phases and the structure's odd shape reflects these phases) with the puddling furnaces in the north end of the shop (the short leg and middle part of the "L") and the nail machines in the south part of the shop (at the top and middle of the long leg of the "L"). The map indicates a total of twenty-four puddling furnaces with the plate and muck rolls in the center of the floor and the ore crusher, in an alcove, adjacent to these furnaces. Five heating furnaces (to heat the iron prior to rolling) are south east of the plate rolls. Adjacent to the nail machines are the grindstones flanking the east and west walls, two nail plate furnaces on either side of the machines and a blueing furnace on the south east wall. The foundation of the main shop is constructed of stone. The powerhouse is east of the nail machines with four steam boilers and a tramway connecting it to the factory. There was a coal tram area on the northeast corner of the building. The annealing house is on the corner of Alley G and 31st Street. The machine and blacksmith shop stand west of the nail machinery. Other outbuildings include the oil house, carpenter shop, office and scrap house. A large brick warehouse, stave yard, and coopery are located south of 31st Street and bounded by 32nd Street, Alley G and Woods Street.

The 1890 Sanborn Map shows few changes to the main shop area. The puddling furnaces are still shown in the northern end of the shop and the nail machines in the southern part. Rolls and roll squeezer are now shown instead of plate and muck mills. The only other major changes were the additions to the blacksmith shop building with an addition on the southern end and a pickling house on the northern end; and another annealing furnace added to the north end of the annealing house. The rest of the site is basically unchanged.

The 1902 Sanborn Map shows major changes because of the tin plate mill. The southern end of the plant is still bounded by 31st Street, but the northern end is now bounded by 29th Street. Alley G and Woods Street still mark the east and western boundaries. The nail works are probably only one quarter of the complete factory site, with the rest being used for the tin plate mill. The major change to the nailery was the removal of the puddling furnaces and the attachment of the blacksmith/machine shop to the main factory floor. The area south of 31st Street was still for material and nail storage and barrel making.

By 1922, all of the tin plate mill was removed. The total area of the plant had shrunk substantially since 1902. The whole nail factory was now housed under one roof (really many roofs, from the many buildings) with the blacksmith/machine shop, annealing house and powerhouse now integrated into the structure. The plant laid out shown on the map is pretty much as it is today. The only major changes were to the warehouse and coopery area, expanding it to include garages and more storage facilities.

The most recent Sanborn Map was updated during the 1950s and shows the site pretty much the same as in 1922, with the exception that the cooper shop and warehouse facilities to the south of the plant are now gone. As well as all the other outbuildings, such as the carpenter's shop. This area is now a parking lot and a baseball field. Today the nail factory remains in the south and central portion of the plant. The pickler is west of the blacksmith/machine shop, with shipping just north of this area. Packing is located in the northern part of the plant where the puddling furnaces were located. Also in the northern end of the plant is the "graveyard," an area filled with old castings waiting to be used for spare parts. The annealing house is now the plant office and the patterns (for castings) are kept on the second floor. To the north of the old powerhouse is the hardener.

The equipment still being used at La Belle is hard to document. Many of the machine castings appear to be original and some still have the Bailey, Woodward and Company cast into them. It would be nearly impossible to date any one machine due their age and in particular because of the cannibalizing of machine parts to keep machines running. Only one nail plate furnace still remains at the plant and is located adjacent to the two large spike cutting machines at the north end of the nail factory.

Glossary

Backwards Vertical Integration: Vertical integration is the acquisition and control of all the raw materials, the goods and services on up to the finished product. Backwards vertical integration is the opposite, it begins with a finished product and gaining control of the raw materials, etc. in a backwards manner. La Belle had been buying pig iron and coal to make nails. Now La Belle, by purchasing blast furnaces and a coal mine could control the costs of these raw materials.

Blast Furnace: The blast furnace is used to smelt iron ore, coke and limestone. Pig iron is produced and is this the basic material for the production of both wrought iron and steel.

Bloom: An elongated wrought iron or steel semi-finished product, approximately square or rectangular in cross-section.

Bull Head Roller: The bull head roller is used to cut nail plate with the grain of the iron. This is important for making cut nails that could be clinched or bent.

Cold Mill: The cold mill rolls the metal cold, not hot. The finished product has a superior surface finish and is more dimensionally uniform.

Draw Back Tube: The draw back tube is the nail return tube in the hardener. It tempers the nails to the required hardness by slowly heating the nails and "drawing them back" to the front of the hardener.

Feeder: The person who "feeds" the nail machines. That is, the person who operates the nail machine and inserts the nail plate into the nail machine. The feeder is the lowest job in the iron worker hierarchy. This job still exists today.

Grind Stone: An abrasive wheel used to grind and sharpen the knives or metal blades used to cut the nails.

Heater: The heater was responsible for the heating of the wrought iron blooms, bars, etc. prior to the rolling process. The heater was second to the puddler and nailer in the mill hierarchy.

Heating Furnace: The Heating furnace was used to heat the iron blooms, bars etc. before rolling operations and to heat nail plate prior to being cut.

Heat Treatment: The process of changing the physical properties of a metal by heating and cooling it. The metal can either be hardened or softened in the heat treating operations.

Hot Mill: The hot mill rolls metal hot. The surface quality is poor and it is not dimensionally uniform.

Lime Slurry: A thin, watery mixture of lime and water, used as a lubricant.

Muck Bar: Muck bar is a rough rolled iron bar, that is produced by several passes in the muck mill. Muck bar varied greatly in quality. Muck bar was used in the production of iron plate.

Muck Mill: A muck mill was a rolling mill used to produce muck bar.

Nailer: The nailer supervises the feeder. The nailer maintains and repairs the nail machines, as well as sharpening the knives and grinding the nail header blocks. The nailer and the puddler were the highest paying jobs in the iron worker hierarchy. This job is still in existence today and the nailer still oversees the feeder.

Nail Plate: Nail plate is the thin bar-sheet stock used to cut nails. It is the same as skelp.

Nail Rod: Nail rod was thin strips of wrought iron produced with the slitting mill and used to make hand wrought nails.

Pig Iron: Pig iron is produced in the blast furnace and has a high carbon content with very little slag. Pig iron is base product to make both wrought iron and steel.

Puddler: The puddler or boiler converted pig iron into wrought iron using the puddling furnace. This was the highest paid job in the iron mills and equal to the nailer.

Puddling: The process of converting pig iron into wrought iron. The pig iron was melted in the puddling furnace and stirred by the puddler. The air within the furnace decarbonizes the pig iron and converts it into wrought iron as it is stirred. Until the advent of steel and its adoption replaced the use of iron, wrought iron was produced this way.

Puddling Furnace: The reverbatory furnace was used to convert pig iron into wrought iron using coal for fuel. The heat was reflected onto the hearth melting the iron and the coal gases never came in contact with the iron. Thus the fumes could not taint the iron. The air within the furnace was used to decarbonize the iron and convert into wrought iron. This furnace was very important in the production of wrought iron during the nineteenth century.

Quenching: Quenching is the rapid cooling of a hot metal in oil or water. This freezes the metal at a specific hardness.

Roller: The roller operated the rolling mill equipment. This was one of the highest paying jobs in the iron mill and second to the puddlers and nailers.

Rolling Mill: A mill machine used to reduce the thickness of plate with a series of passes. The heated iron was offered into the rolls and with successive passes the iron was reduced in thickness.

Shear Plate Mill: This mill rolls plate and shears it to length.

Sheet-Bar Mill: Sheet-bar mill made sheet-bar, thin iron bar approximately eight inches wide.

Skelp: See nail plate.

Slag: Slag is the glass fibers found in wrought iron and are caused by impurities from the materials used in the smelting process.

Slitting Mill: The slitting mill produced nail rod by cutting or slitting the iron plate. The iron plate was offered into the slitting rolls and the plate was cut into long thin strips.

Squeezer: The squeezer was used to squeeze the slag out of iron and form it into a bloom.

Steel: Steel is a form of wrought iron with a small percentage (.5 to 1.5%) carbon and virtually no slag.

Terne Tin Plate: Sheet steel coated with lead and tin.

Tinning Stacks: A series of tanks used to hot dip and coat sheet steel with a thin layer of tin.

Tin Plate: Sheet steel coated with tin.

Tote Box: A large square box used to transport large quantities of nails within the factory.

Tube Mill: A mill which forms tubing from flat stock or skelp. The hot metal is offered into a set of three pairs of grooved rollers, perpendicular to each other and the formed metal comes out tube shaped. The seam is then welded.

Universal Continuous Mill: A rolling mill with two horizontal and two vertical rolls (and the edger which controls the width of the plate). This mill is universal because the width of plate produced can be continuously varied.

Notes

1. Amos J. Loveday, The Rise and Decline of the American Cut Nail Industry: A Study of the Interrelationships of Technology, Business Organization, and Management Techniques (Westport, CN: Greenwood Press, 1983), p. 4.

2. Loveday, Cut Nail Industry, pp. 4-5.

3. Loveday, Cut Nail Industry, pp. 5-7.

4. Loveday, Cut Nail Industry, pp. 8-10.

5. Loveday, Cut Nail Industry, pp. 8-17.

6. Loveday, Cut Nail Industry, pp. 20-21.

7. Loveday, Cut Nail Industry, pp. 27-30.

8. Loveday, Cut Nail Industry, pp. 23-26.

9. The War of 1812 not only increased domestic iron production, but also was the catalyst for the internal improvements movement, such as canal and road building.

10. Dr. Peter Schoenberger after his failures at Wheeling went on to help begin the Cambria Iron Works in Cambria County, Pennsylvania. Although, the Cambria Iron works also failed under Schoenberger's direction, the company eventually became a leading American iron producer. See the America's Industrial Heritage Project-Pennsylvania "Historic Resource Study: Cambria Iron Company," by Sharon A. Brown for the history of the iron works.

11. Loveday, Cut Nail Industry, p. 44.

12. "The Early History of the Iron and Nail Business--The Predecessors of the Present Top Mill," Wheeling Intelligencer, 2 February 1874, p. 2.

13. J. H. Newton, G. G. Nichols and A. G. Sprankle, History of the Pan-Handle: Being Historical Collections of the Counties of Ohio, Brooke, Marshall and Hancock, West Virginia (Wheeling, W.Va.: J. A. Caldwell, 1879), p. 232.

14. "The Virginia Mill and Its Successor, The Benwood Iron Works," Wheeling Intelligencer, 5 February 1874, p. 2.

15. Newton, Nichols and Sprankle, Pan-Handle, p. 233.

16. Robert L. Plummer, Sixty-Five Years of Iron and Steel in Wheeling: Personal Reminiscences of a Long and Active Career as Related by Alexander Glass (n. p., n. d.), pp. 40-41.

17. Scott, Iron and Steel, p. 18.

18. Loveday, Cut Nail, p. xv.

19. The William's Wheeling Directory for 1856-57 reveals all founding partners residing on company property, adjacent to the mill. Mostly on Catherine Street between Jacob and the La Belle Iron Works. The original Plat Map showing the La Belle mill property (see Deed Book No. 37, p. 1) indicates Bailey, Woodward and Company property fronting on both sides of 31st Street (then Catherine) between La Belle and Chapline (then Jacob). These are the probable original La Belle house lots.

20. Intelligencer, 18 February 1874, p. 3. See "Ohio County, West Virginia Deed Book No. 37," p. 3. The deed book reveals some discrepancy as to who owned the La Belle property. Joseph Caldwell sold property to Bailey, Woodward and Co., who turned around and sold the property to Moses Good, a local lawyer.

21. Loveday, Cut Nail Industry, p. 52.

22. "The LaBelle and Jefferson Iron Works," Wheeling Intelligencer, 18 February 1874, p. 3. The above article reported that seven of the original members had died and four had withdrawn. The William's Wheeling Directory of 1856-57 has no listing for Dennis McCoy, Richard Savery, Holsten Hardin, and John McClinton, but the Directory of the City of Wheeling of 1851 lists Harden and McCoy. This seems to indicate that these men either left the firm or died. The 1856-57 directory lists Mrs R. Caswell, this seems to indicate that Robert Caswell had died. This accounts for five of the eleven stated in the above article.

23. Loveday, Cut Nail Industry, p. 26.

24. Henry Dickerson Scott, Iron and Steel in Wheeling (Toledo, Ohio: Caslon Company, 1929), p. 18.

25. Loveday, Cut Nail Industry, p. 50.

26. Intelligencer, 18 February 1874, p. 3.

27. Loveday, Cut Nail Industry, pp. 66-68.

28. Intelligencer, 18 February 1874, p. 3.

29. "Wheeling Industries: A Review," Wheeling Intelligencer, 7 March 1874, p. 3.

30. Scott, Iron and Steel, p. 88.

31. Ibid, p. 66.

32. Loveday, Cut Nail Industry, pp. 115-16.

33. Scott, Iron and Steel, p. 92.

34. An article in The Wheeling Intelligencer 3 December 1891 under the column of "Industrial News" reported that the puddlers at La Belle were to start working again. This seems to suggest that wrought iron was still being used for some nail making applications.

35. Loveday, Cut Nail Industry, pp. 120-25. The wire nail first came into use during the 1850s. They are much easier and cheaper to manufacture than cut nails. Wire nails can be used with nail guns, whereas cut nails cannot. However, cut nails have a superior holding power and cut nails are used in applications where it is desireable that the nails cannot back out. For additional information see NPS Technical Leaflet 48- Nail Chronology As An Aid To Dating Old Buildings, by Lee H. Nelson.

36. Loveday, Cut Nail Industry, pp. 136-138.

37. Scott, Iron and Steel, p. 113.

38. Loveday, Cut Nail Industry, p. 141.

39. Loveday, Cut Nail Industry, p. 141.

40. Loveday, Cut Nail Industry, p. 140.

41. Scott, Iron and Steel, p. 129.

42. Scott, Iron and Steel, pp. 134-36.

43. Scott, Iron and Steel, pp. 137-38.

44. Scott, Iron and Steel, p. 139.

45. B. H. Amstead, Manufacturing Processes (New York: John Wiley and Son, 1977), pp. 47-48. An open hearth furnaces is a regenerative furnace which utilizes the combustion gases to

superheat the air and fuel entering the furnace, thereby increasing the efficiency and temperature of the furnace.

46. Scott, <u>Iron and Steel</u>, p. 150.

47. Scott, <u>Iron and Steel</u>, p. 150.

48. Ibid, p. 155.

49. Scott, <u>Iron and Steel</u>, p. 158.

50. Scott, <u>Iron and Steel</u>, pp. 168-69.

51. Oral interview with Pete Pashalis, La Belle Foreman, 3 August 1990.

52. Scott, <u>Iron and Steel</u>, pp. 65-66.

53. Invented by Henry H. Burden of Troy, New York in 1836. Burden also invented an automatic spike making machine. See Loveday, <u>Cut Nail Industry</u>, p. 20.

54. Scott, <u>Iron and Steel</u>, p. 67.

55. Loveday, <u>Cut Nail Industry</u>, p. 50.

56. <u>Wheeling Sanborn Fire Insurance Map for 1884</u>, p. 12.

57. <u>Wheeling Sanborn Fire Insurance Map for 1890</u>, p. 26.

58. Oral interview with Pete Pashalis, La Belle Foreman, 3 August 1990.

59. Oral interview with Ralph Cronin, the annealer start up man, 2 July 1990. Oral interview with Steve Fabry, electrician, 3 July 1990. Author's own investigation of lineshaft system and plant layout.

60. Harry Turton, "Wheeling Steel Keep Traditions Alive," <u>Wheeling News-Register</u>, 27 August 1949, p. 2. Also see <u>Wheeling La Belle Cut Nails Centennial 1852-1952 Catalog</u>.

61. Scott, <u>Iron and Steel</u>, p. 31.

62. Theadiane Taylor, "Wheeling-Pittsburgh Steel's La Belle Plant Hits the Nail Right on the Head," <u>Wheeling Sunday News-Register</u>, 25 November 1979, p. 45.

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PROJECT INFORMATION

The Historic Wheeling Recording Project was undertaken during the summer of 1990 by the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER), Robert J. Kapsch, chief, Division of the National Park Service. The funding was supplied by West Virginia University through the Institute for the History of Technology and Industrial Archeology, Emory L. Kemp, director. Local sponsorship was provided by and the Victorian Wheeling Landmarks Foundation, Betty Nutting, Bill Fields and Frances Williams, principals. The project was supervised by Paul Dolinsky, chief of HABS, Joseph Balachowski, architect and Catherine C. Lavoie, historian. For West Virginia University, the principals were Emory L. Kemp, director and Billy Joe Peyton, historian. The large format photography was the work of HABS photographer, Jack E. Boucher.

The documentation was produced in the HABS/HAER Field Office, Wheeling, West Virginia in 1990 by Professor John P. White, Supervisory Architect, Texas Tech University; Architectural Technicians Joelynn Barclay, University of Texas at Arlington; Titiana Begelman, Columbia University; Steven C. Byington, Texas Tech University; Lazlo A. Darago, Technical University of Budapest (US-ICOMOS, Hungary); Harold E. Phelps III, University of Southern California; Mark A. Radven, Texas Tech University; Historians Arlene R. Kriv, Rutgers University; and Lee R. Maddex,

ADDENDUM TO:
LABELLE IRON WORKS
Thirtieth & Wood Streets
Wheeling
Ohio County
West Virginia

HAER WV-47
WVA,35-WHEEL,38-

HAER
WVA
35-WHEEL
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