Chapter 2

HISTORICAL CONTEXT

A. OVERVIEW: PATERSON — AN INDUSTRIAL CITY 'PECULIAR TO ITSELF'

> "The birth and growth of Paterson are peculiar to itself, and have but few parallels or counterparts in those of other cities of the Union." – *New Jersey's Leading Manufacturing Centres, 1887*[1]

During the last quarter of the 19th century, observers of New Jersey and the American industrial scene began to realize that something remarkable was happening in Paterson. It was having a third industrial transformation driven by the production of silk, a most luxuriant and, up until that time, exotic fabric. The 30 mills in this survey date from the late 1870s to the 1920s when Paterson sustained an international reputation as "The Silk City" or the "The Lyons of America." About a third of the mills in the survey were built as silk mills, and another third as silk dyeing and finishing mills. The remaining third represent other significant sectors of Paterson's industrial scene and include several machine works, a locomotive works, a brewery and an aircraft engine plant. One characteristic that all of these mills have in common is that they represent a phase of "steam-age" industrial expansion that spread outward from Paterson's historic water-powered industrial core, which was by necessity located near the Great Falls of the Passaic River (Figure 2.1).

As is well known, Paterson was founded under singular circumstances through the speculations of Alexander Hamilton and a cluster of 18th-century gentlemen, most of whom had no practical experience in manufacturing. Their charter for the Society for Establishing Useful Manufactures (S.U.M.), granted by the State of New Jersey in 1791, gave them broad powers to buy land and commission a new industrial town. The S.U.M. initiated an ambitious plan to build a series of raceways or canals dug into the hard basalt downstream of the Great Falls. Along the raceways would be "seated" mills, producing, primarily, cotton textiles. The mills would use technology transferred from Great Britain, the world's leading industrial nation of the time. Despite bright hopes, the S.U.M. faltered, a victim to the personal bankruptcies of its directors, insufficient technical knowledge and skilled-labor shortages; work was suspended in 1796-97. The vision of the S.U.M.'s founders may have been rose-tinted but it was not without merit; following the suspension, Peter Colt, the S.U.M.'s superintendent, and members of his family gained control of the corporation and continued improving the raceway system and leasing waterpower and land to mill operators. About two decades after the S.U.M.'s founding, the Colts' persistence paid off; the 1807 embargo and the War of 1812 shut off the flow of British textiles creating a golden opportunity for entrepreneurial cotton manufacturers. Paterson became a town of textile mills, fulfilling the founders' vision. By the early 1830s, nearly a dozen cotton and woolen mills were in operation employing about one thousand workers.[2]

After the Panic of 1837, the cotton textile sector ceased its rapid expansion, but other industrial sectors moved ahead. Machine builders, initially drawn to Paterson to supply the mills with carding, spinning and weaving machines, were a foundation for future industrial growth. Locomotive manufacturing – a second industrial transformation – began in Paterson during the late 1830s when a former textile-machine maker named John Rogers undertook to build an engine based on the design of an English locomotive

Figure 2.1. Detail from *Bird's Eye View of Paterson, N.J.* 1880, showing the development of the steam-powered industrial district to the south of downtown along the Erie Railroad corridor.

purchased by the Paterson and Hudson Railroad in 1836. Rogers' first locomotive proved reliable and brought in additional orders. The Rogers Locomotive Works was within two decades one of the three largest manufacturers of locomotives in the United States. By 1860, Rogers employed more workers than all the textile mills in Paterson combined. The machine works and their offshoots gave Paterson a skill-intensive reservoir of machinists and foundrymen with productive flexibility. There was a constant demand to develop specialized machines to increase manufacturing efficiency and productive capacity, and Paterson became known as a center for the design and fabrication of innovative machines, especially for the silk industry. Throughout the late 19th and through much of the 20th century, entrepreneurs and innovators sought out Paterson's machine builders to turn their ideas into reality, from rotary aircraft engines in the 1910s to bunching machines for making fiber optic cables in the 1990s.[3]

Silk gained a toe-hold in Paterson in 1840 when John Ryle took possession of a failed silk spinning operation installed by Christopher Colt in the upper floors of the Colt Gun Mill. Ryle, an immigrant silk worker from Macclesfield, an industrial town in northwestern England known for its excellent silk weaves, made a successful restart producing "sewing silk," spooled silk for the new sewing machines being produced by Isaac Singer and others. By 1860, Paterson was home to a half-dozen silk companies, including its first dye works. On the eve of the Civil War, Paterson's silk industry employed 600 workers, many of whom were the wives and daughters of the city's machine and locomotive shop workers. These first silk mills were often located in, or on the sites of, former cotton mills powered by the Great Falls waterpower. In 1861, the Civil War created a political climate favorable to American silk interests when anti-tariff southerners seceded from the federal government. The Tariff Act of 1861 added a 40 percent premium to woven silk goods imported from European silk centers. This, combined with the effects of the 1860 Anglo-French trade treaty, which opened England's silk market to French goods, sent the old established centers of silk manufacture in England into rapid decline, including Ryle's hometown of Macclesfield. The pre-existing links to Macclesfield motivated many English silk weavers to immigrate to Paterson adding a further infusion of skills, expertise and entrepreneurial spirit.

With the return of a peacetime economy to the United States after 1865, Paterson was primed to set a course toward becoming the center of a great silk industry. The town had been favored from the start by its proximity to New York City and its great port. New York was emerging as a center of the nation's fashion industry, a great consumer of silk, and Paterson's silk manufacturers cultivated close contacts with New York's mercantile interests for the investment capital needed to import raw silk from the Orient. Paterson was already known for its waterpower, but steam had become almost as economical as water in driving machinery. Coal was an increasingly cheap and abundant fuel, delivered by way of the Morris Canal and the several railroads that had connected Paterson to the Appalachian coal regions prior to the Civil War. Large quantities of water, fair in purity, were also needed to clean and dye silk, and the Passaic, by coincidence, had a natural softness, its waters passing through geologic formations that contained few of the mineral salts that interfered with the silk-dyeing process. Silk mills also welcomed cheap immigrant labor, which was prolific in the decades after the Civil War as new waves arrived from northern Europe followed in later decades by those from eastern and southern Europe. By 1910, approximately 25,000 were employed in 270 Paterson silk mills, and another 10,000 in 75 silk dyeing and printing establishments.[4]

The following sections of this chapter place the 30 mills in this survey within historic contexts associated with Paterson's industrial heritage. To start, the mills are placed within the context of industrial architecture

with an explanation of the engineering and architectural styles that influenced their plan and design. This is followed by a discussion of the business economics of the six major industrial sectors represented by the mills – silk spinning and weaving, textile dyeing and printing, machine tools, locomotives, brewing and aeronautics. Then the concept of industrial archaeology is introduced along with the potential for the mills to contain significant artifacts and physical data on industrial processes and technologies. The final sections of the chapter place the mills in broader social contexts specifically related to the emergence of Paterson's business and working classes, and, finally, in a cultural context as seen from today's perspective.

B. INDUSTRIAL ARCHITECTURE IN PATERSON

In the late 18th century, American entrepreneurs began to make in factories products that had formerly been made in homes, craft shops or country mills. The hallmark of industrialization involved principles of uniformity in production and division of labor supported by increasing use of power-driven machinery. The Society for the Establishment of Useful Manufacturers (S.U.M.) had these principles in mind when Paterson was created as a manufacturing center with water-powered factories arranged along its impressive three-tier raceway system, which developed in stages from the 1790s to the 1830s. The factory architecture of this early period in Paterson's industrial development drew heavily from European precedents, particularly British cotton textile mill construction, which was first widely adopted in New England but also spread to other textile manufacturing centers like Paterson. The dozen or so textile mills erected near the Great Falls in the first half of the 19th century exerted a powerful influence on the city's industrial architecture even after the development of steam power made it possible to build factories located away from the falls.

The British preferred substantial factories, usually three or four stories of stone or brick, and the S.U.M. tended to follow suit, although some of the very early mills were of timber frame and clapboard construction. By the middle decades of the 19th century, most mills constructed in Paterson were brick, and this trend would extend into the early part of the 20th century. An important characteristic of the mature textile mill form was its narrow width-to-length ratio, allowing for the transmission of power through line shafting that extended the length of the factory (Figure 2.2). Machines were arranged in horizontal rows, and materials could be moved through the aisles between the machines (Figure 2.3). The design maximized power utilization, essentially creating workspaces around a central power source (a waterwheel and later a steam engine).

Furthermore, a multi-story plan kept power losses to a minimum by shortening the distance from the power source to the machinery as compared to a single-floor plan that would have stretched the same number of machines out over a greater area. The narrow width of the textile mills also facilitated the use of natural lighting with long rows of windows allowing light to reach the center of the workspace. The upper story of the mill under the side-gable roof was often fitted with a clerestory to maximize light and usable space. Additionally, the factory interior was plastered or whitewashed to maximize reflective light. Stair towers were a common feature of textile mills, often with a bell or clock to mark the beginning and end of the workday.

The multi-story arrangement also facilitated the creation of spaces within the mill devoted to particular processes. In cotton mills, for example, it was typical for one floor or section of a floor to be devoted to carding (usually a lower floor due to the heavy weight and vibration of carding machines), another to spinning, and another to weaving. Similar divisions were found in silk mills with throwing, warping, and weaving

Figure 2.2. Silk Mill of Hamil & Booth. L. R. Trumbull, *A History of Industrial Paterson*. 1882. The mill in the foreground illustrates the classic textile mill form of narrow width-to-length ratio.

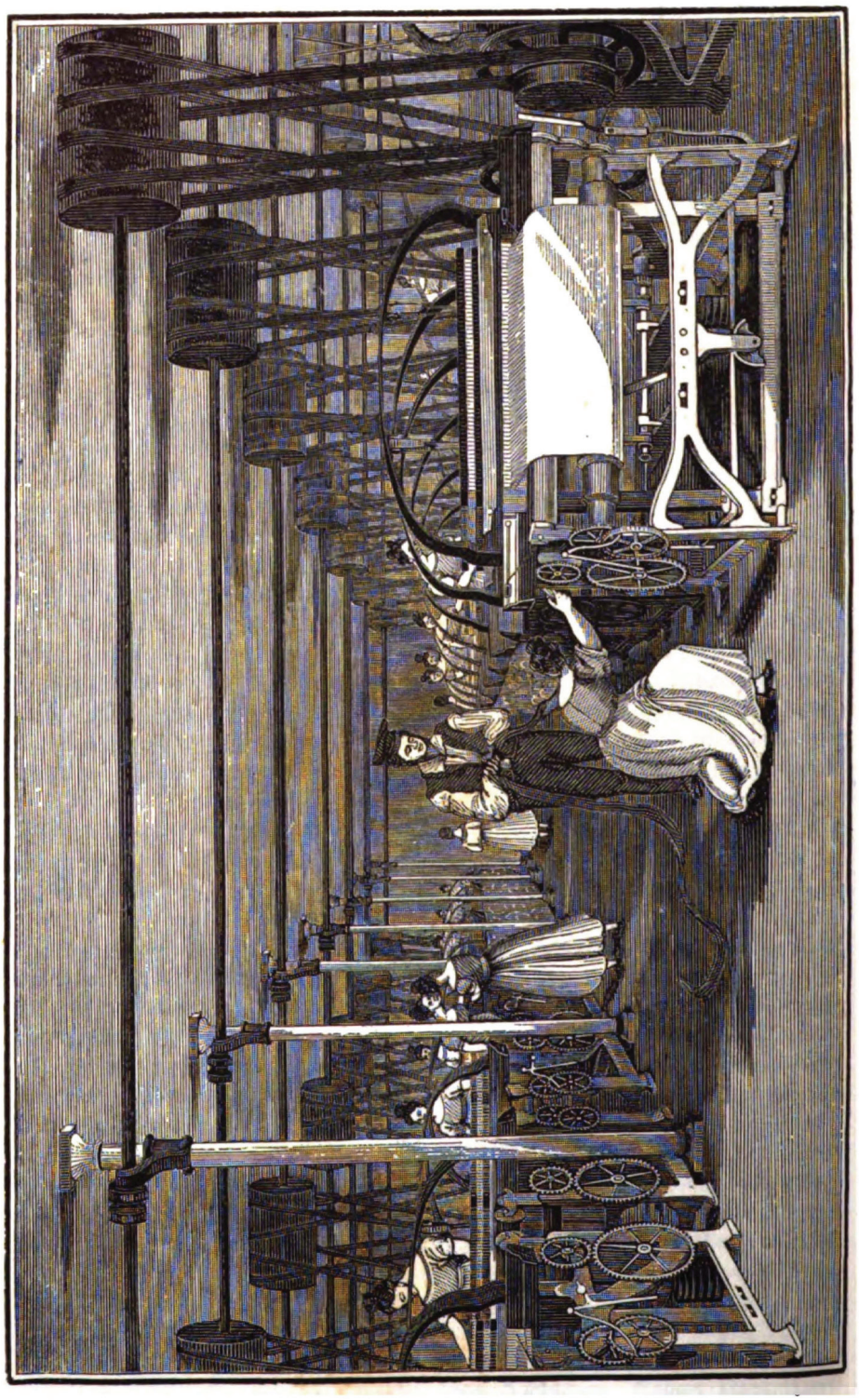


Figure 2.3. Power Loom Weaving. George White, *Memoir of Samuel Slater*. 1836. This classic view of a textile mill weaving room shows the arrangement of machines into aisles. Note the male overseer and female operatives, a typical gendering of work in textile mills in Paterson and other cotton mill towns prior to the Civil War. The power transmission system of overhead line shafting was one of the determining factors in the layout of the mill. Although this view shows a cotton mill, similar arrangements were used in woolen and silk mills.

relegated to their own floors. This compartmentalization reinforced a division of labor and segregation of skill within the factory, with work assignments often based on age, gender and experience. A byproduct of the floor plan was that long aisles provided relatively unobstructed views of work areas making it possible for overseers to watch the activities of many workers at once. The overseer became a notorious figure, capable of controlling the pace of work by speeding up the machines and docking workers' pay for activities that were seen as deleterious to production.[5]

As the foundation of Paterson's industrial economy shifted to silk in the latter half of the 19th century, silk manufacturers continued to utilize the basic textile mill form that had developed during the city's pre-Civil War cotton mill era. As the mills expanded in size, employing hundreds and sometimes thousands of workers and machines, builders replicated over and over the basic multi-story brick textile mill. New construction was oriented to the pre-existing street grid as manufacturing spread outward from Paterson's industrial core. Rectangular city blocks constrained manufacturers, forcing them to build mills fronting on one or more sides of the block, often resulting in complexes that had L, J, U and E-shaped plans, or even enclosed inner courtyards (Figure 2.4). In a few instances, Paterson's radial streets created triangular shaped blocks, resulting in mill complexes with three sides such as the striking Barbour Flax Mill on Grand Street (Figure 2.5). Within the courtyards were often found support buildings like blacksmith and carpenter shops, powerhouses and warehouses.[6]

Underlying every mill's basic form was a structural framing system to support the heavy loads and vibrations of machines and materials. Most mills built before the Civil War and for many decades after were framed with heavy timbers and took advantage of what became known as "slow-burning" construction. Fire was a mill owner's greatest fear and Paterson's history is replete with industrial properties that succumbed to fire during their working lifetimes. The combustible nature of the materials and processes used in industrial settings was the main culprit. Slow-burning construction developed in the 1820s and 1830s and consisted of thick plank floors built without floor joists. The flat-bottomed floor rested on beams of very large section that themselves were supported on timber posts or by the 1850s and 1860s sometimes by cast-iron posts. This style of construction had the advantage of providing few edges to catch fire, less surface area for combustion, and it resisted the tendency of traditional joisted floors to burn through quickly due to drafts created as the thinner floors burned through.[7]

The era of cast-iron architecture, in terms of framing, was relatively short lived, and was used less for factories proper than for bridges, towers, warehouses and, above all, commercial buildings. In the 1890s, steel became the most commonly used, and the most supple, material for manufacturing metal frameworks for industrial buildings, but there is not much evidence, as seen in the mills or Sanborn maps, that Paterson's silk manufacturing sector was particularly quick to move away from traditional slow-burning construction. The architectural conservatism of the textile industry was on display in the Aronsohn Mill, built in 1908, one of the last large, heavy timber-framed, brick-walled textile mills built in Paterson. Most steel-framed mill buildings identified in the survey date to the early 20th century or later and were associated with textile dyeing.[8]

An alternative to steel-frame construction was reinforced-concrete-frame construction, a building technology that developed nationally in the last quarter of the 19th century and rose to the fore during the first decades of the 20th century. Reinforced-concrete industrial architecture is not found in abundance in Paterson, although there are some notable examples. The J.S. Sowerbutt Mill, constructed in the early 1910s, ranks as one of the earliest surviving reinforced-concrete mills in the city. Yet even this mill

Figure 2.4. Silk Mill of William Strange & Company. L.R. Trumbull, *A History of Industrial Paterson*. 1882.

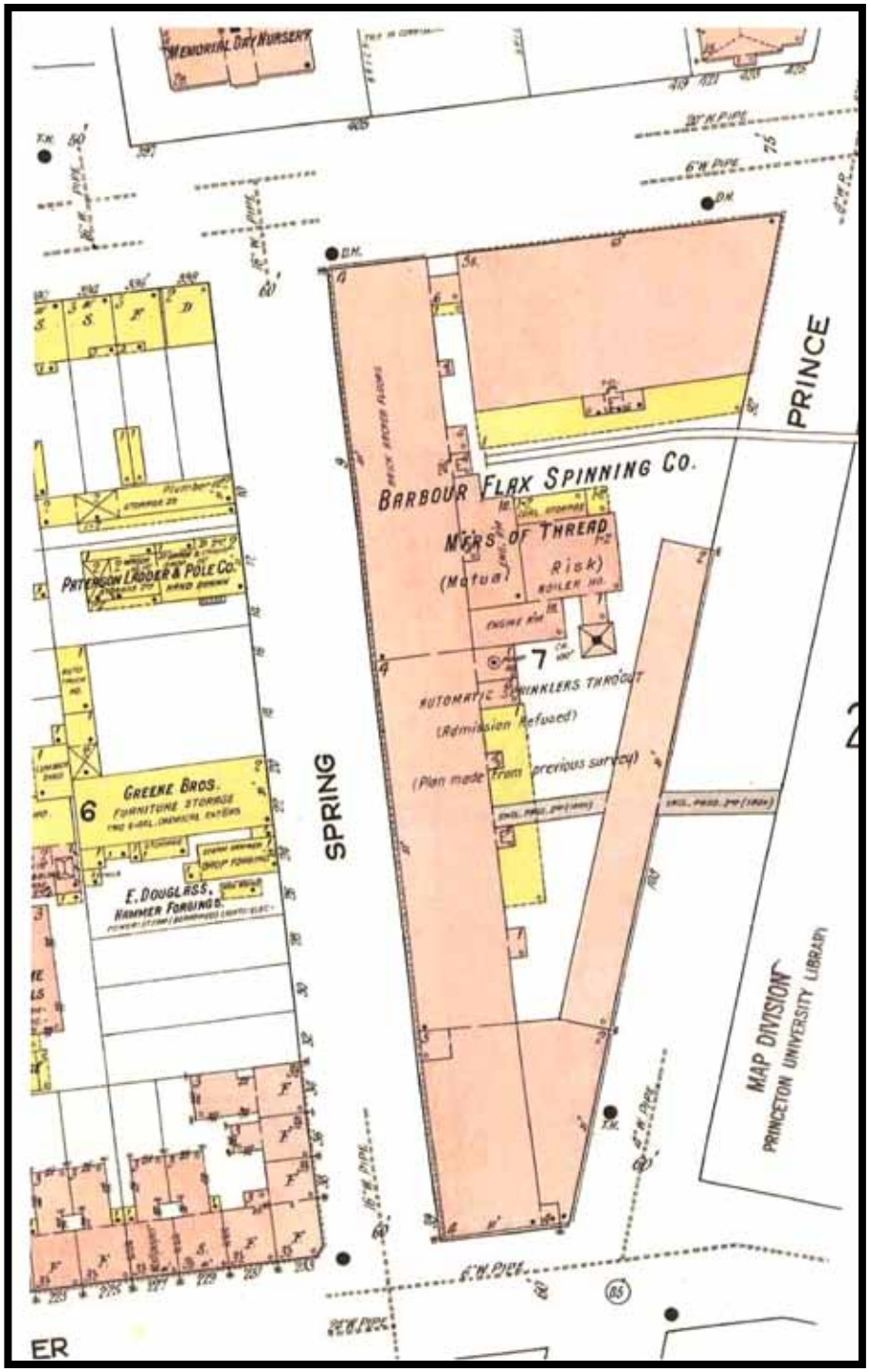


Figure 2.5. Barbour Flax Company, Grand Street Mill. Sanborn Map Company. 1915. The plan shows the classic narrow and long textile mill form, adapted to a triangular-shaped lot in Paterson's street grid.

harkens back to an earlier era with the heavy-appearing reinforced-concrete walls scored to appear as ashlar and the overall form very much that of a traditional textile mill. The Wright Aeronautical factory complex, begun in the mid-1910s and expanded into the 1940s, is the city's premier example of a "day-light" factory where reinforced-concrete framing was used to good effect to create interior workspaces unobstructed by numerous columns and exterior walls featuring wide expanses of metal-sash windows, filling the interior with abundant light and fresh air (Figure 2.6).[9]

All of the mills in the survey reflect the application of various practices that tended to prevent or retard fires. Mill owners were encouraged to install automatic sprinkler systems (invented in 1879), place fire extinguishers on all floors and in stairwells, maintain water tanks and pumps, install alarms and employ nighttime guards. Fire insurance companies promoted these practices and reduced premiums for the industrialists who followed them. Survey companies, like the Sanborn Map Company, produced detailed maps as a means for the fire insurance companies to assess risk. Today, these maps are a boon to historians (Figure 2.7).[10]

Industrial architecture possesses its own aesthetic; one derived mostly from scale, form and materials in tandem with streetscapes that often present interesting geometric patterns, made even more striking under certain conditions of shadow and light. Ornamentation in industrial architecture is not rare, but it usually is considered secondary to functional and utilitarian concerns, such as power transmission, structural integrity and fire prevention. Paterson's industrial architecture, like much of the city's residential and commercial architecture, was subject to the styles and decorative tastes of the time during which it was built. Found within the sampling of 30 mills in this survey are some notable examples of various mid-19th- to early 20th-century revival styles, principally Classical Revival (e.g., the Riverside Silk Mill, the Aronsohn Silk Mill), but also Gothic Revival (e.g., the William Strange Mill). Ornamentation is most often applied to entrances, windows, pilasters, cornices and stair towers (Photograph 2.1). Such embellishment was an extra cost to the mill owner, and it can be inferred that such efforts were intended to be associated with civic pride and the wealth and tastes of mill owners who saw their buildings as an outward expression of their status (see more below).

Few of the architects, engineers or contractors who designed and built Paterson's mills are currently known. Further research in primary sources such as trade journals and local newspapers may identify some, but the best sources of this information such as plans, drawings and contracts, would have likely been kept in company files and probably were disposed of when the original companies were closed or sold. The Watson Machine Works is the only property in the survey that has remained in continuous operation under original ownership. Secondary sources on the history of Paterson, while replete with the biographies of mill owners, are relatively silent on architects with the notable exception of Fred W. Wentworth (Figure 2.8), a Paterson-based architect who carried on a general practice in residential, commercial and industrial architecture from the late 1880s to the 1930s. Among his best-known commissions were the S.U.M. Governor's Mansion, the First National Bank Building and the Masonic Temple, all located in downtown Paterson. He was particularly influential in the rebuilding of the downtown following the Fire of 1902. Two of Wentworth's industrial commissions are included in the survey: the Aronsohn Silk Mill (1908) and the Wright Aeronautical Company Factory (1915), both of which in proportion and detail are outstanding examples of early 20th-century industrial architecture.[11]

The above discussion is not intended to overstate the influence of textiles on Paterson's industrial architecture, but the basic form of the textile mill is clearly

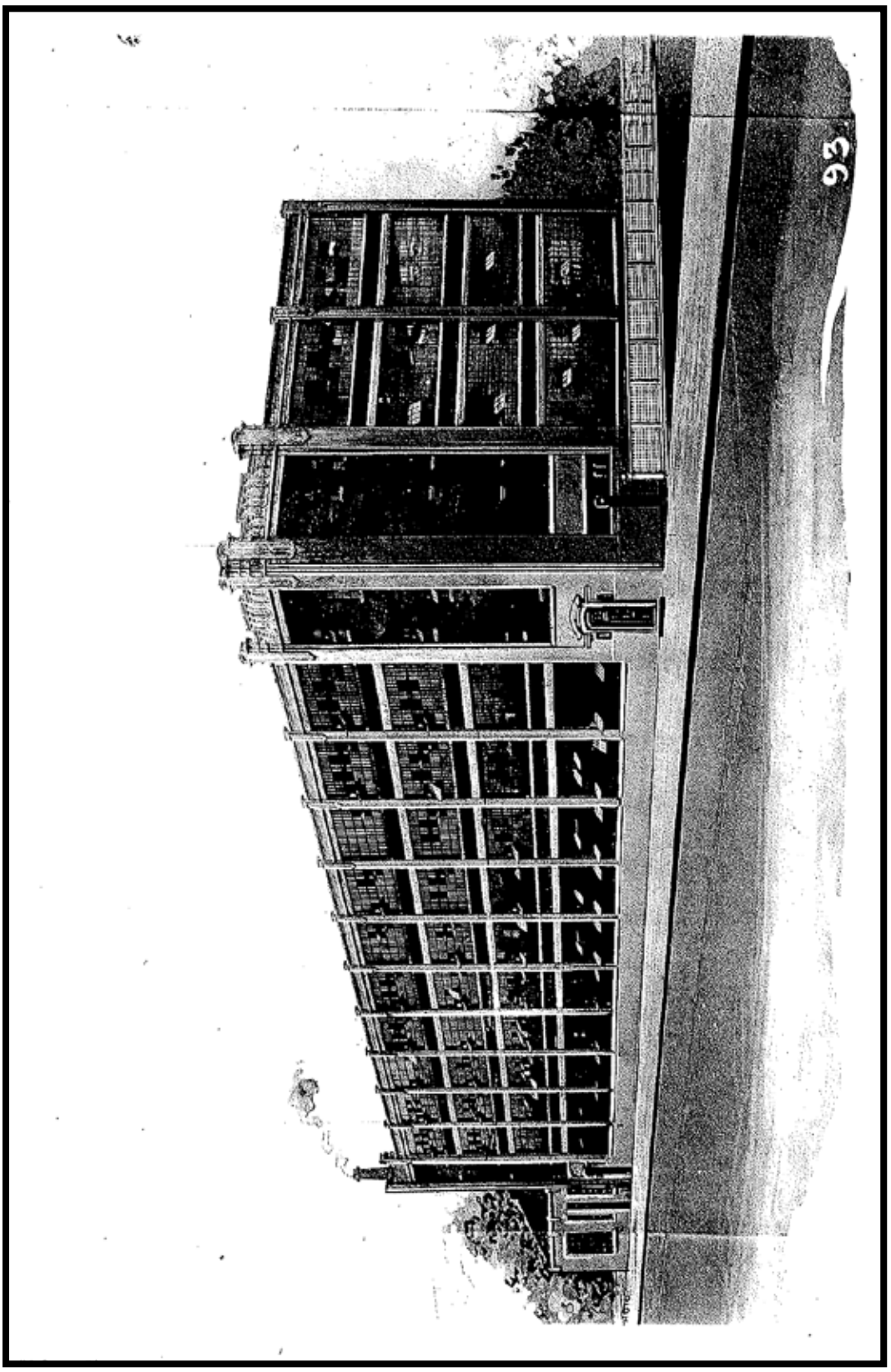


Figure 2.6. Wright Aeronautical Factory. Curtiss-Wright Papers, Passaic County Historical Society. Circa 1916. The factory, designed by Paterson architect Fred W. Wentworth, is a classic daylight factory with reinforced-concrete frame. The frame's structural vertical grid is clearly expressed on the main elevation. Note that this factory retains the narrow width to length ration of earlier textile mills, even though it was built to manufacture aircraft engines.

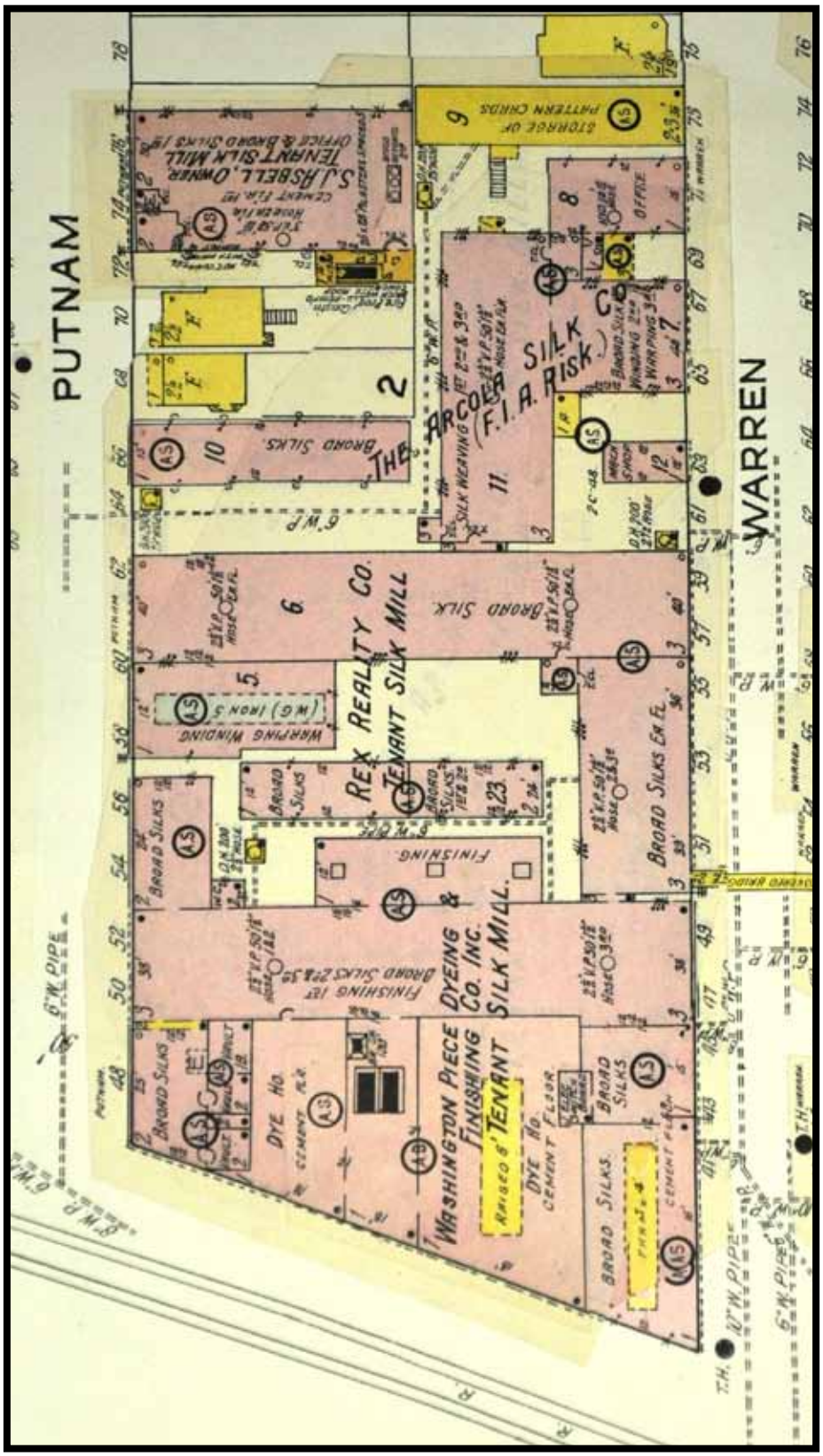


Figure 2.7. Washington Piece Dyeing and Finishing Company, Inc. Sanborn Map Company, 1931. Fire insurance maps documented construction materials (the pink color of the building indicates brick with wood-framed clerestory in yellow), the location of boilers (black rectangles), smoke stacks and chimneys, and automatic sprinklers (A.S.). Other notations indicate number of floors and floor construction, all of which factored into the insurance companies assessment of risk for this building and adjacent buildings, ultimately impacting premiums.

Photograph 2.1. Silk Mills of Dexter Lambert and Company. Shriner, *Paterson, New Jersey*. 1890. The Gothic Revival-style gatehouse and mills of Catholina Lambert's mill are among the most iconic of Paterson's late-19th-century mill complexes.

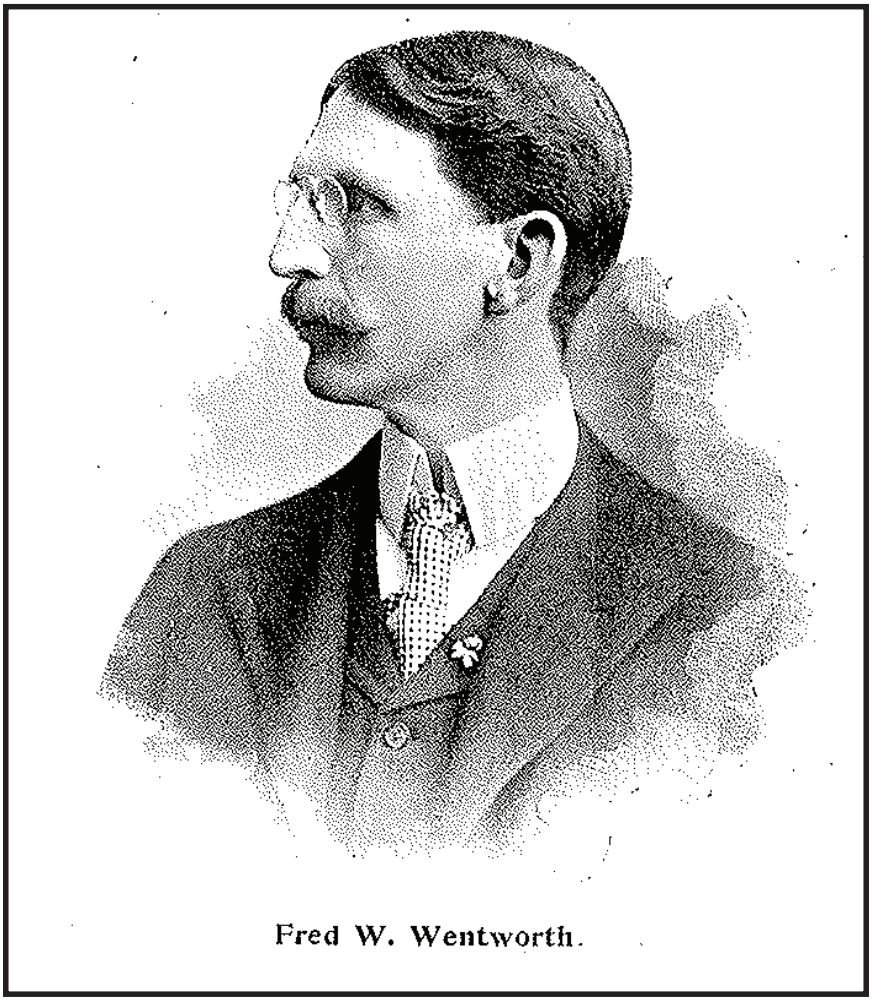


Figure 2.8. Paterson architect Fred W. Wentworth. The Paterson Daily and Weekly Guardian, *Paterson, N.J.* Circa 1898. Wentworth carried on a general architectural practice that included industrial architecture.

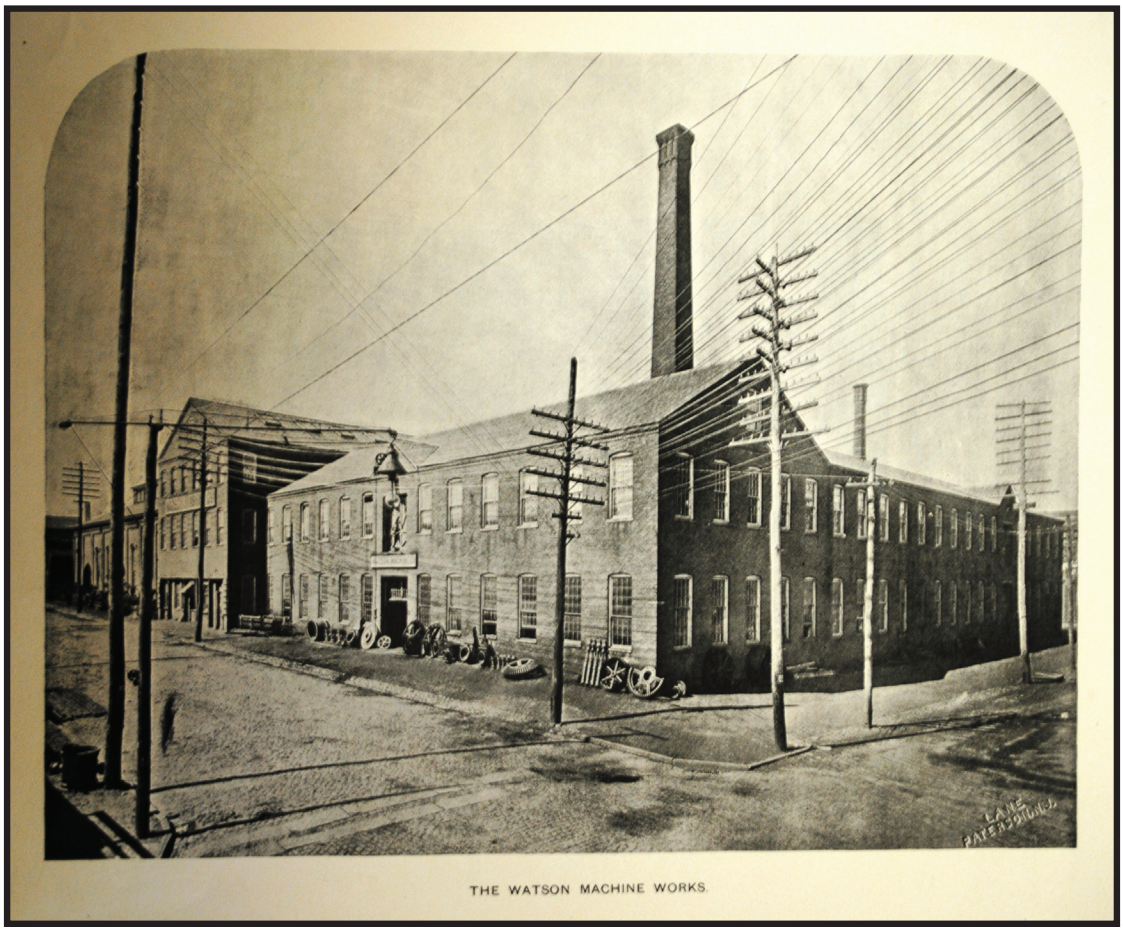
the dominant one in Paterson and within this study's survey population. The form was easily adapted to other industries, for example, paper and machine tools. There are nonetheless exceptions, and these often involved industrial specialties that for reasons of certain processes or materials-handling requirements developed distinctive industrial architectural forms. Prime examples in the survey are foundries, erection sheds, powerhouses, dye houses and breweries. Foundries, for instance, housed hot-metal processes where it was necessary to place furnaces and casting floors at ground level, the furnace house essentially becoming a housing covering a sand-floored workspace for casting and molding hot metal. The foundry at the Watson Machine Works on Railroad Avenue is a good example (Photograph 2.2). Erection sheds housed traveling cranes for moving and assembling heavy equipment such as locomotives or bridges. These one or two-story, clerestory-roofed buildings were long and narrow, the width determined by the traveling crane that rode on tracks supported by main girders running the shed's length. There are surviving erection sheds at the Cooke Locomotive Works on Madison Avenue and at the Watson Machine Company, which at one time fabricated bridges. Sadly, the Hinchliffe Brewery on Governor Street has lost its malt house, but retains portions of the lagering (cold storage) building, nearly windowless due to its insulated brick walls. At the rear of the brewery are the remains of tile and concrete silos once used to receive grains from a railroad siding.

Textile dye works were built around the process of moving batches of thread and fabric (mostly silk and rayon in Paterson) through a series of discrete processes to create various colors, patterns and finishes. The works were heavy users of water and steam, and those in Paterson by necessity sought out locations near the Passaic River, which historically also served as a sewer for the dyers' wastes. The orientation of the dye works was a character-defining feature. The handling of water and chemicals through pipes and tanks, as well as the tendency toward batch as opposed to mass production, explained why dye works were more horizontally than vertically oriented, differentiating them from the previously discussed silk mills (Figure 2.9). The dye works also remained economically vital well into the first half of the 20th century allowing them to expand their physical plants and adopt more modern forms of industrial architecture, which also favored single-story construction.[12]

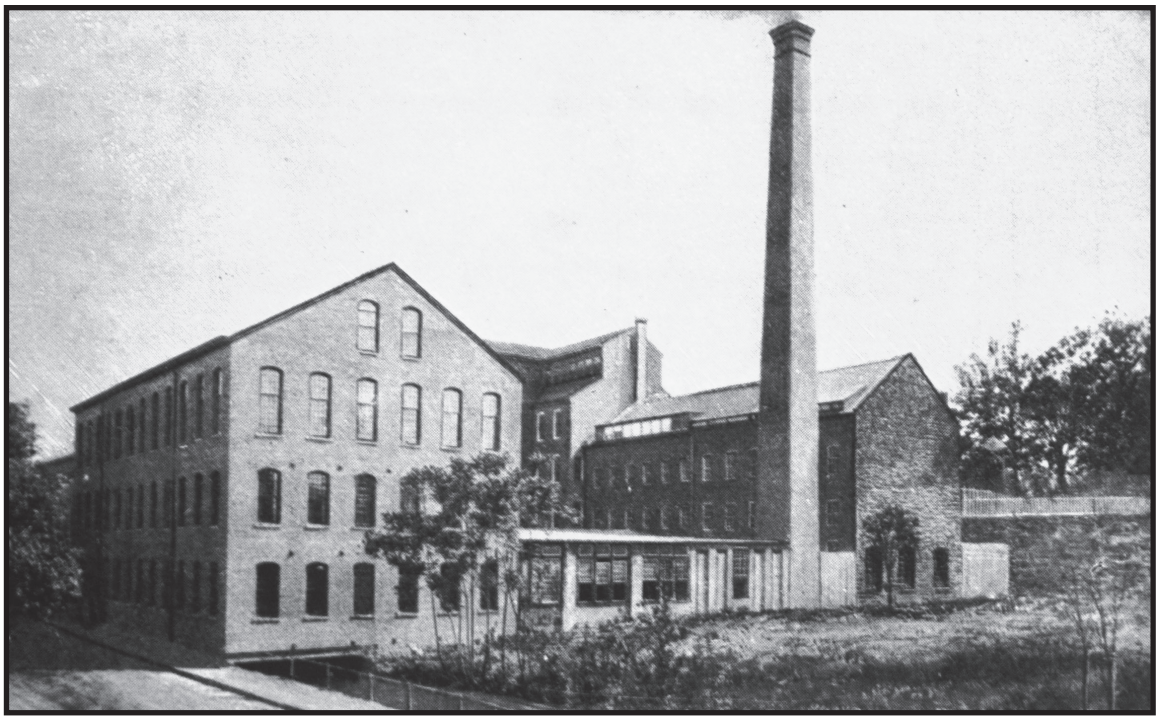
Sprawling complexes of interconnected vernacular industrial buildings characterized Paterson's dye works. They rarely had any obvious architectural plan or stylistic cohesion. For instance, the Weidmann Silk Dyeing Works stretched out over more than four blocks between 5th Avenue and the Passaic River. Composed of dozens of buildings built from the late 19th to the mid-20th centuries, most of them abutted one another. Today, it is difficult to tell where the plant's main entrance is, let alone define a primary façade. Yet, the plant's history of expansion and adaptation of old buildings to new uses is evident; the industrial architecture has an organic quality growing outward from late-19th-century buildings with brick walls and clerestory roofs to mid-20th-century buildings with concrete block walls and flat roofs.

Powerhouses and their associated smokestacks were significant features of almost all of the mills built from the 1850s to the 1910s, prior to widespread electrification (Photograph 2.3). The development of high-pressure steam engines in the early decades of the 19th century freed mills from sources of waterpower. By about 1850, all of the prime waterpower seats on the S.U.M.'s raceway system had been occupied, meaning that any of Paterson's mills built after that date in other parts of the city by necessity relied on steam power. Every mill had a powerhouse that featured a boiler, engine and smokestack, and in large mills there might be multiple boilers and engines within a single powerhouse or even multiple powerhouses. While it was possible to locate a small

Figure 2.9. Gaede Silk Dyeing Company. The Paterson Press Guardian, *Paterson in Pictures*. 1923.



Photograph 2.2. Watson Machine Works. Shriner, *Paterson, New Jersey*. 1890.



Photograph 2.3. Silk Mill of Hopper and Scott. Shriner, *Paterson, New Jersey*. 1890. The powerhouse is the one-story building located in the courtyard of the U-shaped mill. It is distinguished by its square-plan smokestack.

steam-power plant within a mill proper, it was most often the case that powerhouses were ancillary structures located adjacent to the mill, thus facilitating the delivery of coal for fuel and separating the boilers (and thereby the possibility of fire or explosion) from the rest of the mill. In many instances, powerhouses followed the architectural style of the main mill if not its form, since powerhouses were rarely more than one or two stories tall and usually roughly square in plan. Towering brick smokestacks on the other hand were a character-defining feature of a large steam-powered mill, while some smaller powerhouses might have shorter metal stacks. Stacks could be either square or circular in plan, with square brick stacks tending to be more associated with powerhouses from the 1840s to 1880s, and the circular stacks with later facilities. A common practice was to display the name of the mill in the stack's brickwork. Stacks, now strongly associated with air pollution, were regarded in the 19th century as positive features of the urban industrial landscape with their rising smoke associated with productivity and economic strength.[13]

Access to transportation was a relevant concern in the design of any industrial facility. Mills that relied on large quantities of bulk material, like grain or coal, by necessity chose to be near railroads and all of Paterson's heavy industries had railroad sidings, mostly located along the north-south Erie Railroad corridor that sliced the city in two. Paterson was served by other railroads, including the Delaware, Lackawanna & Western Railroad on the west side of town, but its line along the base of Garrett Mountain at the grade of the Morris Canal serviced mostly coal and lumber yards. The New York, Susquehanna & Western Railway entered the town from the east and offered a secondary industrial corridor to that of the Erie. Some industrial facilities, like the Peerless Plush factory and the Sipp Machine Works, had platforms offering direct interchange with the Erie's main line. Others like the Cooke Locomotive Works had their own spurs. Most of Paterson's textile mills and dye works, however, although obviously preferring to be near railroads, did not need direct access since their raw materials and finished products could be delivered to and from freight depots by wagon, and later by motorized truck. These mills often had an area of the plant that was designated for shipping with bay doors, loading docks and block-and-tackle for handling of materials.

C. INDUSTRIAL SECTORS REPRESENTED IN THE MILLS SURVEY

This chapter section offers brief historical summaries of the economic and business organization of the industrial sectors represented by the mills in the survey. The purpose is to provide context for understanding the timing and extent of certain industrial activities and the products that manufacturers were bringing to market. In each instance, the summary focuses on the half century between 1875 and 1925, representing the time period when most of the mills were built and achieved their significance. The summaries are not intended to cover the full range of history associated with each industrial sector.

i. The Silk Industry

The basic process of manufacturing silk products involved a series of discrete technological operations beginning with the cultivation of silk worms and proceeding through the steps of reeling, throwing (spinning), dyeing, warping and weaving, usually divided into broad goods for fabrics used in upholstery and clothing; ribbon goods for fabrics used in ribbons, hats, ties and handkerchiefs; and narrow goods for braids, fringes, tassels and other trimmings. Furthermore, silk fabrics were finished in various ways, described in more detail in the section below on the silk dyeing, printing and finishing industry.

All of the steps in the silk production process took place in Paterson with the exception of the cultivation and reeling steps, which usually occurred in China or Japan, and to some lesser extent in Turkey or France, prior to the shipment of the raw silk to the United States. Once the reeled silk arrived in this country, it was inspected and graded and then sent on to mills, first for throwing, then for dyeing in the skein, followed by weaving and finishing. It was rare, although not unheard of, for these operations to take place within a single mill, for it was characteristic of Paterson's silk industry to specialize in every imaginable variety of silk – yard goods for dresses, ribbons for decorations, drapery and upholstery silks, veiling, linings and braids. It was entirely possible, and not uncommon, for a mill to adjust its operations based on shifting consumer demand and changing fashions, and it was a rapid ability to adjust to the marketplace that helped to foster Paterson's rise to prominence and profit in the silk trade. It was entirely possible within the silk business to be successful either as a large mill operating with thousands of spindles and hundreds of looms or as a small specialist with a handful of looms weaving a specialty item for that season's hottest fashion (Figure 2.10).

Characterizing Paterson's silk industry is a challenge because of the range of large to small operators and the relatively low costs of entry into the business (established manufacturers were frequently heard to complain of start-ups that bought a few used looms and leased some space in a backroom or loft). Some generalizations, however, may be made based on contemporary accounts and the analysis of data collected by silk trade organizations. The organization of the industry tended to follow four possible models: 1). large integrated mills; 2). corporations that divided work across many mills in Paterson and elsewhere; 3). tenant mills that leased space to several operators; or 4). small family-run shops that could be located in tenant mills, lofts or back lots.

Most of Paterson's large fully integrated mills, with throwing, warping, weaving and sometimes dyeing operations, emerged in the 1870s and 1880s. These mills were the ones established by Paterson's famed silk barons like John Ryle, Catholina Lambert, William Strange, Robert Hamil, James Booth, Joseph Wadsworth and Henry Dougherty. While many of these mills were based on humble beginnings, they were established early in the silk industry's growth curve and rode it upward to great fortune and success. Fully integrated mills later became more the exception than the rule, a curious phenomenon in the late 19th century when most American industries were scaling up and merging smaller competing operations into large corporations. The economic reasons behind this reverse trend in the silk industry were multi-faceted, but the prime reason, according to observers at the time, was related to the method of financing. Large integrated mills usually received advance financing from prominent New York City commission merchants who worked closely with the mill operators to purchase raw silk, manufacture it to each fashion season's requirements, and then sell the silk to the wholesale and retail trade. In the 1890s, a competing model of financing took hold. This model involved machine manufacturers who extended long credits so that small operators, usually an immigrant weaver, could buy a few looms. It also involved raw silk merchants, called "converters," who sold to the small operators on a promise to pay in the future. This financing system placed few barriers to entry; the smaller operator could usually undercut a larger mill's prices since they had lower taxes and fewer overhead charges, and had no labor unions to deal with. On the other hand the system introduced a high level of debt that would ultimately prove to be one of the root causes of the industry's collapse in the Great Depression of the 1930s.

Labor accounted for a high percentage of the cost in manufacturing silk. Large manufacturers discovered in the late 1870s and 1880s that improved machinery

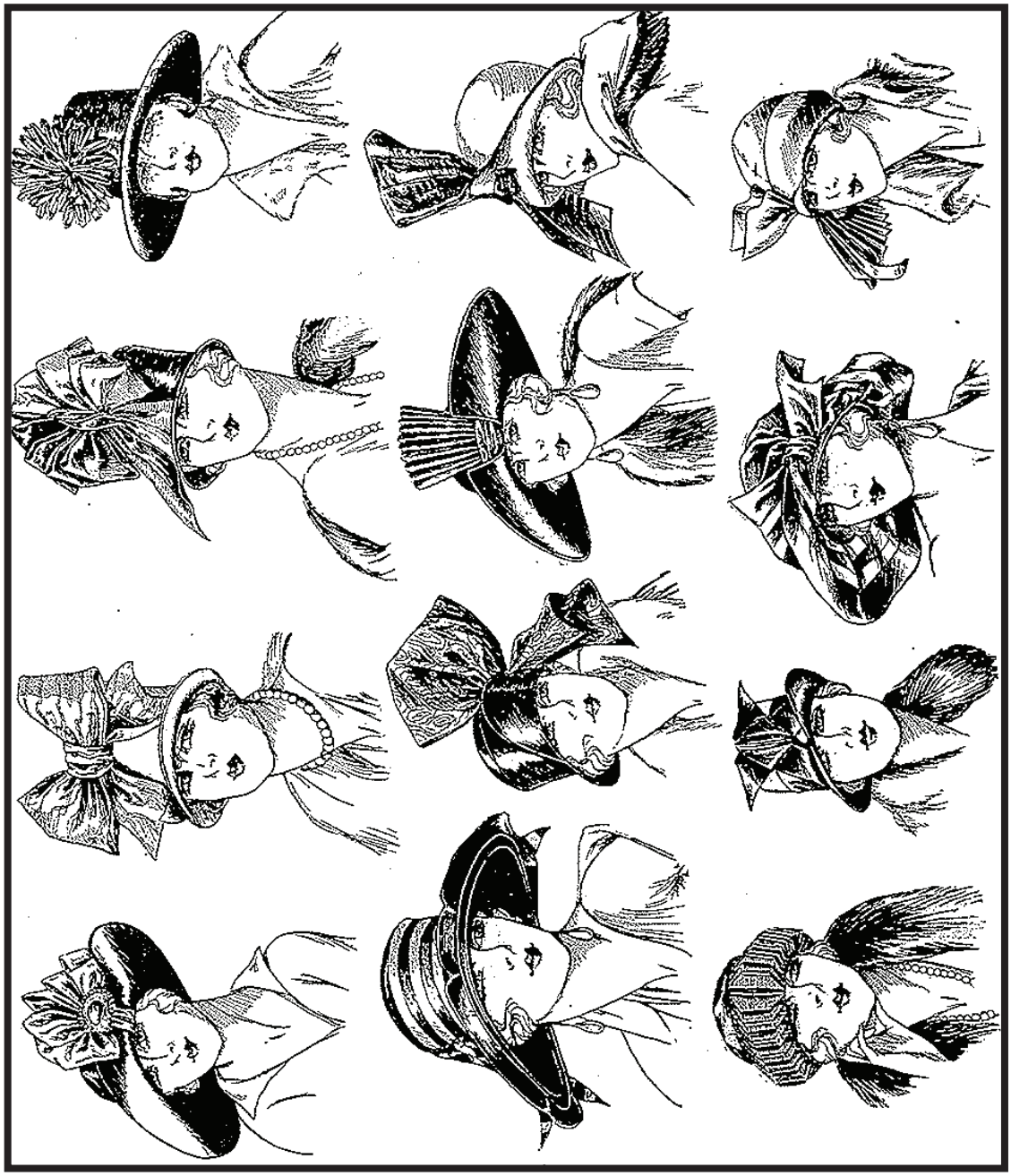


Figure 2.10. Hats Trimmed with Silk Ribbon. *The American Silk Journal*. September 1924. Paterson's silk manufacturers responded rapidly to changes in fashion.

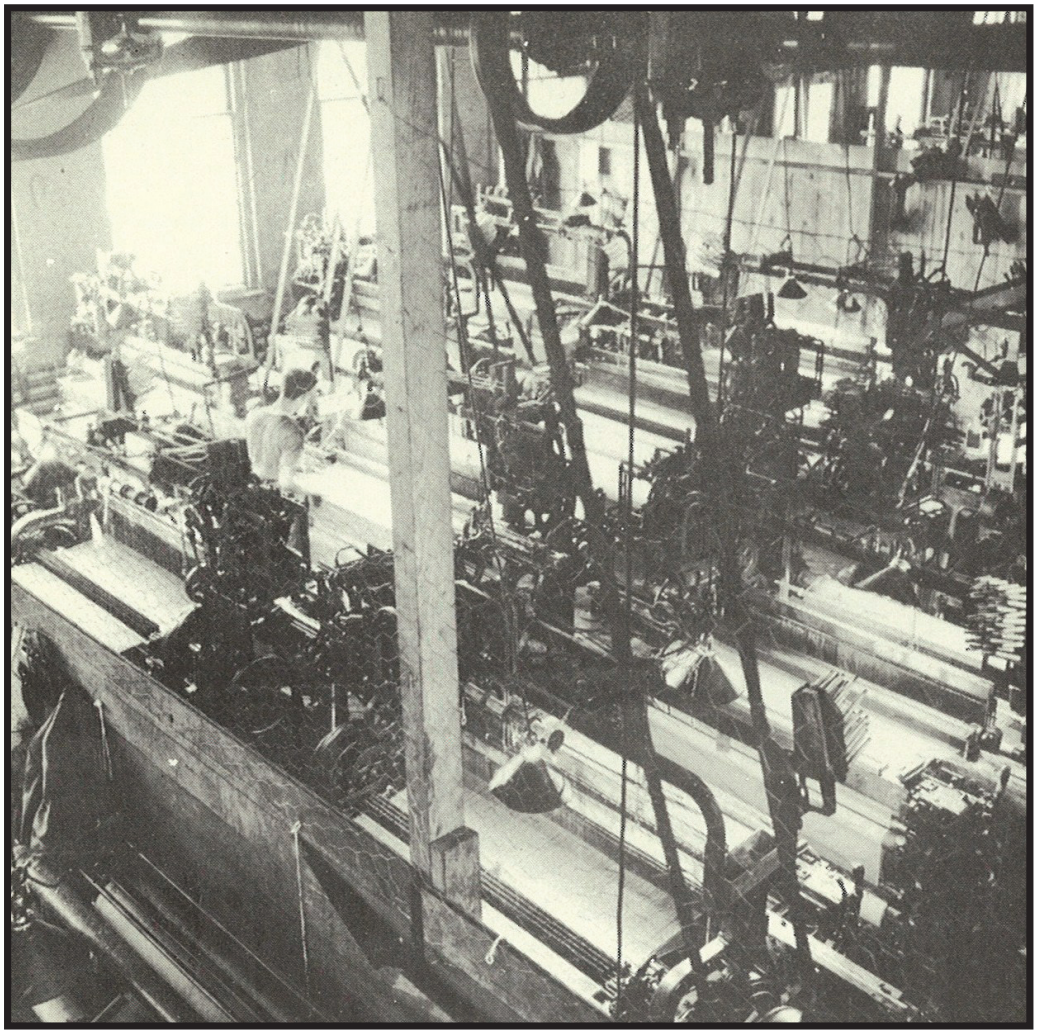
reduced the level of skill required in some operations, particularly throwing, and that deskilling created an opportunity, even a necessity in a competitive market, to cut wages. In Paterson, cutting wages proved challenging, especially because throwers worked cheek-by-jowl with weavers, the most highly skilled and highly paid workers in the business. The weavers were also highly protective of their status in the mills and objected to attempts to speed up looms or increase the number of looms attended above the traditional number of two. Wage cuts and layoffs due to business cycles motivated unionization and created labor unrest. Mill owners found the weavers the most problematic of their workers because they were not easily replaced, but throwing was a skill that could be learned quickly. In 1880, two of Paterson's largest integrated silk mills – Dexter, Lambert & Company and Phoenix Manufacturing Company – chose to begin shifting their throwing operations to a different labor market, settling on the coal mine and steel towns of Pennsylvania where a ready pool of underemployed women workers, mostly the wives and daughters of miners and steelworkers, was eager for wage work. This trend accelerated so that by 1900 about two-thirds of 1.5 million spindles throwing for New Jersey-based silk companies were actually operating in Pennsylvania mills. Following the strike of 1913, almost all of Paterson's throwing mill operations closed. As a result of the shift in throwing operations, Paterson increasingly became a silk city whose reputation was based on weaving and dyeing with the large companies dividing their operations among several mills, each carrying out one step in the process.

Tenant mills were numerous in Paterson and an option for any small silk operator who did not have the capital to build his own mill but could afford to lease a floor or two of one of the mills owned by an industrial real estate developer. This model of operation was as old as the S.U.M., which had built some of its earliest mills based on such speculation. Many of Paterson's best-known late 19th-century silk mills, like the Dale and Barnert Mills, were built as tenant mills, and many fully integrated mills were eventually converted to tenant mills as their owners scaled back or divided up their Paterson operations (Photograph 2.4). There were no outward architectural differences between a tenant mill and a fully integrated mill. During the steam-power era, tenants frequently purchased power from the landlord's steam plant as part of the terms of their lease. By the early decades of the 20th century, most mills had converted to electric operations. Some tenant mills, like the Aronsohn Mill, had their own electric power plants, but most mills were supplied by public utilities.

The willingness of converters to loan raw silk to small operators who worked on commission resulted in the final stage of Paterson's silk industry. The outcome was the "family shop," an unusual form of modern industrial organization more familiar to the 16th than the 20th century. The family shop had two distinguishing characteristics: it was very small, with fewer than 20 looms, and nearly all of the workers were family members who shared in the net proceeds of the business, but were rarely paid wages. A few of these family shops were set up in homes or garages, but most were located in tenant mill buildings (Photograph 2.5). In 1937, Lewis Hine paid a visit to Paterson and counted more than 150 shops located in 16 mill buildings, often with the workspaces divided by simple partitions of chicken wire. The proliferation of the family shop was reflected in the number of operators, which soared from about 150 in the early 1900s to nearly 700 in the mid-1920s. The number of mills did not reflect increased production; the number of silk workers in Paterson during the same period fell from about 25,000 to 16,000.

During the Great Depression of the 1930s, Paterson's once-thriving silk weaving industry entered its final chapter. A few long-established firms were still in the city, operating in half-empty buildings, while family shops struggled under increasingly unmanageable

Photograph 2.4. Barnert Silk Mill. Shriner, *Paterson, New Jersey.* 1890. The Barnert Mill was a tenant mill.



Photograph 2.5. Family broad-silk weaving shop in a tenant mill. Wood, *Employment Experience of Paterson Broad-Silk Workers*. 1939. Note the looms set up in rows, closely spaced, and the overhead line shafting and belting. A thin mesh of chicken-wire, barely visible in the photograph, separates this workspace from an adjacent family shop.

debt. The appearance of synthetic fibers, rayon and then nylon spelled the end of silk. The cheap synthetics were better suited to large-scale operations, particularly new mills opening in the South. World War II disrupted the supply of raw silk from Asia, and American consumers became accustomed to the synthetics. Following the war, the silk industry failed to rebound and many mills and family shops closed, selling off used equipment, sometimes to mills located in Southeast Asia.[14]

ii. The Silk Dyeing, Printing and Finishing Industry

Like silk spinning and weaving, silk dyeing in Paterson owed much to technologies and processes imported from Europe and skills sets supplied by immigrants. The firm of Brown & Mayers, established in 1859, relied on the talents of William Brown, a Coventry, England-born silk dyer who was a friend of John Ryle. Browne began dyeing Ryle's silk in the Colt Gun Mill yard but soon relocated to a small shop on Straight Street. In 1863, Browne relocated again to River Road, on the site now occupied by the Manhattan Shirt Company Mills. Browne's 1863 dye works was likely the first purpose-built dye works built on a lot adjacent to the Passaic River to take advantage of the river as a source of water. As previously mentioned, a source of "soft" water was absolutely essential to the process of cleaning and dyeing silk. In the basic process, skeins of spun silk thread and yard were delivered to the dyer in skeins. The skeins were boiled in soap and water to free it from gum and give it a more lustrous appearance. They were then placed in dye vats to impart the desire color. Dyers also added minerals and chemicals to the vats to add "weight" to the silk. During boiling, the silk could lose up to 25 percent of its weight, from the removal of the gums and sugars in the silk. Adding weighting agents, such as bichloride of tin, gave the silk a more solid and thicker appearance. Poorer quality silks were heavily weighted and wore out quickly, but were popular in the mass market beginning in the late 19th century due to their inexpensive pricing. The demand for cheap silks was a major boon to the silk dyers.

Most of the best-known silk dyeing men set up shop in Paterson during the late 1860s and 1870s. Among this distinguished group were: Claude Greppo, a trained silk dyer from Lyons, France, who early worked for William Strange & Company; George Morlot, another Lyons silk dyer who came to Paterson in 1869 and the following year established the first dye works along the Passaic River in the Bunker Hill neighborhood of north Paterson (Figure 2.11); and Jacob Weidmann, a Swiss silk dyer who learned the trade from his father, and immigrated to the United States in 1867, soon forming a partnership with Greppo and establishing a works on Paterson Street near its intersection with Ellison Street. Weidmann became, according to an authoritative history of the silk dyeing industry, "the foremost figure in the American silk dyeing industry of the last [19th] century." His plant on 5th Avenue in the Bunker Hill section of Paterson, established in 1882, was considered the largest silk dyeing works in the United States for nearly 40 years (Photograph 2.6).[15]

The founders of Paterson's silk dyeing companies had a high level of experience and technical training. It was absolutely necessary to have a working knowledge of chemistry and lab work to be successful. Owners, who were almost always trained dyers, and their trusted assistants, master dyers, were usually the only ones given access to the "recipes" for the chemical composition of the dye mixes, as well as the temperature and timing of the work, critical to achieving acceptable levels of color matching, fastness and finish. Within the dye works most master dyers were of French or English heritage. The actual work of moving skeins and tending vats, however, was unskilled work, and for these jobs "dyers helpers" were employed. By the 1890s, Italian immigrants filled the ranks of helpers.

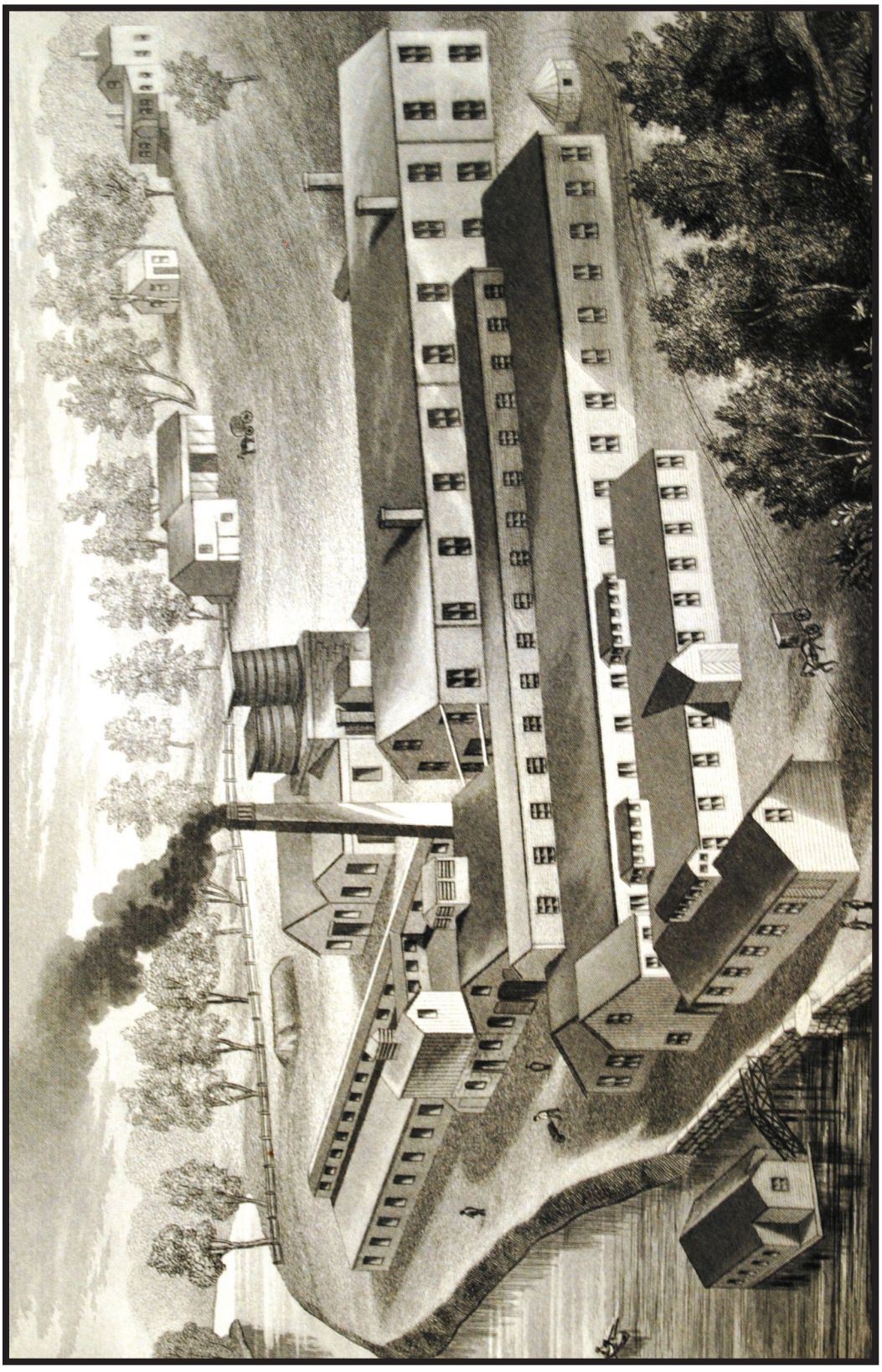


Figure 2.11. Dye works of George Morlot. L. R. Trumbull, *A History of Industrial Paterson*. 1882. Morlot was among the first dyers to establish a works along the Passaic River in the Bunker Hill neighborhood of Paterson, an area that became known for its large dye works.

Photograph 2.6. Aerial Photograph of Bunker Hill neighborhood and its dye works. Paterson Historic Preservation Commission. Circa 1970. Looking southwest. At the bottom of the photograph is the former Weidmann Dye Works, which by this date had been subdivided for other purposes. Further up river are the former Auger & Simon Dye Works and the Pierre Thorneaux Works. All three works are included in the survey.

During the last decades of the 19th century, a major innovation in silk dyeing was the introduction of aniline dyes that made it advantageous to dye and print woven silk fabrics as opposed to yarns in the skein. Known as piece dying as opposed to skein dyeing, this process allowed dyers to stock unfinished broad silks ready for dyeing and/or printing in immediate response to popular colors or patterns. Paterson was a national center of the piece dyeing industry and there developed around the industry a number of support industries including machine and chemical works. Paterson's machinists were specialists in producing a range of machines to support the piece dyeing process including rope-dyeing machines, dye jigs, dryers, tentering machines, printers with engraved rollers, steamers and washers. By 1920, piece dyeing had passed skein dyeing in volume of output.[16]

At the turn-of-the-century, the silk dyeing industry in Paterson was represented by about 75 separate dye works. The level of competition was intense, especially as Paterson's silk spinning and weaving sectors slowly contracted. The silk dyers countered by merging and consolidating their operations into larger corporations that could better absorb costs and control the markets. The leading figure in this reorganization of the industry was Charles L. Auger, the son of a French silk dyer, who moved to Paterson in the late 1860s to serve an apprenticeship in the dye houses of the William Strange Silk Mills. In 1886, Auger established a dye works with partner August Simon, purchasing a lot at the western end of 5th Avenue bordering the Passaic River (Photograph 2.7). As Auger & Simon's business grew, the plant was enlarged. By 1906, the company had outgrown the 5th Avenue location and a second dye works was erected in Williamsport, Pennsylvania. During the early 1900s, Auger & Simon, along with several other Paterson silk dyers, had resisted an attempt by outside financiers to consolidate the silk dyeing industry. The dyers valued their independence but soon realized it might be in their best commercial interest to combine. In 1908, Charles L. Auger led in the establishment of the National Silk Dyeing Company consolidating five of the most important Paterson dye works (Auger & Simon, Emil Geering Silk Dyeing Company, Knipscher & Maass Silk Dyeing Company, Gaede Silk Dying Company and Kearns Brothers), along with two works in Pennsylvania. National eventually operated a dye works in Paterson known as the East Fifth Street Works (former Auger & Simon works), the East Main Street Works (former Gaede works), the Wood Street Works (former Kearns Brothers) and the Valley Works (the former Geering plant on Ryle Avenue).[17]

The high level of expertise and skill associated with Paterson's silk dyeing industry was not easily replicated in other places, and the industry, unlike its throwing and weaving counterparts, was versatile enough to make the transition to synthetic fabrics in the 1930s to 1950s. Although many silk dyers were not able to survive the Great Depression, some, like the National Silk Dyeing Company and Allied Textile Printers did emerge from the crisis in sound enough financial condition to continue in operation into the 1960s and 1970s.

iii. The Machine Tool Industry

Machinists with wood and metalworking skills came to Paterson in the early 19th century to produce and maintain mill machinery from waterwheels to looms, and they remained an important part of the city's industrial landscape well into the 20th century, in many instances far outlasting the textile industries that they initially served. Among the early machinists in Paterson were Benjamin Eastwood, William and James Watson, Joseph C. Todd, Samuel Smith, Thomas Rogers and at least a dozen others. Many of these machine works eventually branched out into turbines, steam engines, bridges and many different types of specialty products, but at least until the early

Photograph 2.7. Dye Works of Auger & Simon. Shriner, *Paterson, New Jersey*. 1890.

decades of the 20th century, textiles were a major component of the work. Among the late 19th and early 20th-century machine works devoted principally to the building of silk machinery were the Eastwood Machine Company, the Morrison Machine Company, and the Sipp Machine Company, while other works such as the Todd Machine Works and the Watson Machine Company carried out a more diversified trade.[18]

Machine works typically consisted of a series of shop buildings designed to carry out metal casting, stamping, forging, machining and erecting operations (Photograph 2.8). The essential elements of the machine works did not change much over the course of the 19th century, although the size of the machines and the volume of output varied greatly from one company to the next. Paterson's machine works tended toward small to medium-sized operations capable of producing machines on custom order or a limited run of a certain model, such as when an order came in for looms to furnish a new silk mill. One of the greatest ongoing transformations in machine shops over time was the introduction of new standards of precision and workmanship for the average workers, who were also expected to carry out the work rapidly. Skilled machinists learned how to make accurate gauges, set up and adjust a variety of machine tools from milling machines to planers and drill presses, and to produce machine parts that did not vary in specification, eventually becoming interchangeable.

The Watson Machine Company (see Photograph 2.2) exemplified the skill level and versatility of Paterson's machinists and foundrymen. Founded in 1845 by brothers William and James Watson, the machine works successively occupied space at the Franklin Mill, the Nightingale Mill and a small shop on Van Houten Street in the heart of the Great Falls district before erecting a works at the corner of Railroad Avenue and Grand Street. By the 1850s, Watson was casting enormous cast-iron waterwheels and fabricating iron-truss bridges, and then in the mid-1870s the firm won a contract with McCormick to manufacture parts for harvesting machines. In 1907, the company briefly branched out into the automobile industry, even producing its own model, the Watson Conover. During the 1910s and 1920s, Watson became known for twining and wire-twisting machines for twisting strands of twine and wire to form ropes and cables. The company remains in business today producing machines that wrap cables for the electronics and fiber optics industry. It is the only industrial complex in the survey that remains operational under original ownership.[19]

iv. The Locomotive Industry

The origins of Paterson's locomotive industry are storied, being traced back to Thomas Rogers, a textile machine builder who undertook in 1837 to build a locomotive, patterned after an English prototype purchased by the Paterson and Hudson Railroad. Rogers' first locomotive was a success, and he soon turned his attention to building locomotives. Rogers was credited with developing some important innovations in locomotive design including counterbalancing of the drive wheels with hollow rims and spokes. The Rogers Locomotive Works grew to occupy both sides of Spruce Street near the corner of Mill Street in the Great Falls district (one of its buildings survives today, now occupied by the Paterson Museum) (Figure 2.12). From 1837 to 1900, Rogers produced 5,654 locomotives with its peak production years in the 1870s.

The American locomotive industry was not widespread in the middle half of the 19th century with the five strongest commercial builders located in Philadelphia (Baldwin, Norris) and Paterson (Rogers, Grant, Cooke). The Paterson builders were considered the most innovative, championing a number of reforms in design that increased the power and efficiency of locomotive operation. The history of most

Photograph 2.8. Shops of Samuel Smith & Son. Shriner, *Paterson, New Jersey*. 1890. Smith, which specialized in steam boilers, represented the multi-faceted nature of Paterson's machine works.

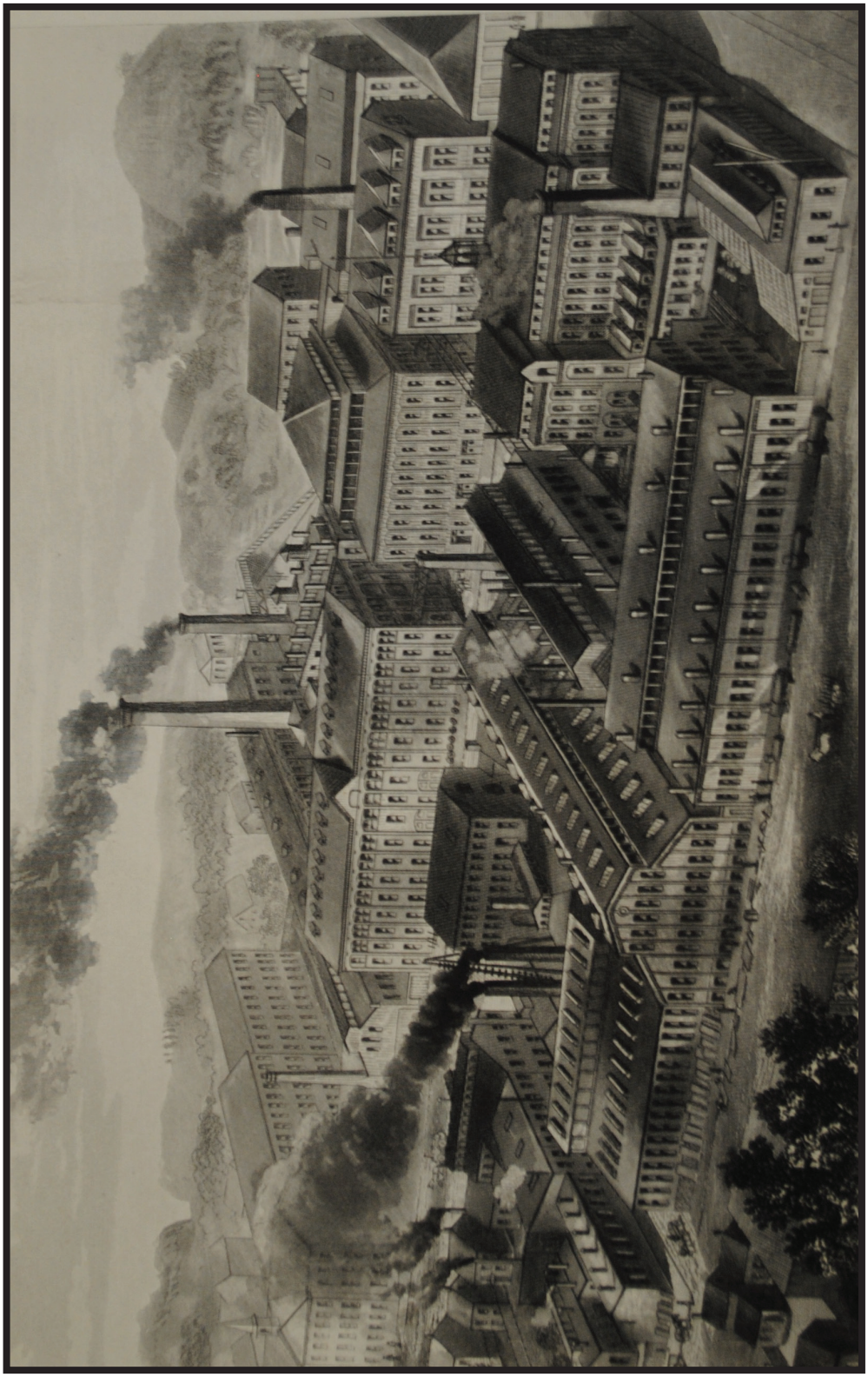


Figure 2.12. Rogers Locomotive Works. L. R. Trumbull, *A History of Industrial Paterson*. 1882.

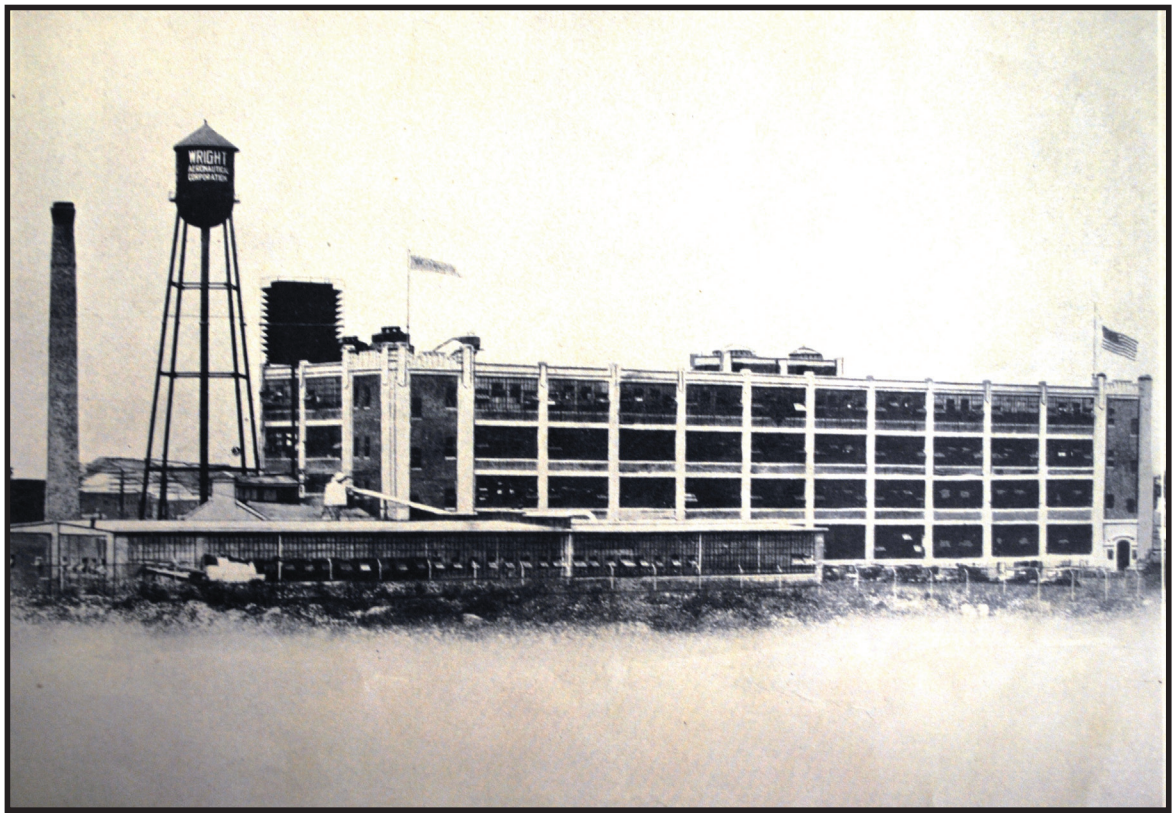
locomotive builders was filled with episodes of financial crisis and near-bankruptcy, changing partnerships, and constant striving to improve the works to meet the varying motive-power needs of railroad companies. Buildings associated with locomotive works were machine shops, erecting sheds and foundries. The machine works were of a larger scale than the typical machine works in order to handle what were some of the largest machines of the Victorian age.

Rogers was always the dominant and largest of the locomotive builders in Paterson, but this firm was followed into the business by two other smaller companies of note. The Grant Locomotive Works was the offshoot of a business started in 1842 and was reliant on the talents of William Swinburne, a former superintendent of the Rogers Works who branched off on his own. The works, which were eventually taken over by Oliver DeForest Grant in 1863, were located on the corner of Market and Spruce Streets. The Grant Locomotive Works remained in business until 1895 producing about 1,900 locomotives before making a disastrous business decision to relocate to Chicago. The company produced only 24 locomotives in Chicago before closing permanently.

Like Rogers, the Cooke Locomotive Works was an offshoot of a textile machine works. Charles Danforth was a machinist who set up shop in Paterson in the 1840s and began making locomotives in 1852 in a building on Market Street to the east of the Rogers works. Danforth incorporated as the Danforth Locomotive and Machine Company in 1865. John Cooke, a former Rogers superintendent, joined Danforth to oversee its locomotive production and was appointed president in 1871 after Danforth left. Cooke renamed the firm after himself in 1878. Business grew rapidly in the 1880s, prompting Cooke's decision in 1888 to seek out more room and build a second works on the south side of Paterson on Madison Avenue. The original Cooke Locomotive Works on Market Street no longer exists, but a portion of the 1888 expansion on Madison Avenue survives and is included in this survey. The Danforth-Cooke company produced about 3,000 locomotives from 1852 to 1901. Both it and the Rogers Locomotive Works were absorbed into the American Locomotive Company (ALCO) during the first decade of the 20th century. Although both of the Paterson works remained in operation for a few more years, they were eventually closed down as obsolete and redundant.[20]

v. The Aeronautics Industry

Paterson's aeronautics industry has many similarities to the locomotive industry, being an offshoot of earlier machine works and the skill sets of Paterson's machinists. The principal firm associated with this industrial sector in Paterson was the Wright Aeronautical Company, although there was at least one short-lived offshoot known as the New Standard Aircraft Company that operated briefly from *circa* 1927 to 1931. As the name suggests, Wright Aeronautical was a direct descendant of the company formed by the Wright Brothers prior to World War I to build engines for their airplanes. The Wright four-cylinder motors were produced in Dayton, but in 1916 Wright merged with the Glenn L. Martin Company to form a short-lived firm known as Wright-Martin, which produced a revolutionary new rotary engine under license to a Spanish firm with a Swiss founder, known as Hispano-Suiza. Wright-Martin chose Paterson as its manufacturing center, largely because of its skilled workforce, consisting of many machinists with experience in the locomotive and textile industries, which were then experiencing layoffs. About 1916, Wright-Martin built a factory on Beckwith Avenue, and would continue to expand it through the early 1940s (Figures 2.6 and Photograph 2.9). In 1919, Wright-Martin reorganized with the Paterson factory becoming part of the Wright Aeronautical Company, a firm that eventually operated plants located all over the country to produce various airplane components. Under the



Photograph 2.9. Wright Aeronautical Company. The Paterson Press Guardian, *Paterson in Pictures*. 1923.

leadership of F.B. Rentschler, a former U.S. Army Air Force officer concerned with engine production, Wright continued improving the Hispano engines, developing ever more powerful and efficient models marketed under names like Tempest, Tornado and Whirlwind. A major innovation was the development of an air-cooled radial engine that met the specifications of the U.S. Navy in the mid-1920s, prompting a major expansion of the Beckwith Avenue plant. This original Wright plant built about 1916 was a multi-story, reinforced-concrete "daylight" factory, which was expanded in the late 1920s to accommodate the additional military orders.

The Wright Aeronautical Company engine division did modestly well, but at the time it was usually considered to be "second fiddle" to Pratt and Whitney, its major competitor located in Hartford, Connecticut. In 1929, Wright merged with Curtiss, a company that was struggling to stay in the market with its V-8 and V-12 engine designs. The new Curtiss-Wright Corporation merged its engine-design department in Paterson, coming up with the Whirlwind or G-series engine, a highly regarded air-cooled radial engine that was considered among the most highly refined of the pre-jet engine era.

During World War II, Wright Aeronautical was inevitably caught up in the military's demand for aircraft engines. In 1939-41, Wright doubled the size of its plant, building a large single-story factory building to the northwest of its original premises and adding an unusual windowless brick building with an irregular cubicle roof line to house reinforced cells for testing engines. Wright built a second wartime plant in Wood-Ridge, New Jersey. After the war, the company's headquarters and principal base of manufacturing moved from Paterson to Wood-Ridge. By 1950, the plant in Paterson had been sold off.[21]

vi. The Brewery Industry

Brewing was a major industry in the United States from the colonial period up until the disruption caused by Prohibition in 1919. Paterson, like most American cities, had breweries that served what was primarily a local market. In 1870-71, there were eight breweries in Paterson, with the two largest operations being those of Graham & Post at the corner of Hamburgh and Matlock Streets and Shaw, Hinchliffe & Company at Governor and Ann Streets. The latter, which is included in this survey, was established at its current location in 1867 by John Hinchliffe as the Eagle Brewery.

While the brewery industry in the United States is today most often associated with Germans, there was a strong tradition of English-owned breweries, as well. Hinchliffe was an English immigrant, born in Yorkshire, who came to Paterson in the late 1850s. Whether John Hinchliffe had learned brewing in England is unclear, but the Hinchliffe Brewery by the 1870s was producing lager beer, a German style of beer that had for all intents and purposes taken over the American brewing industry in the middle decades of the 19th century. The Hinchliffe Brewery, like other large lager breweries of its time, relied on steam power to heat the wort, and the malt house, usually the largest building in a brewery complex would have featured a hall with large copper kettles heated from beneath by pipes. Sadly, the Hinchliffe Brewery's malt house has been demolished, but its office building and lager house remain, exhibiting some of the ornate architectural embellishments for which breweries were known, including an upper-story niche for a statue of a patron saint of beer (Figure 2.13). The lager house was a refrigerated building where the beer was stored for several months until aged and ready for sale. Until the advent of mechanical refrigeration, introduced in many breweries during the 1890s, the

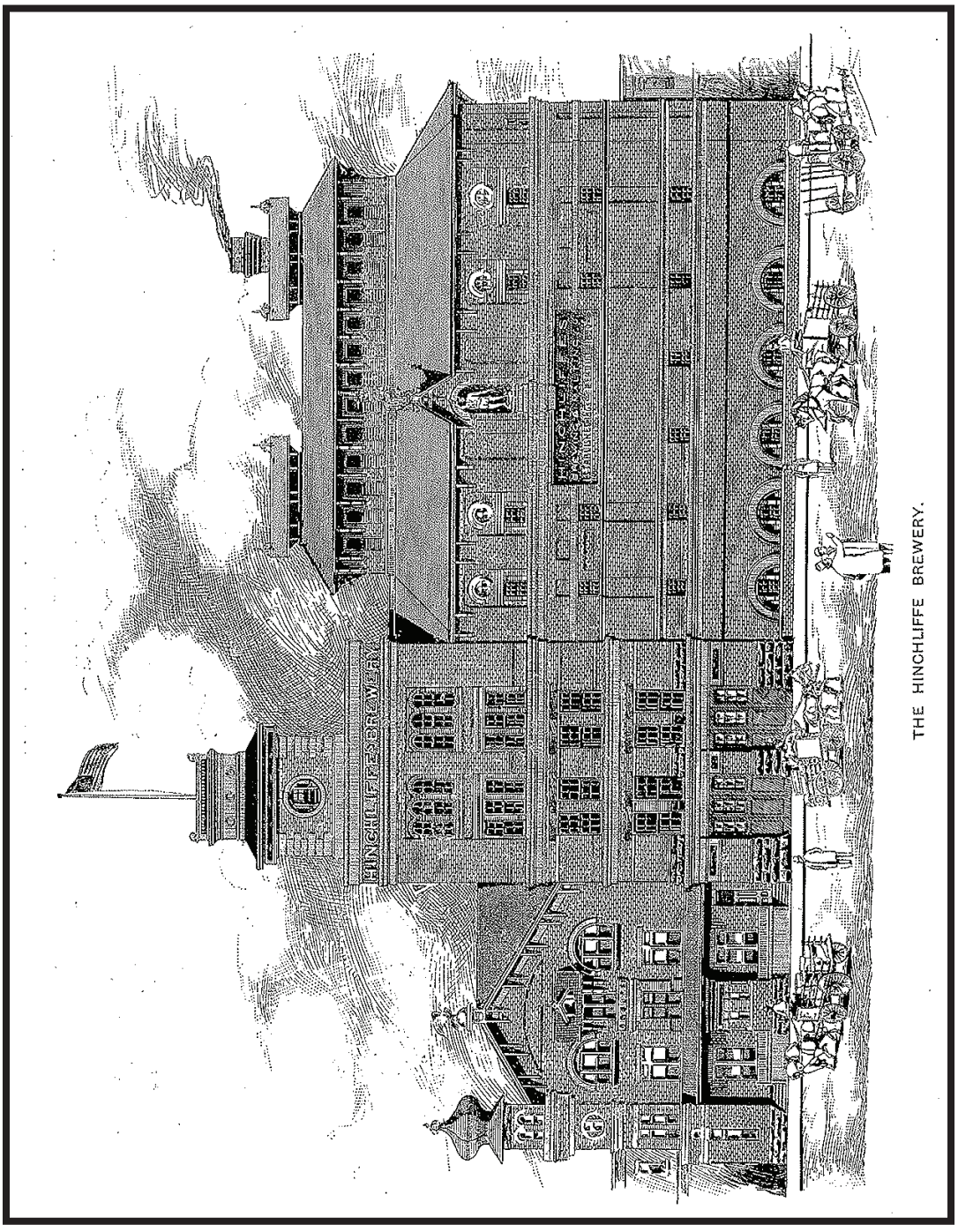


Figure 2.13. Hinchliffe Brewery. Shriner, *Paterson, New Jersey*. 1890.

lager house would have been cooled with natural ice, harvested from lakes in winter and stored for use in summer.

In 1890, a major restructuring took place in Paterson's brewery industry with the formation of the Paterson Consolidated Brewing Company, a merger of four breweries under the leadership of the Katz Brothers, who operated a brewery at 69-83 Straight Street. Hinchliffe initially remained outside the consolidation, but in 1899 joined Paterson Consolidated, which at about the same time changed its name to the Paterson Brewing and Malting Company. Historic atlas maps indicate that the consolidated company did not close the pre-existing Katz or Hinchliffe breweries but operated the facilities jointly. It is unclear from historical documentation how severely Prohibition impacted the Paterson breweries, but circumstantial evidence suggests that they were able to avoid complete closure. The Paterson Brewing and Malting Company officially re-opened at the end of Prohibition in 1933 and continued in operation until about 1957.[22]

D. THE INDUSTRIAL ARCHAEOLOGY OF PATERSON'S MILLS – PROCESS AND TECHNOLOGY

Industrial archaeology is the study of the physical record of industrialization to answer questions about how and when new technologies were created, how they were selected or rejected, and how industrialization – its raw materials, machines, processes and wastes – impacted economies, societies and cultural values. Evidence from architecture and artifacts is important to industrial archaeologists for what they can tell us about managers, workers, inventors, machines, materials and the industrial landscape. In large part, this is because industrialists and industrial workers rarely had the incentive to write, and were often, with good reason, reluctant to reveal information about their knowledge and skills. The culture of work tended for most of the 19th century and well into the 20th century to be one of "doing" rather than "documenting." Those industrial histories that were written emphasized triumph over adversity, and rarely considered those aspects of work and technology that failed or were merely repetitive and mundane.[23]

Industrial archaeology is particularly relevant to Paterson because of what it can add to the narrative of the rise and fall of certain industrial sectors, potentially filling gaps in our knowledge. Each of the mills in the current study offers the possibility of capsulizing a physical record that may contain at least some evidence of how work was carried on, what natural and economic resources were used, and what skills were required of workers and managers. While some of this evidence may be found in the exterior architecture of the mills, for the most part it is going to be contained within the buildings and workspaces, areas that are not currently accessible without special permission from owners. The evidence does not necessarily have to be contained in complete machines or spaces that were not modified or scrapped out at a later date; it can be found in floor plans, abandoned machine parts, scattered or lost tools, scraps of materials, piles of buried waste, and even in the graffiti left by workers. Even in a largely abandoned and vacant state, industrial sites can yield remarkably informative clues, for example, grease stains and bolt holes in floors and ceilings indicating the locations of line shafting and the arrangement of certain types of machines.

Information gathered through industrial archaeological techniques not only can provide data about a particular mill; it can also assume great significance if it can be shown to form the basis for generalization about the character of work in similar mills, the effectiveness of different technologies, hazardous conditions to which workers were subjected, or the reasons behind an industry's success or failure. From an industrial archaeological perspective, Paterson's mills have the potential to yield significant information

about industries that are not well represented in the nation's industrial archaeological record. For example, a review of the Historic American Engineering Record (HAER) collection at the Library of Congress, a major repository of industrial archaeological information, indicates that no Documentation Level I report has ever been prepared that studies in detail the flow process and layout of a historic silk mill or dye works. While there are some former Paterson silk mills (Essex Mill, Todd Mill, Industry Mill, Phoenix Mill) and a dye works (Allied Textile Printers) in the HAER collection, these documentation packages are limited to exterior photographs, architectural descriptions and summary narrative histories.[24]

E. MILL OWNERS AND DEVELOPERS – THE MILLS AS SYMBOLS OF PROSPERITY AND POWER

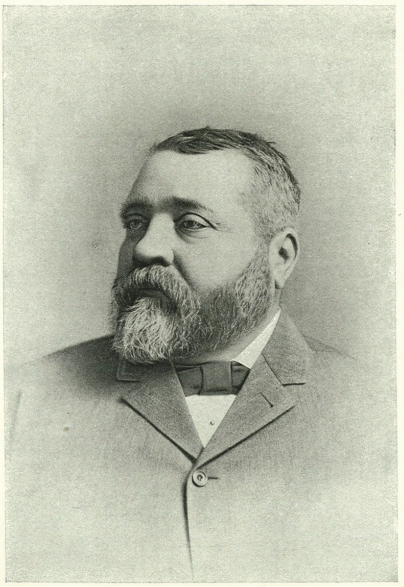
In 1890, the Paterson Board of Trade sponsored publication of a book with the assertive title, *Paterson, New Jersey, Its Advantages for Manufacturing and Residence: Its Industries, Prominent Men, Banks, Schools, Churches, etc.* The leather-bound volume and many others like it featured largely two types of images: illustrations of mills and portraits of mustachioed men in suits and ties (Figure 2.14). This juxtaposition of industrial architecture and confident businessmen, found not only in this but in almost any history of Paterson published from the 1860s to the 1920s, was no coincidence because in tandem and in such abundant numbers they represented the direct connection between the accumulation of individual wealth and the success of the city's business class in manufacturing and commerce. And in no small measure in the thinking of the time, a mill was an extension of a man's character and reputation. Mills thus took on the individual personalities of their owner, reflecting for instance in the case of the William Strange Silk Mills "a thorough understanding of the business and … characteristic energy soon mastered in every branch [of the business]."[25]

Who were these mill owners and developers and where did they come from? The biographical profiles of course vary, but general patterns emerge from a reading of their life stories. Few were descended from the "old families" of New Jersey. Many were immigrants and almost all arrived in Paterson with an entrepreneurial frame of mind and at least some access to capital. There were few Horatio Alger rags-to-riches stories, but a man of middling means could make his way into Paterson's expanding business class. What seems abundantly clear is that Paterson's notable businessmen of this era had good timing, which allowed them to build their fortunes while riding the wave of Paterson's late 19th-century industrial boom. The majority of Paterson's most successful mill owners of this generation had gained a foothold prior to the rapid upward swing of the silk industry during the 1870s and 1880s. Henry Doherty and Joseph Wadsworth, for instance, were silk weavers who emigrated from the silk mills of Macclesfield, England, and came to Paterson in the late 1860s. After working in the Paterson mills for a decade, they invested their savings, purchasing some looms and leasing a small workshop, working diligently to fulfill customer orders for broad silks, handkerchiefs and other fancy silks. From this humble beginning, they had extraordinary success, eventually purchasing the Arkwright Mill and employing almost a thousand workers by the early 1890s.

Another of Paterson's best-known businessmen was Nathan Barnert (Figure 2.15), a Jew born in Prussia in 1838. Immigrating to New York City at the age of 11 with his father, a tailor, he learned the trade in his father's shop prior to venturing to California lured by the promise of the gold rush in the late 1840s. There, as was the case for so many others, he realized that an easier fortune might be made not by seeking gold but

SILK AND COTTON DYERS.

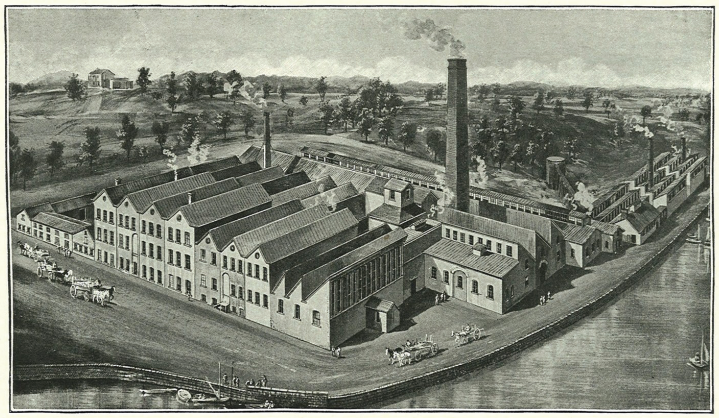
George Morlot.—Silk Dyer.—It would be next to an impossibility to complete a thorough and useful review of the commercial and industrial history of Paterson, without making more than a passing reference to the great dyeing establishment of Mr. George Morlot. The business was first begun in 1869, when Mr. Morlot and Mr. Stettheimer built extensive works on the banks of the Passaic, at what is now the foot of Thirtieth street. It was the most improved and complete dyeing plant in this country, but was insignificant compared to that now operated by Mr. Morlot alone. Quiet and of unassuming manners Mr. Morlot is to-day, nevertheless, the leading representative of the art of dyeing silks in America. But this honor has not come to him without indefatigable labor, and years of study. Mr. Morlot was born in Lyons, the very heart of the great silk industries of France. When only seventeen years of age he was graduated from the Lyons Institute of Chemistry and Mathematics and two years later was made general manager of the great dye works of Vignat Fréres in St. Etienne. His reputation as a skillful and progressive manipulator of chemicals in their application to coloring silk soon spread, and in 1857, when twenty-one years old, he received the offer to superintend the famous dyeing establishment of Savigny & Bernaud, of Lyons, which position he accepted and retained until he came to the United States in 1864. During the following five years he remained in New York experimenting in his art and studying the methods of American institutions. His advent in Paterson was a source of great pleasure and profit to the silk manufacturers, and they were not slow in enlisting his aid in a branch of the business which up to this time had been only indifferently carried on. Manufacturers in New York, Philadelphia and other cities soon learned of his skill, and within a very short time the works were kept continually going on large contracts from concerns in all these cities. It is no surprise, therefore, that irresponsible men entered the business and did much harm to an industry that was young in this country, and which was dependent, to a large degree, upon good and reliable dyeing. Through the persistent efforts, however, of Mr. Morlot these adventurers were finally crowded out, and the art of silk dyeing, at Paterson, advanced to a position second to none in the world. To carry out practically to success a business of the vast dimensions attained by Mr. Morlot's establishment, necessarily requires exceptional water facilities, light and spacious premises. The combination of these conditions are happily secured in this enterprise, and to these must be added mechanical appliances of the most improved and intricate character. Not alone those in general use in progressive dyeing establishments, but any number of ingenious apparatuses invented by Mr. Morlot and which have no counterpart anywhere else. The plant involves the use of some twenty buildings, the main structure being 200 x 50 feet, two being 160 x 30 feet each; three 50 x 60 feet and others of somewhat smaller dimensions. And in this connection it is only necessary to add that the work turned out of this model dyeing establishment is as near perfection as human ingenuity can make it. The operatives employed, numbering several hundred, are all skilled in the art, but notwithstanding this fact, Mr. Morlot, gives his entire time and personal supervision to all the important details of the business. As a consequence he is experiencing a steady increase in the volume of his business, and in the popularity of his works.



GEORGE MORLOT.

Thomas Davies. — Dyer of Cotton Velvets, Velveteens, Silk Piece Goods, Dress Goods and China Silk; Franklin Mill.—Much attention has been given in this volume to reviews of the various silk manufacturing establishments in Paterson, and in order that a correct idea may be obtained of the various processes through which the silk passes before being made ready for the market, it is necessary that some account should be given of the dyeing establishments which give the brilliant colors and shades to these beautiful goods. Engaged in this business is Mr. Thomas Davies, a native of Manchester, England, who came to Paterson some ten years ago and who, until 1884, was employed in the dyeing establishment of Mr. Greppo. The plant is equipped with a variety of machinery of the best construction, designed expressly for the purpose, the establishment in all its appointments being one of the most complete in the city. Throughout the works a thorough system and order prevail, and work emanating from this establishment is always of the best class and is highly spoken of and appreciated by the silk and velvet manufacturers not only of Paterson, but those of New York as well, who avail themselves of its services. Mr. Davies enjoys the reputation of being one of the most skillful and reliable among those engaged in the art of dyeing in this country. He dyes silks in piece goods, velvets and velveteens, making mixed silk and cotton piece goods a specialty, and gives employment to thirty skilled, practical workmen.

Knipscher & Close. — Silk Dyers, Gun Mill Yards; Van Houten and Mill streets. —Mr. W. E. Knipscher came to Paterson from Germany about nine years ago. A skilled practical silk dyer, he sought and obtained employment first as a silk dyer, and afterward as foreman of a leading dye-house here. In 1887 the present firm was formed, Mr. Robert Close, a pleasant and capable gentleman of English extraction, joining Mr. Knipscher and taking charge of the finances and office business. The works occupy two brick buildings, one of three stories, 40 x 50 feet, the other of one story, 30 x 110 feet, both fitted up in the completest manner with requisite machinery, apparatus and appliances, and of great capacity. From 50 to 75 people are employed, and the output, dyed for the trade, ranks with the best and most uniform in quality produced in this



GEORGE MORLOT'S DYE WORKS.

Figure 2.14. Mills and Leading Men. A sample page from *New Jersey's Leading Cities Illustrated*, 1889.

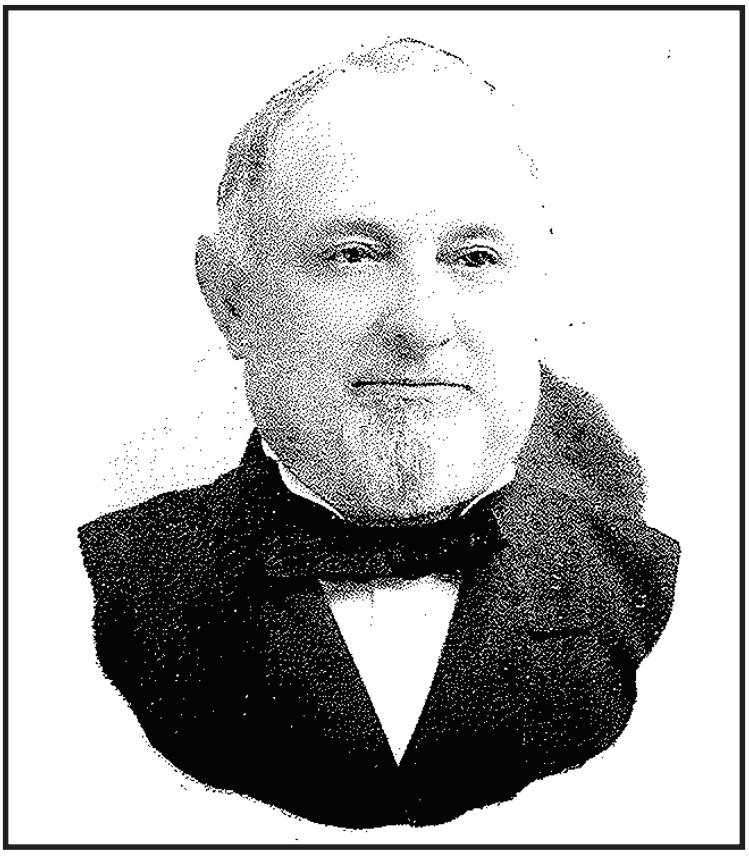


Figure 2.15. Nathan Barnert. The Paterson Daily and Weekly Guardian, *Paterson, N.J.* Circa 1898.

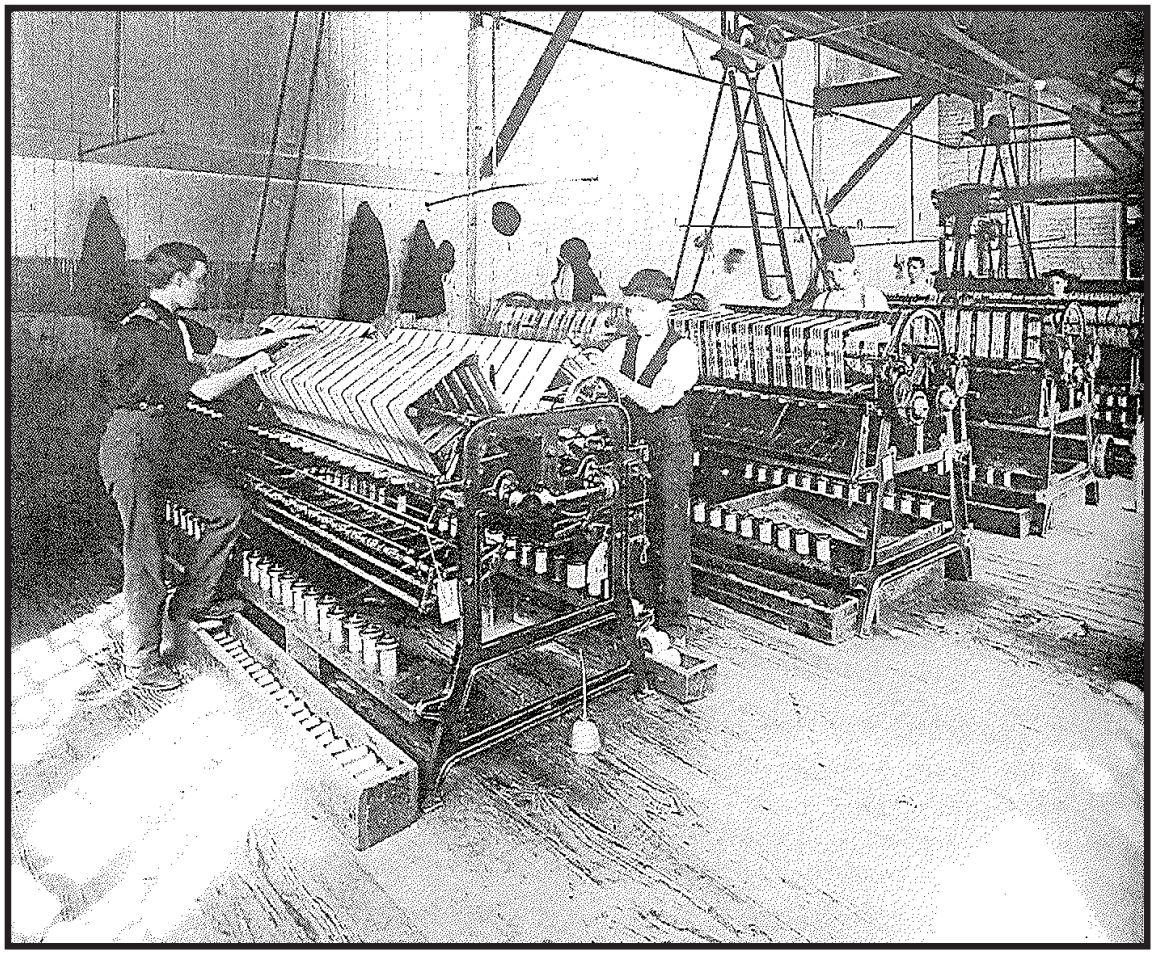
by selling goods to those who did. Eventually returning to New York City, Barnert accumulated significant wealth executing large contracts for clothing Union forces during the Civil War. Relocating to Paterson after the war and announcing his "retirement" from mercantile concerns, he had the foresight to invest in real estate, undertaking the erection of the Barnert Mill on Grand Street, regarded at the time as the first "great modern mill" outside of the Great Falls waterpower district. As a real estate developer specializing in tenant mills, Barnert represented another avenue to business success in Paterson and a model that would be followed by others including the owners of the Hall, Aronsohn and Sowerbutt mills. Barnert also parlayed his business success into political power, serving two terms as mayor of Paterson. Other mill owners active in city politics included I.A. Hall, a tenant mill operator and manufacturer of loom parts, and John Hinchliffe, a member of Paterson's prominent brewing family.[26]

By the early 20th century, the window of economic opportunity that had been open to Paterson's post-Civil War entrepreneur class was closing. The hale and hearty days of the early silk industry were over; most of Paterson's developable real estate had been built upon, limiting the opportunities for spectacular gains from the construction of new tenant mills, and producing only modest returns on existing real estate. Labor troubles had given the city a soured national reputation among entrepreneurs and venture capitalists, most of whom were now looking for opportunities to buy out competitors and close non-profitable mills rather than build new mills. As the silk industry slowly drained away from Paterson, tenant mills became less profitable and the competition among the proliferation of smaller silk manufacturers intensified. Silk dyeing and machine works maintained sufficient specialization and control of their market niche to remain vital, and in some cases even expand, but the time was over when "behind every mill stood a man."

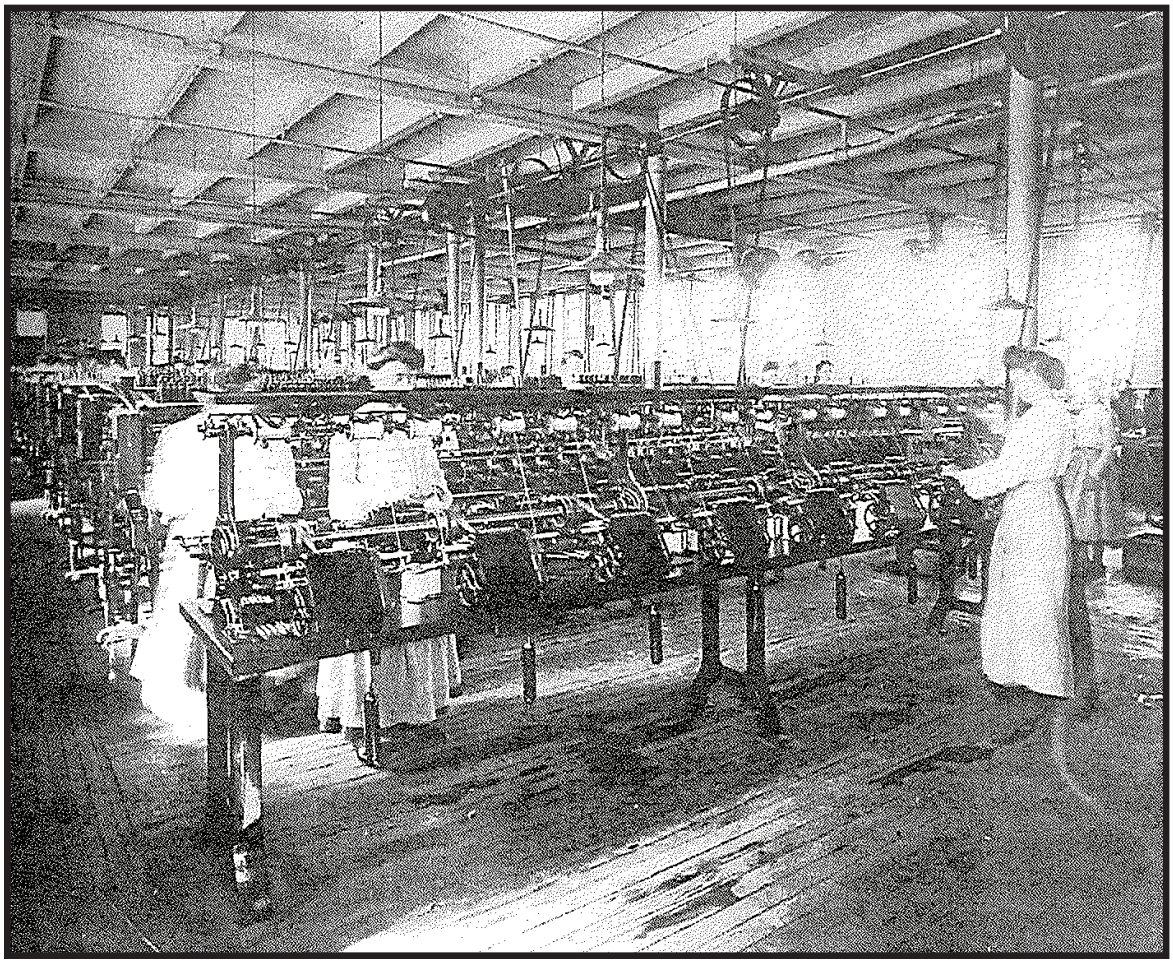
F. WORKERS IN THE MILLS AND THE COMMUNITY – THE MILLS AS SITES OF PRIDE IN LABOR AND LABOR UNREST

As a center for specialty manufacturing in both the silk industry and metal trades, Paterson was a working-class city with a population that soared from under 20,000 in 1860 to 130,000 in 1930. During these seven decades, most of the workers drawn to Paterson came from successive waves of immigrants arriving primarily from Ireland, England, Scotland, Holland, France and Germany followed in the late 19th and early 20th centuries by those from Italy, Poland and Turkey. The mills, and the economic opportunities they represented, were what attracted the immigrants, who often also had political, ethnic or religious reasons for leaving their homelands. In many instances, they arrived in Paterson under the aegis of a relative or friend who had written back home of the availability of work and the freedoms associated with the American way of life.[27]

Mills were essential spaces in shaping the worker and immigrant experience (Photographs 2.10 and 2.11). Upon arriving in Paterson, immigrants were soon introduced to the patterns of work in a specific type of industrial setting associated with the industrial sector in which they sought employment. Given the typical 55-hour work week at the turn of the century, most workers were in mills for the better part of their waking hours, forming bonds with co-workers and coming to understand that opportunity in America would be hard won. Industrial work in mills had health risks; some were obvious such as accidents caused by moving machines, impact with heavy objects, or contact with steam, while others were less obvious including hearing loss from constant exposure to noise or contraction of communicable diseases like tuberculosis that spread in the humid environment of textile mills.



Photograph 2.10. Silk mill workers. Circa 1900. Paterson Museum, as reproduced in Wallerstein, *Voices from the Paterson Silk Mills*, 2000.



Photograph 2.11. Silk mill workers. Circa 1900. Paterson Museum, as reproduced in Wallerstein, *Voices from the Paterson Silk Mills*, 2000.

Some immigrants, such as silk weavers from England or Poland, arrived with the necessary experience to take on higher paying jobs in the mills. Often they brought with them Old World concepts of what it meant to be working class and boundaries that could be tested by employers who wanted more work for less pay. Others arrived with no experience and had to take on lower paying unskilled or semi-skilled jobs. Every factory, depending on what it produced, had its labor needs and a shop culture based on negotiated understanding among workers and managers. Many shops had established routines for bringing in new workers; sometimes new workers were treated as apprentices on their way to learning highly skilled work, at other times they might be given jobs as manual laborers who might never be given an opportunity to advance.

Workers were keenly aware of the skill differences of each job and they identified certain jobs with certain ethnic groups. The breweries employed large number of Germans, the machine shops preferred workers with English, German and Scandinavian backgrounds. In the dye works, French immigrants, often with a high degree of training and understanding of chemistry, were sought out as master dyers, whereas Italians filled the ranks of dyers helpers, the semi-skilled laborers who manned the tubs. Within the silk industry as a whole, managers and workers alike recognized that ribbon weavers were more skilled than broad silk weavers, who were more skilled than warpers, who themselves ranked above the semi-skilled throwers. Prejudices based on ethnicity and religion were common, and even workers who brought skills from the Old World, such as Jewish weavers, could often find themselves paid less than Protestants with similar skills. Overseers and foremen judged all workers on their ability to create silks of various degrees of fineness, to work efficiently, and to be prompt and attentive at work that was repetitive, noisy and frequently tiring. Many mills paid based on piece work rather than hourly wages, and employers were free to level fines for a wide range of transgressions from damaged goods to bathroom breaks. Also, there was also always the prospect of layoffs due to downturns in the economy.[28]

The worker experience in Paterson's mills could be ambivalent. On the one hand, many workers expressed a pride in their abilities to produce the goods for which Paterson was famed – massive locomotives, intricate machines, and yards of shining, beautifully colored fabric. Workers knew they were an integral part of the manufacturing system, and even if they did not see much of the profits, many were able over the long haul to save wages and build better lives for their families. On the other hand, working conditions were harsh, and Paterson had by the turn of the century become a major center of labor unrest, much of it focused on the silk industry. Workers, legally denied the right to bargain collectively, used the strike as their preferred tool for protesting against wage cuts, reduction in hours, punitive fines, work speed-ups, increases in the number of machines tended by each worker, and the deskilling of work through mechanization. A particularly sensitive topic was the out-sourcing of jobs to other parts of the country, primarily the movement of silk throwing operations to the coal regions of Appalachia where miner's wives and daughters were eager for wage work.

Workers initiated strikes usually in direct response to a change in working conditions at a particular mill. Between 1887 and 1891, for instance, there were 21 strikes against silk and dyeing industries in Paterson, but only five of those strikes were against more than one mill.[29] Attempts at unionization in Paterson often fractured across lines of skill and ethnicity, with Italian dyers helpers, for instance, reputedly expressing reluctance to join a strike action initiated by Polish weavers. Beginning in the early 1900s, however, unions began to show greater effectiveness at organizing larger strikes, and although lockouts or walkouts might begin at a single mill, the strike action became increasingly prone to spreading to other mills through

a shared concept of worker solidarity. This pattern of labor unrest eventually reaching a crescendo in the protracted general strike of 1913, when close to 26,000 silk workers walked off their jobs. Like most strikes before it, the strike of 1913 began over a specific grievance at a specific mill, in this case 800 broad-silk weavers left work at the Doherty Mill to protest against a multiple-loom system that increased the number of looms attended by each weaver. In this instance, the United Textile Workers and most notably the militant International Workers of the World (I.W.W., often referred to as Wobblies) had laid groundwork for workers across the silk trades to accept the call for a general strike. The strike of 1913 has long been understood as a major watershed in Paterson's industrial history. Although the workers' unity eventually crumbled and the mill owners were the technical victors, the strike was a factor in the decline of the city's silk industry, which would never be the same again. Within 15 years, the number of workers employed in the industry had fallen by close to 40 percent, and most of those still employed were increasingly working in a system of small family-run weave shops, sometimes derisively referred to as "cockroach shops," occupying rented space in tenant silk mills. [30]

The primary and secondary literature related to Paterson's labor history is extensive, but most labor histories emphasize tactics and strategy, factors that pulled labor and management together or apart. The emphasis is rarely on the role that specific mill buildings played as part of the landscape and as a physical space where the experiences of workers were shaped. It is possible to glean from some of the literature that certain prominent mills, such as the Doherty Silk Mill and the Weidmann Dye Works, were often at the center of labor unrest. Smaller and more obscure mills, like the John Hand Silk Mill or the Susquehanna Silk Dyeing Company, are not, however, so easy to associate with specific events in the city's labor history.

G. THE CULTURAL MEANING OF PATERSON'S MILLS – THE 'SILK CITY' YESTERDAY AND TODAY

Paterson's industrial heritage presents a rich fabric that extends well beyond the Great Falls/Society of Useful Manufactures National Historic Landmark District. It provides a frame of reference in time and place for understanding Paterson as a historically distinct city of mills and machines created by entrepreneurs and workers. Their experiences and the landscape that they created provide us with a wealth of opportunity for recognizing ourselves as part of the continuum of events that shaped Paterson and the nation. For those prior generations that labored in the mills and benefitted from their productivity, the experience of being a silk worker, a dyers helper or a machinist had moments of triumph and loss, both poignant and bittersweet, given the stark reality that the city's industrial economy rarely stood still for long, rising and falling with changes in technology, labor and capital. While Paterson's narrative may not revolve around a great military battle or a momentous political event, the city offers a story that allows the informed observer to explore the profound ambiguities of the human experience, particularly as it relates to the need to earn a living and make material contributions to society, be it as the owner of a business or a worker tending a machine.

Paterson is changing rapidly at the beginning of the 21st century. Demographically, it has once again become a city of immigrants. Many first-generation immigrants have arrived from the Dominican Republic, Peru, Columbia, Mexico, and various other Central and South American nations. The median age of the city's nearly 150,000 citizens is about 32 years old, making it a relatively young urban community compared to other formerly industrial cities in the Northeast and Midwest. Today, there is an energy in Paterson that is moving beyond the bitterness of closed factories and shuttered mills.[31] With the establishment

of the Paterson Great Falls National Historical Park in 2011, there is an increased public interest in the Silk City's heritage and opportunities to use the local environment to teach history and culture to new generations. While some may argue about the direct relevance of industrial heritage to these audiences, that really is not the point; the city's industrial heritage is a resource directly connected to the daily life experiences of those who live today within the confines of a built environment that it shaped. Encouraging today's Patersonians to feel what is happening in their lives is connected to important events and issues of the past cannot help but make it more likely that they will appreciate their own surroundings and communities and invest in ways to shape them for the better.[32]

The mills in this survey are located throughout the city, in almost every neighborhood from the dye works in the Bunker Hill and Riverside areas at the northern tip of the city to the former locomotive and aircraft engine factories in South Paterson. Sprinkled throughout the city are several dozen larger silk mills and countless other small shops and spaces that manufactured silk. While it is today commonly recognized that much of Paterson's industrial heritage is concentrated at the Great Falls, if there is one thing this survey brings to the forefront it is how visually powerful was the outward expansion of industry from the falls in the half century from 1870 to 1920. Industry in the form of brick silk mills, machine shops, erection sheds, powerhouses and dye works multiplied into almost every corner of the city, not so much congregating in great masses, but like the silk itself, weaving its way into the communities, often with the weft of the mills alternating with the woof of residences and commercial blocks. From the perspective of cultural geography, this interweaving may be Paterson's most distinctive historical characteristic. It is this geography that gives Paterson a unique and powerful "sense of place," an asset which can be capitalized upon today and for the future.

Endnotes

1 International Publishing Company, *Quarter Century's Progress of New Jersey's Leading Manufacturing Centres, Embracing in One Volume a Carefully Prepared Review of the Prominent Manufacturing Cities of Northern New Jersey, Showing Their Growth, Development, and Present Advantages, The Data Compiled to the Time of Issue,* (New York, 1887), p. 189.

2 A definitive modern history of the S.U.M. has yet to be written. There are many summaries, many of which repeat similar information and perspectives, including a common misrepresentation that the experiment was a complete failure. Perhaps the best summary based on primary source material is an unpublished manuscript of the New Jersey Historical Records Survey, "Project Copy of the Calendar of the S.U.M. Collection of Manuscripts," n.d. (est. 1942), On-file at the New Jersey State Archives, Trenton, N.J. [Available on-line at www.patersongreatfall.org/sum.html].

3 The history of Paterson's machine works is scattered across numerous secondary histories, usually offering company-specific background but little synthesis. Among the more useful compilations for the period of this mill survey is found in William Nelson and Charles A. Shriner, *History of Paterson and Its Environs*, Vol. I (New York: Lewis Historical Publishing Company, 1920), pp. 351-57.

4 The literature of Paterson's silk industry is vast. One of the most useful modern syntheses is in the introductory chapters of Philip B. Scranton, ed., *Silk City, Studies on the Paterson Silk Industry, 1860-1940* (Newark: New Jersey Historical Society, 1985). Among the most thorough of the contemporary histories, written by those involved in the silk industry, are: L.P. Brockett, *The Silk Industry in America: A History Prepared for the Centennial Exposition* (New York: The Silk Association of America, 1876) and Albert H. Heusser, *The History of the Silk Dyeing Industry in the United States* (Paterson, N.J.: Silk Dyers' Association of America, 1927). Other useful works include Morris William Garber, "The Silk Industry of Paterson, New Jersey, 1840-1913: Technology and the Origins, Development, and Changes in Industry,"

Ph.D. Dissertation, Rutgers University, 1968; and Giovanni Frederico, *An Economic History of the Silk Industry* (London, U.K.: Cambridge University Press, 1997).

5 Robert P. Gordon and Patrick M. Malone, *The Texture of Industry, An Archaeological View of the Industrialization of North America* (New York: Oxford University Press, 1994), pp. 297-315; Louis Bergeron and Maria Teresa Maiullari-Pontois, *Industry, Architecture, and Engineering* (New York: Harry N. Abrams, Inc., c. 2005), pp. 185-87.

6 Examination of late 19th-century atlases easily confirms how mills conformed to the pre-existing street grid. See for example, Sanborn Map Company, *Fire Insurance Maps of Paterson, N.J.* (New York, 1885, 1899 and 1915).

7 Richard Candee, "The 1822 Allendale Mill and Slow-Burning Construction," *IA: Journal of the Society for Industrial Archeology*, Vol. 25 (1989), pp. 21-32.

8 Bergeron and Maiullari-Pontois, p. 186.

9 Carl Condit, *American Building* (Chicago, Ill.: University of Chicago Press, 1980), pp.

10 Bergeron and Maiullari-Pontois, p. 187.

11 The Paterson Daily and Weekly Guardian, *City of Paterson, N.J., Illustrations and Sketches of the Professional, Banking, Wholesale and Manufacturing Interests Including the Portraits and Biographies of Well Known People* (Paterson, N.J., c. 1898), p. 129; The Paterson Press Guardian, *Paterson in Pictures* (Paterson, N.J., 1923), n.p.; Richard Polton, "Fred Wesley Wentworth, The Architect Who Shaped Paterson, NJ and Its People," On-line at www.fredwesleywentworth.com [Accessed September 22, 2012].

12 Albert H. Heusser, *The History of the Silk Dyeing Industry in the United States* (Paterson, N.J.: The Silk Dyers' Association of America, 1927).

13 Gordon and Malone, pp. 166-69.

14 Jane Wallerstein, *Voices from the Paterson Silk Mills* (Charleston, S.C.: Arcadia Publishing, 2000), pp. 115-18.

15 Heusser, pp. 207-08.

16 Heusser, pp. 513-30.

17 Heusser, pp. 257-71.

18 L. R. Trumbull, *A History of Industrial Paterson* (Paterson, N.J.: Carleton M. Herrick, 1882), p. 82; Nelson and Shriner, Vol. I, pp. 356-57.

19 Library of Congress, "Watson Machine International: Microcosm of American Industrial Development," n.d. On-line at http://memory.loc.gov/ammem/collections/Paterson/essay3a.html. [Accessed 24 September 2012].

20 Nelson and Shriner, Vol. I, pp. 351-55; John White, Jr., *American Locomotives, An Engineering History, 1830-1880*, Revised and Expanded (Baltimore, Md.: Johns Hopkins University Press, 1997).

21 Herschel Smith, *Aircraft Piston Engines, From the Manley Balzer to the Continental Tiara* (Manhattan, Kan.: Sunflower University Press, 1986); Bill Gunston, *World Encyclopedia of Aero Engines*, 3rd ed. (Somerset, U.K.: Patrick Stephens Limited, 1995), pp. 180-187.

22 Stanley Baron, *Breweries in America, A History of Beer and Ale in the United States* (Boston, Mass.: Little, Brown and Company, 1962); Cultural Resource Consulting Group, "Historic Architecture Investigation, 69-83 Straight Street, Block 3113, Lot 1/96-112 Harrison Street, Block 3113, Lot 2, City of Paterson, Passaic County, New Jersey." October 10, 2008. On file Paterson Historic Preservation Commission, Paterson, New Jersey.

23 Neil Cossons, *The BP Book of Industrial Archaeology*, 2nd rev. ed. (London, U.K.: David and Charles, 1987), pp. 10-25; Gordon and Malone, pp. 11-35.

24 Library of Congress, "American Memory Collection" (Historic American Buildings Survey/Historic American Engineering Record). On-line at www.memory.loc.gov [Accessed September 22, 2012].

25 Charles A. Shriner, *Paterson, New Jersey, Its Advantages for Manufacturing and Residence: Its Industries, Prominent Men, Banks, Schools, Churches, etc.* (Paterson, N.J.: The Press Printing and Publishing Company, 1890), p. 201.

26 Nelson and Shriner, Vol. II, pp. 140-44.

27 Philip B. Scranton, ed., *Silk City, Studies on the Paterson Silk Industry, 1860-1940* (Newark: New Jersey Historical Society, 1985), pp. 1-8.

28 Wallerstein, pp. 32-33.

29 Paula M. Slagle. "The Silk Industry and Its Early Exodus of 1880, Paterson's Loss – Pennsylvania's Gain" (1983). Manuscript on file at the Passaic County Historical Society.

30 Paterson's labor history is a topic of major scholarly interest, particularly in the subfields of social and labor history. A classic text, and still one of the most contextual because of its fine introduction, is Philip B. Scranton, ed., *Silk City, Studies on the Paterson Silk Industry, 1860-1940* (Newark: New Jersey Historical Society, 1985). The mechanics of the strike and the role played by unions is well covered in Anne Huber Tripp, *The I.W.W. and the Paterson Silk Strike of 1913* (Urbana, Ill.: University of Illinois Press, 1987). Much of the information in the labor history section of this chapter is drawn from these two works.

31 City of Paterson, "City of Paterson 2010-2014 5 Year Strategic Plan" Available on-line at www.patersonnj.gov/egov/docs [Accessed 24 September 2012].

32 For a good summary of this perspective, see the introduction to Charles S. White and Kathleen A. Hunter, *Teaching with Historic Places* (Washington, D.C.: National Trust for Historic Preservation, 1995).