Society for
Industrial Archeology

Milwaukee

34th Annual Conference

June 2-5, 2005

MACHINE SHOP OF THE WORLD

THE SOCIETY FOR INDUSTRIAL ARCHEOLOGY

THE MACHINE SHOP OF THE WORLD

Selected Historic Industrial Sites in the Milwaukee Area

Mary Habstritt, Text Editor

Larry Mishkar, Photo Editor

34TH ANNUAL CONFERENCE 2005

ACKNOWLEDGEMENTS

This conference and guidebook would not have been possible without the dozens of sites that opened their doors for tours and provided information to enrich this guidebook. We offer our sincere gratitude to all sites appearing in the table of contents and on the conference program.

Thanks to those authors who contributed to this guidebook, some with as little as a week's time between assignment and deadline. Many of these writers also supplied the contacts to open doors for the tours and acted as tour guides too; fulfilling the promise of the saying, "If you want something done, ask a busy person to do it."

SOCIETY FOR INDUSTRIAL ARCHEOLOGY

SIA is a nonprofit, international, interdisciplinary association that brings together people of varied backgrounds having a shared interest in the archeology--the physical remains--of industry, engineering, and technology, mostly above-ground. To learn more about the Society, visit its web site: www.siahq.org; request a brochure from SIA Headquarters, Department of Social Sciences, Michigan Technological University, 1400 Townsend Drive, Houghton MI 49931-1295; phone 906-487-1889; or send e-mail to sia@mtu.edu.

***The Machine Shop of the World* is the tour guidebook for the SIA's 34th Annual Conference, held June 2-5, 2005 in Milwaukee, Wisconsin. This book is intended to provide a reference for those sites visited as part of the conference, but it does not claim to be a comprehensive catalog of all the industrial sites and structures in the area. There is much more!**

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INTRODUCTION

The 1825 opening of the Erie Canal brought settlers to lands along the Great Lakes. Pioneers looking for sites with potential ports along the western shore of Lake Michigan started towns where rivers or streams entered the lake, including Racine at the Root River and Port Washington at Sauk Creek. Although a swamp when Yankees arrived, Milwaukee Bay and the Milwaukee River, fed by the Menomonee and Kinnickinnic Rivers, was quickly identified as the most important—even more so than Chicago, which was then considered something of a dead end at the southern tip of the lake. Land speculation at Milwaukee rose to a frenzy by the mid-1830s and a city was born.

Competing townsites were launched with Solomon Juneau, a French Canadian fur trader on the east bluff of the Milwaukee River, Byron Kilbourn, a Yankee surveyor, on the west, and George Walker, a southern trader, at the mouth of the river on what is now the South Side. Due more to politics than geography, the downtown grew up away from the river mouth with the east and west banks battling it out, refusing to build bridges over the river until ordered to do so by the territorial legislature in 1840. The two different street grids left a legacy of misaligned streets and bridges set at an angle still obvious in today's downtown, now knit together with an extensive network of bridges. The three towns finally united and were chartered as a city in 1846.

The first German immigrants came to this most German-American of U.S. cities in 1839 and established a neighborhood near what is now Third Street and Juneau Avenue. A flood of Germans followed in the 1840s and by the 1860s German immigrants and their American-born children constituted a comfortable majority. Beer soon followed with breweries and *bierstube* cropping up all over the city.

Agricultural development brought wheat farming to the area and Milwaukee served as its port with the first boatload of wheat clearing the harbor in 1841. This prompted harbor improvements that had been bogged down by politics for years in spite of the Great Lakes providing the city with its only link to the world. To protect ships from rough weather, a cut was made through the sandbar at the mouth of the Milwaukee to provide an inner harbor closer to the business district. The resulting island was named for a shipbuilder and is still known as Jones Island even though sand eventually filled the natural river mouth re-creating a peninsula. The north end became the site of the Metropolitan Sewage Treatment Plant in 1919 while the south end was developed with terminal facilities for the outer harbor.

A canal that would have joined the port of Milwaukee with the Rock River, allowing ships access to the Mississippi, was begun in 1840. After building a dam on the Milwaukee and a 1.25 mile ditch along its west side, the company went broke. "The Water Power" which resulted gave rise to the city's first industries, powering flour mills, sawmills, and woodworking plants.

The Milwaukee & Waukesha, the first of Wisconsin's railroads, was chartered in 1847 and the first rails were spiked into place on September 12, 1850 under a new name, the Milwaukee & Mississippi. Shortly thereafter, a second Milwaukee-based road, the La Crosse & Milwaukee, was incorporated. It went on to expand rapidly west as the Milwaukee & St. Paul and to gobble up regional competitors after the Civil War to finally become the great Milwaukee Road.

With its new harbor and rail lines, and Mississippi River trade shut down during the Civil War, Milwaukee surpassed Chicago as the largest shipper of grain in the world. By 1886, however, with the rise of Minneapolis as a milling center, Milwaukee's prominence as a wheat center was a thing of the past. Poetic justice was achieved when E. P. Allis and Company was supplying nearly 85 percent of the milling machinery used in the Twin Cities by the 1890s.

The Army's appetite for pork and beef during the Civil war stimulated meatpacking in Milwaukee, which supported a host of ancillary industries. Meat scraps were turned into sausage, fat into lard, feet into glue, bristles into brushes, and bones and blood into fertilizer. Tanners were busy processing hides using the local hemlocks as a source of tannin. This in turn spawned several local shoe and boot manufacturers.

The first heavy manufacturing was founded in 1866 with establishment of The Milwaukee Iron Company on the South Side to take advantage of Upper Michigan's iron and provide rails to the Milwaukee & St. Paul. Even more important to choosing this site was the iron ore deposits at nearby Iron Ridge. These Dodge County mines yielded an ore that, when mixed with other softer Lake Superior varieties, produced an iron of unusual strength.

By 1918, Milwaukee's top four industries were machinery, packed meats, leather and beer. Prohibition knocked beer out of the running. Tanning soon followed as autos eliminated the need for saddles and harnesses, and electric motors eliminated leather belting. However, by 1929 Milwaukee was turning out more tractors than any other city in the world and heavy machinery, from mining hoists to steam shovels to overhead cranes, was being built in "The Machine Shop of the World."

The struggle of the Depression was followed by the manufacturing boom of World War II. Milwaukee industries continued to prosper after the war with 56 percent of the workforce involved in manufacturing—one of the highest concentrations in the U.S. But the workers themselves pushed out to the suburbs and much of the city's core became blighted, though not to the extent of other cities. Similarly, deindustrialization since the 1970s has seen many manufacturers, including Allis-Chalmers, Blatz, and Heil, become smaller or disappear altogether from the local scene, but not to the degree seen in other industrial cities. Industrial giants like Bucyrus, Falk, and Harnischfeger are still prospering. And much of the city's industrial heritage is evident in the new uses found for former factories in "The City of Diversified Industry" which still "glories in a forest of factory chimneys."

For Further Reading:

Gurda, John. *The Making of Milwaukee.* Milwaukee: Milwaukee County Historical Society, 1999.

Courtesy of Library of Congress, Prints and Photographs Division, Detroit Publishing Company Collection.

BLATZ BREWING COMPANY

BROADWAY & DIVISION STREETS. MILWAUKEE, WISCONSIN

Begun in 1846 by John Braun, what was then a small frame brewery made only 60 barrels of beer. Valentine Blatz became foreman in 1848, his Bavarian brewing training helping to increase production to 150 barrels in 1851. Braun died that year, and Blatz married Braun's widow and took over the brewery. He enlarged facilities, expanding production to 16,000 barrels per year by the late 1860s. An 1872 fire destroyed Blatz's malt and ice houses, but was only a brief setback. Rebuilding in just three months, Blatz pushed production above 52,000 barrels by 1874, and initiated beer bottling in Milwaukee in 1875. Blatz's brewery was soon the third largest in Milwaukee, behind Best and Schlitz, and constantly innovating, acquiring its first artificial refrigeration machine in 1878 and a 150-hp Corliss engine with 14-ft. diameter flywheel in 1882. The early 1880s brewery occupied an entire block, employed 100 workers, and shipped beer daily, nationwide and to Mexico, with a half-dozen agencies in the East and South. Val Blatz celebrated his success with a new $50,000 home in 1884.

The brewery's rapid, ongoing growth was visible architecturally and otherwise. A host of substantial buildings of Milwaukee cream brick with Wauwatosa limestone trim rose from the 1870s to the 1890s, and by 1885 Blatz employed 200 at the plant which by then had a brewing capacity of 200,000 barrels per year. Refrigeration equipment expanded dramatically, adding still more capacity. Incorporated in 1889 (capitalization $2 million), the Val. Blatz Brewing Company built a lavish new office in 1890, designed by Milwaukee architect H. Paul Schnetzky. The office is now the Alumni Partnership Center of the Milwaukee School of Engineering.

Larger scale architectural plans in 1891 included substantial improvements by Chicago brewery architect August Maritzen. Significant elements of the block along Broadway south of Juneau are likely his, along with the former Wash and Racking Houses west of the brewery's main block. Another sort of change came that year, when Val Blatz quietly sold out to the United States Brewing Company, the first major Milwaukee brewery to succumb to an English brewing syndicate. Still called the Val. Blatz Brewing Company, it was no longer family-controlled, though Blatz retained a stock interest, passed to his children after his death in 1894. Expanding further, the brewery added new buildings by another Chicago brewery architect, Louis Lehle, including the 1904 boiler house and stack, and depots and agencies in far-flung places.

At Prohibition (1920), Edward Landsberg bought the plant, making ginger ale, malt syrup, near beer, soft drinks, even chewing gum. With Repeal in 1933 Blatz resurged, maintaining a strong brewing industry presence from 1933 to 1958. From this period comes the sleek, streamlined structure built in 1948-49 to house a bottling plant, personnel offices and auditorium, now in use as MSOE's Student Life & Campus Center and Todd Wehr Conference Center.

Pabst bought Blatz in 1958, but its attempts to operate under the Blatz name were foiled when an antitrust suit voided the sale. Blatz became part of G. Heileman Brewing Co. until closing in 1988. Efforts to preserve it since have led to listing the complex on the National Register of Historic Places and adaptive reuse of the brewery as residential and commercial space.

BREWING IN MILWAUKEE—BIRD'S EYE VIEW OF PREMISES OF VALENTINE BLATZ BREWING CO. MILWAUKEE.

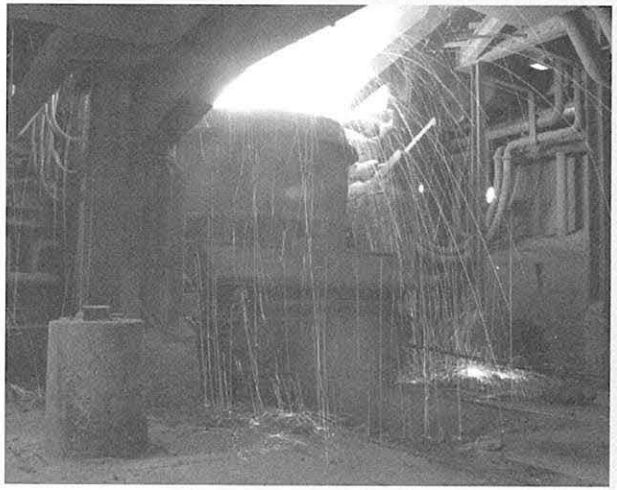
Photo courtesy of Susan Appel

For Further Reading:
Apps, Jerry. *Breweries of Wisconsin.* Madison: University of Wisconsin Press, 1992.

Susan Appel

CHARTER STEEL

1658 Cold Springs Road. Saukville, Wisconsin



Charter Steel is a division of the Charter Manufacturing Company headquartered in Mequon, Wisconsin. The company was founded by Alfred Mellowes, a 1906 Cornell engineering graduate, who started working for Johns-Manville in Dayton, Ohio. He developed a mechanical refrigerator there and left to start the Guardian Frigerator Company. When he sold it in 1919 to General Motors, it became the Frigidaire Corporation. Mellowes then moved to Milwaukee to start a refrigerator division for Briggs & Stratton.

In a surprising shift, Mellowes then started the Milwaukee Lock Washer company in 1922 to market a new form of fastener invented by a fellow Cornell graduate and neighbor who had been an engineer for Cutler-Hammer, a local maker of electrical equipment. Continuing in the entrepreneurial spirit, Mellowes sold out to National Lock Washer and managed its plant, which produced split-type nut locks. As a director of that company he decided to become a supplier of their primary raw material by founding Charter Wire in 1936. He brought in his son Charles, also a Cornell graduate, to run the operation.

In 1948 the company got into the automotive industry when it responded to a request from the Chrysler Corporation for engine and powertrain oil dipsticks by creating Milwaukee Wire Products. The company then went into competition with National Lock Washer and purchased the company in 1968. Dipping again into the ranks of Cornell engineering graduates, Charles brought his son John into the business and he became president of Charter Manufacturing in 1973. The company then implemented a strategy of vertical integration with construction of its own melt shop and rolling mill in Saukville, Wisconsin to ensure a reliable supply of steel.

Concentrating on steel and wire, the company ended 40 years of washer production in 1991. With Charles A. Mellowes the fourth generation entered the company and he oversaw plants constructed in Fostoria, Cleveland, and Risingsun, Ohio. The company's divisions now include Charter Specialty Steel, Charter Wire, and Milwaukee Wire Products. A new melt shop is planned to open in Cleveland in 2006.

The Charter Steel mill in Saukville melts only scrap steel in an electric arc furnace. The molten steel is continuously cast into slabs, which are then rolled at the facility into a variety of sizes of rod and wire. These can be processed further in the onsite plant or sold as green rod to other manufacturers, primarily in the automotive and fastener industries.

Photo courtesy of Charter Steel

Gerald Weinstein

CHERRY STREET BASCULE

CHERRY STREET W. AT MILWAUKEE RIVER. MILWAUKEE, WISCONSIN

The West Cherry Street Bridge carries Cherry Street over the Milwaukee River, a short distance upstream from the State Street Bridge and the West Kilbourn Avenue Bridge. The overall structure length is 214 ft. with a clear channel for navigation of 80 ft.. To the west is a brick fire-boat house, built as part of the bridge construction project and connected to the bridge with a concrete mooring dock and water main connector originally designed for the Fire Boat *Torrent*. The length of the mooring dock was determined by the size of the *Torrent*, the largest fire boat ever used by the Milwaukee Fire Department. The house accommodated the Milwaukee Fire Department (MFD) Engine Company No. 29.

Campaigning for a new bridge at Cherry Street began in 1926, but construction was delayed until Public Works Administration (PWA) funding became available in the New Deal era of the 1930s. Completed in 1940, it was the first debt-free bridge in Milwaukee's history, paid by PWA funds and a special bridge and viaduct tax in 1938-39.

The movable span is a late example of the Milwaukee Type simple trunnion design with a double-leaf, plate-girder, bascule span, based on the 1904 Muskego Avenue prototype and similar to the State Street and West Kilbourn Avenue bascules. Each leaf has two built-up plate girders that share a single, concrete-filled, metal-plate counterweight box that descends into a concrete pit when the leaf is raised. Attached to the bottom of each girder is a cast-steel segmental rack, which is moved with a pinion gear to raise the leaf.

Each leaf retains the original steel open-mesh deck that was used here for the first time in a Milwaukee bridge. The deck grid has numerous repairs made with metal plates, which affect the balance of the leaves and require adjustments to the counterweights. The bridge retains the original lift machinery, although the electrical equipment in the operator's houses and in the machinery area has been modified or replaced to accommodate the change from two operators to one.

Cherry Street is the only bascule bridge in Milwaukee designed in the Art Deco architectural style, which is also reflected in the design of the adjacent fire-boat house. Its two operator's houses were built in concrete, stainless steel, aluminum, and glass block. When the bridge was converted to single-operator design in the 1950s, the west house was removed and the east house altered. In 1990 the west house was reconstructed and the east house was restored, largely following the 1939 plans. The appearance now closely resembles the original bridge construction.

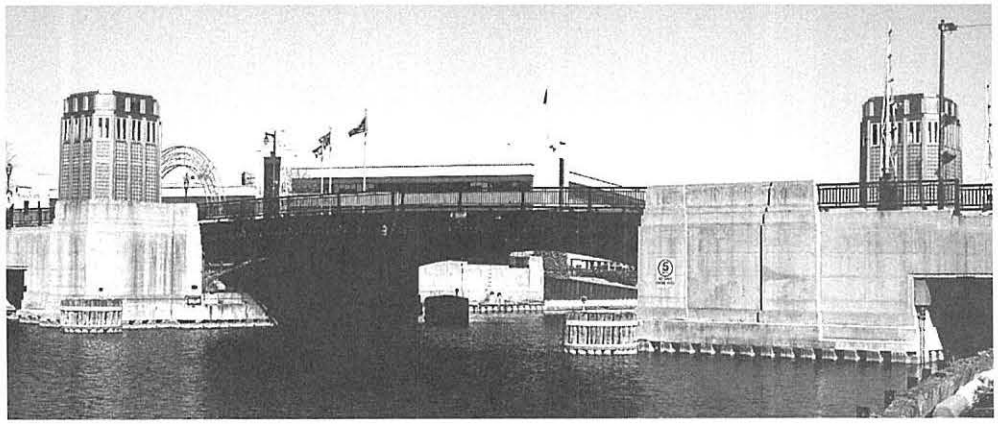


Photo courtesy of Mead & Hunt

Located between the Cherry Street and State Street bascules is Milwaukee's newest movable bridge, the Knapp Street Bridge, completed in 2004. It is a hydraulic vertical-lift design, introduced in 1966 by Milwaukee city engineers to replace the Milwaukee Type bascule that had been used successfully since 1904. The city now has six hydraulic vertical-lift bridges. The movable span is raised by hydraulic cylinders at each end, with counterweights concealed in the piers. The low-rise hydraulic mechanism is feasible because vertical navigation clearance requirements are minimal for movable Milwaukee River bridges located upstream of the fixed Interstate-794 Bridge, which sets the maximum height. The vertical lift design costs less to construct than the bascule design.

Bob Frame

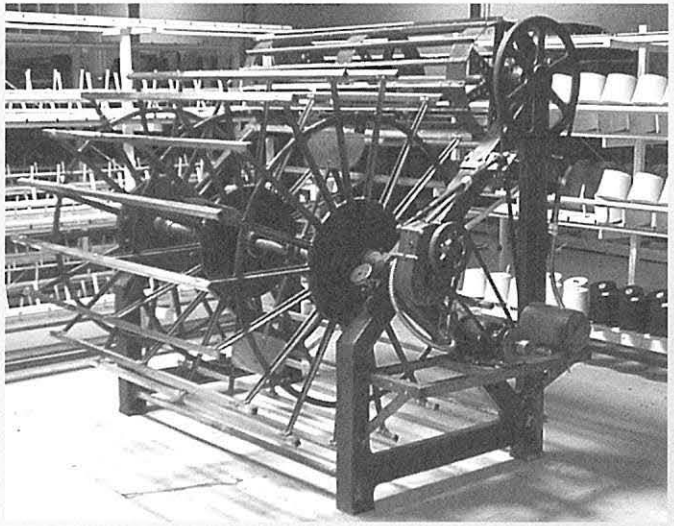
CREAM CITY RIBBON

430 W. Vliet Street. Milwaukee, Wisconsin

General Printed String was founded in 1934 by Carl E. Mueller and Lemuel Hendee. After many changes of ownership it was purchased at an IRS auction by Lorette Russenberger in 1988 and re-named Cream City Ribbon. Russenberger was an architectural historian and art restorer looking for another career when she decided to go into manufacturing and was attracted to this business because it did not involve chemicals, but did involve history and craft.

Cream City Ribbon makes a biodegradable cotton ribbon for packaging and gift wrapping on equipment made in Germany in the 1920s. The technology for making non-woven ribbon originated in that country early in the century. Instead of weaving yarns together, it uses continuous lengths of yarn laid parallel to each other and bonded together with adhesive. This was faster and used less complex machinery than woven ribbon and was conceived to make industrial ribbons and reinforcing tapes. Colored yarns were soon being used to make decorative packaging ribbons that were inexpensive enough to be disposable and could have printing applied to create personalized ribbons for such small businesses as bakeries and flower shops. Cotton was the most commonly used fiber for customized ribbons, but rayon ribbon with its shiny finish became more popular for gift wrapping and led the field until the 1950s. When it was discovered that polypropylene could be extruded in large volume at extremely low cost for ribbon making, plastic became the standard for gift ribbon and is the most popular today. Cream City is now the only company in the U.S. making non-woven cotton ribbon.

At Cream City the process begins with bobbins of pre-dyed yarn on racks at one of the five U-shaped setups. Strands of the yarn run through eye hooks onto rollers where they are laid into a ribbon. The ribbon then moves through a small vat of water-soluble glue, is squeezed between brass rollers to remove excess adhesive, and then dried on reels with heated air, wound, and calendared to achieve a smooth surface. For customized ribbon it next goes to a printer where a brand name or pattern can be applied. Finally a winder puts the ribbon on spools.



Although Cream City's manufacturing operation is in a 1960s warehouse, the company's offices are housed in part of the former E. L. Husting Company brewery. Dating from the late 19th century it is evidence of one of the many small breweries of the city. The company was established by Eugene L. Husting in 1877 and incorporated in 1900. It first manufactured soda water, then added weissbier in 1886--an unusual sequence, but likely spurred by association of Husting with his father-in-law, Peter Altpeter, another small-scale local brewer. Oscar Husting followed his father into the business, as did Oscar's son William after him. The firm survived Prohibition by making near-beer and soda and then branched out into wholesale distribution of both alcoholic and non-alcoholic beverages. In 1932 the company won the exclusive right to bottle and sell Coca-Cola in Milwaukee County after a lengthy court battle. The company was sold to Capitol Liquor in 1964 and became Capitol-Husting.

Photo courtesy of Cream City Ribbon

Mary Habstritt

FALK CORPORATION

3001 W. Canal Street. Milwaukee, Wisconsin

The Falk Corporation's lineage goes back to Franz Falk who started out in the brewing business in Milwaukee after emigrating from Bavaria in 1848. Although it grew to be the fourth-largest brewery in the city, after a fire Falk's sons sold out to Pabst in 1892.

One of his sons, Herman had a mechanical turn of mind and co-founded a machine shop to manufacture wagon axle couplings, which grew into a general machine shop with Pabst as a major customer. The company broke out of job-shopping with an innovative method of cast welding streetcar rail joints in the field. The success of that technology led to the incorporation of the Falk Manufacturing Company in 1895. The company expanded into the production of street railway track parts and then into the installation of complete systems.

Always looking for new areas of opportunity, and sensing that the streetcar boom was ebbing, Herman started a foundry to supply heavy machinery components. Diversification under a new name, Falk Company included manufacture of oil-immersed switches for electrical distribution and purchase of the Western Gear Company of Milwaukee in 1899. Getting into gear manufacturing at the beginning of the 20th century proved to be a prescient decision for Herman Falk.

The rise of the steam turbine pioneered by Sir Charles Parsons provided the impetus for new transmission gear designs for use in ships and mills. The engineering challenge was to mate the turbine's efficiency at high rpms with the low-speed operation of ship's propellers, electrical generators, and rolling mills. The centuries' old spur gear of iconic imagery did a poor job of transferring the power from a turbine running at thousands of rpm to a shaft that had to run at hundreds of rpm. The helical gear with many small teeth running at an angle (skewed) across the faces of the gear wheels gave a smoother action but the side thrust had to be restrained by oversize bearings. Placing two gears on the same shaft with the teeth opposed in a herringbone pattern gave a balanced thrust that could transmit large powers. Falk was fortunate to get the rights to the Swiss patent of Caspar Wuest for an improved herringbone gear with staggered teeth that could handle ratios as high as 20 to 1, and the all-important hobbing machine that produced it. He also hired the British engineer who designed the first hobbers to make the marine and mill gears installed by the Parsons company. Falk went on to be a major supplier of reduction gears to the U.S. Navy, merchant marine, turbine manufacturers, steel mills, and the Panama Canal Commission.

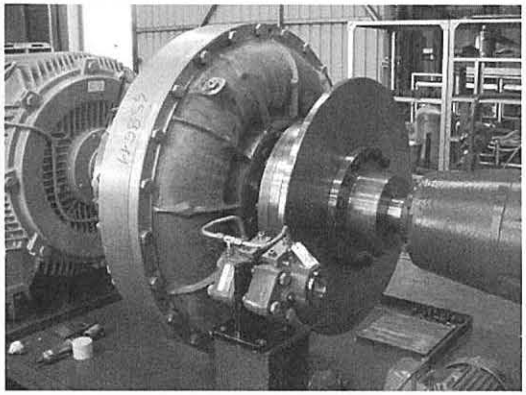


Photo courtesy of Falk Corporation

In 1968 Falk was acquired by the Sunstrand Corporation of Illinois, a company which got its start in 1914 producing adding machines and then branching out into machine tools. Sunstrand went into the aerospace field in 1967 producing power and control systems, and later entered the compressed air market with the acquisition of Sullair. Growing by diversification, the company purchased Westinghouse's Electric Systems Division and a ram air turbine manufacturer.

In 1999 United Technologies of Stamford, Connecticut bought Sunstrand and merged it with its Hamilton Standard Division creating a broad-range supplier of pumps, gas sampling devices, aircraft power systems, propellers, controls, and international aircraft repair services. Its products will be in the world's largest aircraft, the Airbus A380.

For Further Reading:

Gurda, John. *The Making of "A Good Name in Industry:" Falk, a History of the Falk Corporation, 1892-1992.* Milwaukee: Falk Corporation, 1991.

Gerald Weinstein

IROQUOIS

505 N. Riverwalk Way. Milwaukee, Wisconsin

The *Iroquois* has an 83-year history of providing passenger service from a number of ports around the Great Lakes.

Built as the *Detroit* in 1922, in Bay City, Michigan by the Defoe Boat & Motor Works for John C. Dahmer, she spent the first years of her life operating out of her namesake city. Her dimensions are 61.9 ft. registered length by 21 ft. beam and a registered depth of 6.4 ft. She was built to be just under the 65 ft. limit for motorboats at the time requiring only an operator and a deckhand.

In 1936 she was purchased by Leonard A. Seeberger, a ferry operator in the town of La Pointe on Madeline Island in the Apostle Islands. During the World War II era her home port was Duluth and she operated as a fish pickup vessel for the H. Christiansen & Sons fish company along the North Shore of Lake Superior.

Along the way, her original 60 hp Fairbanks-Morse Oil Engine was replaced by a Kahlenberg direct reversing Semi-Diesel engine. The Kahlenberg produced 120 hp at 375 rpm in four cylinders of 10-in. bore with a 10½ -in. stroke. The massive engine was over thirteen ft. long, and weighed in at almost 12,000 pounds.

The mid-1950s found her working the Straits of Mackinac for the famous Arnold Transit Company. The Arnold line has a history of naming their boats for the Indian tribes of the Great Lakes region. Thus the *Detroit* became the *Iroquois,* and joined her fleetmates *Ottawa* and *Chippewa* carrying thousands of tourists each season to Mackinac Island.

Increasing traffic prompted the Arnold line to replace its aging fleet with larger and faster boats. The *Iroquois* became surplus, and in the early 1960s changed hands again. This time she headed for Milwaukee to become the tour boat you see today. She was first purchased by Captain Art Fransee in 1963.

The current owner, Captain Roger Chapman, has owned her since the late 1970s. He took great pride in the old Kahlenberg engine, which served until the late 1990s when there was a main bearing failure. The *Iroquois* is currently powered by a Detroit Diesel 671. She is U.S. Coast Guard-inspected and licensed to carry 150 passengers.

Photo courtesy of
Andy LaBorde

Eric Bonow

IRON BLOCK

205 E. Wisconsin Avenue. Milwaukee, Wisconsin

Cast iron, the highest carbon alloy of iron, began to be used for structural purposes in the late 18th century for iron bridges in England. Cast iron columns soon began to be used in textile mills to improve their fire resistance . Then cast iron, strong in compression, was used in combination with girders made of wrought iron, strong in tension, creating a system that allowed for some of Chicago's earliest high-rise buildings. Several engineers and inventors went on to devise buildings made entirely of iron, not just with iron skeletons. James Bogardus of New York, inspired by designs he saw in England, designed a system of cast iron architectural parts—columns, lintels, and panels—that could be bolted together to form a freestanding building and received a patent for his method of fastening the parts together. He went on to create a plan for putting cast iron parts together for a façade with rear and side walls of brick and floors of wood. The first facades and his first all-iron building were built in New York in 1848 and 1849. This created a new market for iron foundries, including that owned by Daniel D. Badger in Boston.

Badger was already selling iron storefronts (not entire facades), which allowed for larger show windows due to the slender strength of the iron, and patented iron rolling shutters in 1842. He moved his operation to New York City in the mid-1840s and built his first full iron façade there in 1853. By 1854 he had taken on the gifted young English architect George H. Johnson who designed many of the modules marketed by Badger. In 1856 the foundry was incorporated as the Architectural Iron Works of New York. In its 1865 catalog the Architectural Iron Works lists its principal works and the Iron Block, designed by Johnson, is one of four buildings listed for Milwaukee. It is now the city's only remaining iron building and one of only a small number of Milwaukee's commercial buildings that pre-date the Civil War.

An 1860 fire destroyed a large number of small frame buildings, including ones on the east side of East (now North) Water Street and Wisconsin Street (now East Wisconsin Avenue). These newly vacant lots were purchased by James Baynard Martin, a grain and real estate dealer, insurance executive and banker. Construction of the Iron Block began in mid-1860 and, when completed in the fall of 1861, the Italian Renaissance Revival building offered space for a bank, four stores and an office on the first floor, office suites on the second and third floors, and a Masonic hall on the fourth. It had a high basement on the northwest corner and an attic. An elevator was added to the building in 1879 and was still in service in 1969. A four-bay addition of cream brick in harmonious style was added in 1899. A 1984 restoration returned the exterior to nearly its original appearance.

The Iron Block is on the National Register of Historic Places and is part of the locally designated three-block East Side Commercial Historic District. This district is comprised almost exclusively of mixed-use buildings and was always characterized by banking, commodity trading, wholesale and commission offices, and professional offices in contrast to the retail trade and entertainment offered on the West Side.

For Further Reading:

Badger, Daniel D. *Badger's Illustrated Catalogue of Cast-Iron Architecture*, with a new introduction by Margot Gayle. New York: Dover Publications, 1981.

Photo courtesy of
Larry Mishkar

JONES ISLAND SEWAGE

JONES ISLAND. MILWAUKEE, WISCONSIN

The City of Milwaukee, like many American cities, discharged its storm water runoff, sewage, and industrial wastes into local bodies of water, in this case the Kinnickinic, Menomonee, and Milwaukee rivers and ultimately Lake Michigan via a sewage system constructed in 1863. As a result the Menomonee River became severely polluted. A water works was constructed in 1872 and in 1884-5 new intercepting sewers were built that partially separated the storm from the sewage which was pumped out into the lake. Later the Milwaukee River became "...perhaps as black, foul, and offensive as any stream in the country," with twenty-four inches of semi-liquid sludge covering the river bottom.

A commission of engineers was set up to devise long-term solutions to both sewage treatment and water supply problems. For the short term, G. H. Benzenberg, ASCE, recommended (over much citizen and press opposition) construction of a flushing tunnel running from Lake Michigan to the Milwaukee. Completed in 1888, a 14-ft. diameter screw propeller type pump wheel driven by an E. P. Allis steam engine moved almost 600,000 gallons of lake water per day through the 12-ft. diameter tunnel. This flushed pollution out of the river at a greater rate than could be gotten from its natural flow. A second tunnel was built in 1907. Despite these improvements conditions again deteriorated leading to a typhoid scare in 1909 with death rates reaching forty per 100,000 citizens. Another lapse in water quality in 1912 brought the death rate to a level not seen since 1895. A new study commission was formed and in 1911 recommended that the city build both a sewage disposal system and water filtration plant with the latter being the most urgent. In 1913 the Sewerage Commission was formed and it authorized construction in 1915-16 of a pilot plant on Jones Island to try out the then new activated sludge process of sewage disposal.

Activated sludge treatment was a result of bi-directional technology transfer between the U.S. and England. Pioneering research in the aeration of sewage was carried out in Massachusetts at the Lawrence Experiment Station in 1912. Dr. Fowler of Manchester, England visited the station and on returning to England worked out the modern activated sludge system. It utilized concrete settling tanks used in the earlier Imhoff system and added aeration to speed up the natural processes that occur in bodies of water. In principal, activated sludge ("good" bacteria) was used to consume the (bad) bacteria in the wastewater. Sewage was admitted to the tanks filled with the activated sludge from a seed tank under air pressure from blowers. Some settling of solids occurred before the mix was sent to additional tanks for more aeration. The spent activated sludge and the remains of the consumed bacteria again settled to the bottom of the tanks and was further aerated to maintain nitrogen levels. Some of the sludge was recycled back to the beginning to provide continuous treatment. The whole process required a delicate balance between the nature of the incoming sewage, the activity of the micro-organisms, the temperature, and the air pressure. When properly controlled, the system proved to be far better at removing bacteria and controlling odor, used less real estate, and was more cost efficient than the earlier methods of sewage farms, filtration, chemical precipitation, Imhoff tanks, or electrolysis.

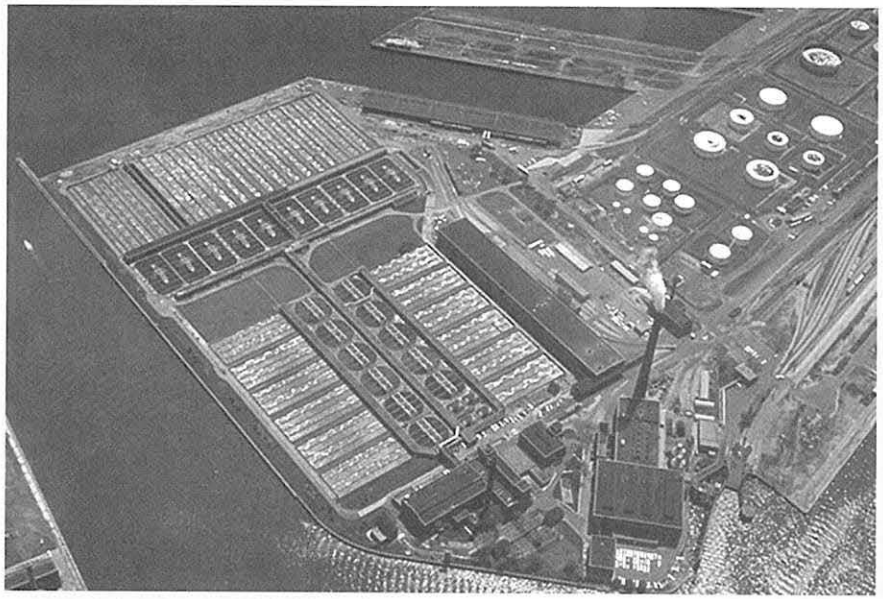
During 1915 the city began liquid chlorine treatment of drinking water. A shutdown for only a few hours in 1916 led to a spike in typhoid cases and brought renewed calls for a water treatment plant and a full-size sewage disposal facility, each of which had its supporters and detractors. Opposition to the filtration plant was strong enough that only sewage treatment was instituted.

Construction of the first large-scale activated sludge sewage plant in the U.S. began in 1919 with a goal of treating 85 million gallons per day (gpd) of sewage. When completed in 1925 it had 24 aeration tanks, 15 settling tanks, a coal-fired boiler house, and a blower building containing four Allis-Chalmers steam turbine-driven Ingersoll-Rand turbo blowers. In addition to the biological processes, the incoming sewage was cleaned in a coarse screen house and grit chamber building. The production of commercial fertilizer made from sludge was pioneered at the Jones Island plant. The

TREATMENT PLANT

high nitrogen content of Milorganite (Milwaukee Organic Nitrogen) fertilizer was made possible by the waste streams from local breweries, tanneries and meatpackers. Two major expansions in 1935 and 1952 increased capacity to 200 million gpd with fertilizer production reaching 70,000 tons per annum. In the 1960s gas turbine generators were added with waste heat boilers providing steam for the sludge dryers reducing the plant's fuel requirements by 20 percent.

While the plant was an engineering milestone it could not eliminate the problems caused by Milwaukee's intercepting sewer system during heavy rains. To mitigate the frequency of direct discharges to the river, a 3.9-million-gallon detention tank was built by 1971 to contain most overflows until the intercepting system could return it to the plant for treatment. A chlorine injection system was used to treat any flows beyond the tank capacity.



By 1927 Milwaukee's water was far superior to the standards set by the U.S. Treasury, however, there were still periods of high pollution with orders to boil all drinking water from the Commissioner of Health. A new plan for a water filtration plant was approved by the Common Council, but, in true Milwaukee fashion, was met by protests and a lawsuit from--of all things--a laundry company, before finally being approved by the Public Service Commission of Wisconsin and, after more court travails, the Public Works Administration in Washington around 1934.

In 1929, Activated Sludge Inc, the American holder of the rights to the original British patents covering the process sued the cities of Milwaukee and Chicago for patent infringement, failure to obtain licenses, and monetary damages. The United States Court in Milwaukee found for the plaintiffs. Milwaukee appealed, claiming that the invention was the work of the Lawrence Experiment Station. In 1934 the United States Supreme Court sustained the lower court opinions in favor of Activated Sludge and the city paid a substantial penalty.

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Photo courtesy of
The Carl Guell Slide Collection,
Dept. of Geography, University of Wisconsin, Oshkosh

KOHLER COMPANY

444 Highland Drive. Kohler, Wisconsin

The Kohler Company is one of the largest privately owned businesses in the United States. It has been owned and operated by the Kohler family for over a 130 years. A premier leader in plumbing products, Kohler has set new standards in design with its line of baths, sinks, toilets, and other plumbing fixtures. The company is also a leading producer of electric generators and internal combustion engines. In recent years, Kohler acquired two furniture manufacturers, and has become involved in real estate and tourism in Kohler, Wisconsin the site of its headquarters and largest manufacturing facilities.

John Michael Kohler and Charles Silberzahn established the Kohler Company in 1873. Kohler, a 29-year-old Austrian immigrant purchased the Sheboygan Union Iron and Steel Foundry off of his father-in-law. Initially the firm produced cast iron and steel farm implements, furniture castings, and ornamental iron pieces. The company struggled in the early years as an economic depression gripped the country. Silberzahn sold his shares at the end of the Depression to two employees Herman Hayssen and John H. Stehn.

In 1883 John Michael Kohler experimented with applying baked enamel coating to an iron horse trough. This experiment launched a new line of cast iron enameled products that caused it to outgrow its Sheboygan facilities. In 1900 Kohler started building new facilities four miles west of Sheboygan in the small community of Riverside. Many people within Sheboygan viewed this move as risky and bold. This view was compounded as a streak of ill-fated events began with the death of Kohler. Three months after his death, a fire destroyed the company's new foundry, machine, and enamel shops. The devastating events led the other two partners to sell their interests to the Kohler family. In 1902 the company reorganized as J. M. Kohler Sons Company under the leadership of John Michael's oldest three sons Robert, Walter, and Carl. In 1905 both Robert and Carl died leaving the business to Walter.

Walter Kohler had a vision for the community of Kohler that surrounded the new facilities. In 1912 he traveled to England and Germany to study planned garden communities. Walter hired Werner Hedgemann, a German-born planner who was a prolific author with several years of experience. Hedgemann led a team of designers R. Phillip, a Milwaukee architect, J. Donohue an engineer from Sheboygan and Elbert Peets, a landscape architect who collaborated with Hedgemann on several projects. Hedgemann and Walter Kohler's relationship became strained and Hedgemann and Peets left in the early years of the project. The community continued to expand and in 1925 the Olmsted Brothers firm contracted with Kohler to design two more neighborhoods. The planning was costly with houses selling for $5,000 to $12,000, often out of the reach of an average worker.

The Kohler Company had a reputation of benevolence to it workers through its garden community and progressive benefits packages, but several volatile strikes altered the public's perception of Kohler. A strike in 1954 lasted over five years and was one of the longest strikes in the country's history. In 1965 the U.S. Circuit Court of Appeals upheld the National Labor Relations ruling that found Kohler guilty of unfair labor practices.

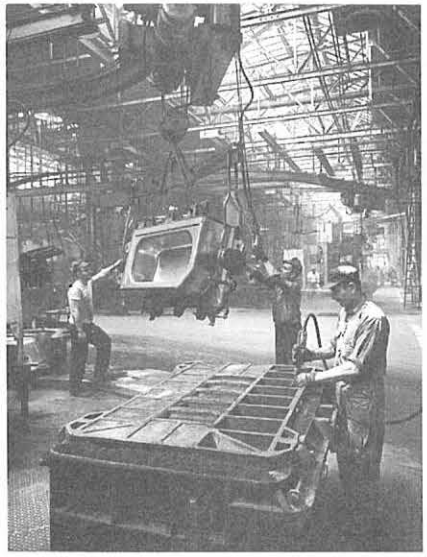

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Photo courtesy of
Kohler Co. Corporate Archives

Erin C. Timms

LAKE PARK ARCH BRIDGES

LAKE PARK. MILWAUKEE, WISCONSIN

Milwaukee's historic Lake Park, designed by Frederick Law Olmsted in the 1890s, features four arch bridges along the park's original carriage road and a fifth arch for pedestrians. The Lake Park Footbridge is among the earliest reinforced-concrete rib-arch bridges in the U.S. Completed in 1906 and designed by Wisconsin engineer F. E. Turneaure (1866-1951) and Ferry & Clas Architects, the bridge has an overall length of 216 ft. with a 118-ft. span and 18-ft. rise. The two 12 -in. by 54-in. ribs, 12 ft. apart in the clear, are reinforced with Kahn-patent trussed bars and are connected by cross walls, struts, and lateral bracing which, together with pierced spandrel walls, reduce overall structural weight. The circle, teardrop, and triangle openings in the spandrel walls provide an unusual aesthetic effect. The deck carries a pedestrian walkway across a 50-ft.-deep ravine.

Photo courtesy of Mead & Hunt

The original reason for using a new rib-arch design is unknown, but it might have been inspired by a reinforced-concrete rib-arch bridge built in 1905 in an Illinois park that was declared at the time to be the first known example of the type (*Engineering News*, Sept. 21, 1905). In his 1911 *History of Bridge Engineering*, Henry G. Tyrrell included a description and plan of the Lake Park Footbridge, stating that "Ribbed arches were not used to any great extent in America previous to the erection of the one in Lake Park...."

Also in Lake Park is a rare brick-arch bridge built in 1893 as part of Olmsted's plans. It is one of America's most prominent ornamental park bridges and Wisconsin's only remaining example of a high-style masonry arch bridge, according to HAER documentation. It also represents Milwaukee's brick industry, which was nationally significant in the nineteenth century.

Designed in the Renaissance Revival style by the German-educated Milwaukee engineer Oscar Sanne, the 36-ft. span is constructed of hard sewer brick with brown face-brick, rock-faced limestone abutments, and terra cotta railings, medallions, quoins, and pilasters. The deteriorated west railing was replaced with a pre-cast concrete replica in 1984.

Sanne also designed the park's three other major bridges: the Lion's Bridges, a pair of steel arches spanning two adjacent ravines that were built in 1896-97 and narrowed in 1964 when the carriage road was closed to vehicular traffic; and an 1893 steel arch, now supported by new structural steel girders with the outer spandrel walls retained in a non-structural role.

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Bob Frame

LAKEFRONT BREWERY

1872 N. Commerce Street. Milwaukee, Wisconsin

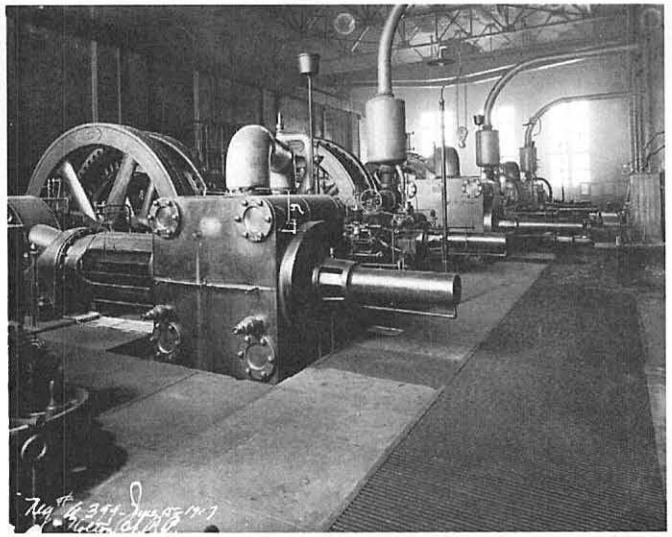
This contemporary microbrewery, owned by Russ and Jim Klisch, began operations elsewhere in Milwaukee in 1987, and only recently moved to North Commerce Street. In 1999 Lakefront acquired German brew kettles that, in one batch, allow the brewery to produce more beer than the 60 barrels the firm made in its entire first year of operation. Lakefront now distributes throughout Wisconsin and to parts of adjoining states. Originally it sold only to taverns within rolling distance of the brewery.

Its current building, constructed in 1890, was built adjacent to the Conrad Brothers Tannery facilities, which were located immediately west on contiguous properties. It appears likely that the building was originally used to provide steam to the tannery.

The building had brewing connections early on, however, in that it was owned by the Joseph Schlitz Brewing Company between 1907 and 1911 and sported a Schlitz saloon, probably in a now-gone adjacent building. Schlitz sold the property to the Ackley Land Company which later sold it to The Milwaukee Electric Railway and Light Company (TMER&LCo.) in 1917 with a condition that Schlitz would be permitted to occupy the saloon rent free until the brewing company could remove the building within one year.

While the land was owned by Ackley, that company associated with the Commonwealth Power Company and the Continental Realty for "conducting of the business of furnishing heat, light or power in the City of Milwaukee." An early plat map shows the building as "the Continental Realty Company Power Plant" and indicates that it ran two 1,000 kilowatt generators and one 300 kilowatt generator night and day, fueled with coal. The map shows four iron chimneys, extending 50 ft. above the roof (two additional boilers were added in 1911, which probably resulted in six chimneys).

The original boilers were Edgemoor water tube boilers, 185 psi pressure, rated at 500 hp. The original engines were Allis-Chalmers horizontal reciprocating engines. In 1911 a 3,000 kilowatt Allis-Chalmers Parsons-type condensing turbine was installed – apparently replacing the steam engines.



After the building was acquired by TMER&LCo. in 1917, along with "all assets of every nature and description of the Commonwealth Power Company," it became known as the Holton Street Power Plant. The plant was shut down in 1920, perhaps when the Lakeside Power Plant in St. Francis went into operation.

Between 1942 and 1947, the building was leased to the Allis-Chalmers Company, possibly for steam turbine testing. The building was remodeled in 1952 and used by the Wisconsin Electric Power Company (which had formerly been TMER&LCo and is now doing business as We Energies) as the headquarters for its underground electrical operations and was known as Holton Building. It was sold in 1976.

Photo courtesy of Tom Fehring

Susan Appel & Tom Fehring

MARSHALL BUILDING

E. Buffalo and N. Water Streets. Milwaukee, Wisconsin

Early reinforced concrete floors such as the Ransome, Hennebique, and Kahn systems mimicked wood and steel floor construction by using cast concrete girders and beams to support the floor slabs, which acted in flexure in one direction or in "one-way" action. The term "flat slab" refers to a reinforced concrete floor that acts in flexure in two directions or in "two-way" action. Concrete flat slabs on separate iron columns were built by George M. Hill between 1899 and 1901 for buildings for the Central Railroad of New Jersey near Elizabethport. A patent for a concrete flat slab floor on separate iron columns was awarded to Orlando Norcross in 1902 (No. 698,542), however, it is uncertain whether the Norcross system was ever applied to an entire building.

Claude Allen Porter Turner introduced a monolithic concrete column and flat slab system in 1905 that resulted in a rapid, widespread adoption of reinforced concrete flat slab floors in the U.S. C.A.P. Turner disclosed his flat slab system in the October 12, 1905 *Engineering News*. The central features of his design were four bands of flexural steel and a substantial steel "shear head" to resist the large shears in the slab near the columns. The shear head was a truncated shallow cone with a diameter approximately one-half the span, fabricated with large radial and circumferential reinforcing bars. The shear head was completely contained within the thickness of the slab. Turner promoted his design by using the term "mushroom" to denote both the shear head and his system; the term was never intended to refer to the small column capital.

Turner first used his flat slab system for the Johnson-Bovey Building (since razed) in Minneapolis in 1906 which led directly to the commission to design a warehouse for John Hoffman and Sons in Milwaukee. This 1906 warehouse, now called the Marshall Building, is the oldest extant reinforced concrete flat slab structure in the world. The original building had five stories; a sixth was added in 1910-11. Typical bays are 17 ft. by 16 ft., 8 in. and the slab thickness is 8½ in. Cast iron forms, which were adaptable for a range of column sizes, were used for the column capitals. Turner performed a load test of the flat slab floor. A distributed load of 1000 lbs./ft.^{2} (!) was placed on one bay. The observed maximum vertical deflection was 7/16 in. Images of the Hoffman warehouse and the load test results were published in the British publication *Concrete and Constructional Engineering* in 1907, introducing the mushroom system to European engineers. Robert Maillart's Giesshübel warehouse, built in Zurich in 1910, is considered to be the first European flat slab structure.

The economic advantages of flat slab floors were compelling: form work was minimized, floor framing depths were reduced, and lighting and finishing were simplified. The success of Turner's system brought him an avalanche of work. In a remarkable article in the February 18, 1909 issue of *Engineering News*, he stated: "...the writer has been associated in the erection of over 400 acres of floor built without ribs or beams, scattered from Portland, Me., to Portland Ore., in the United States and from Regina, Saskatchewan, in the north to Melbourne, Australia, in the south."

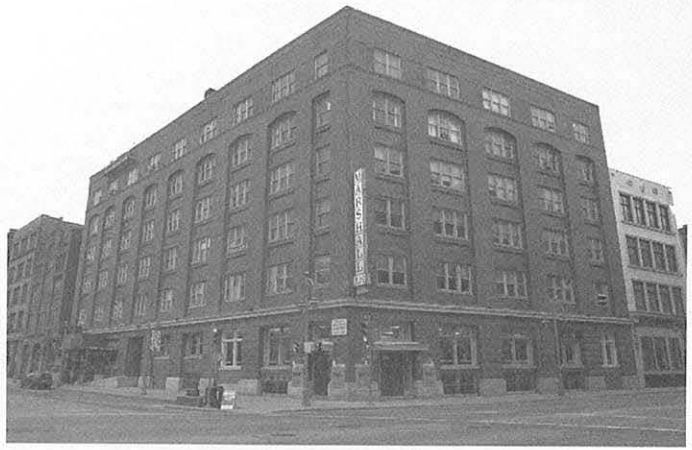


Photo courtesy of Steven Reyer

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Gasparini, D. A. "Contributions of C.A.P. Turner to Development of Reinforced Concrete Flat Slabs 1905-1909." *Journal of Structural Engineering* 128, No.10 (October 2002): 1243-1252.

MILLER BREWING COMPANY

4000 W. State Street. Milwaukee, Wisconsin

Miller Brewing Company began as the Plank Road Brewery, founded about 1850 by Charles and Lorenz Best, sons of Jacob Best, patriarch of the Best (later Pabst) brewery. The Bests sold out to Frederick Miller in 1855. Miller had run a royal brewery in his native Germany, but emigrated after losing his wife and seven children, and in response to political turmoil in Germany. He steadily expanded the brewery and its lagering caves, dug by hand and eventually extending 600 ft. underground; these were abandoned in 1906, replaced by the artificial refrigeration that Miller began using in the 1880s. By the mid-1880s, Miller distributed his beer nationally, expanded the Milwaukee brewery over six blocks, and started bottling. Such growth led to Miller's employing Fred W. Wolf, Chicago brewery architect, to rebuild his Milwaukee brewery (its facade, inscribed 1886, is still visible along State Street), along with a second brewery in Bismarck, Dakota Territory. Now the fourth largest of nine Milwaukee breweries, the Miller firm incorporated as the Frederick Miller Brewing Company early in 1888, just months before Miller's death. Carried on by Miller's sons, the brewer built continuously until Prohibition, adding a dozen buildings between 1888 and 1920. Despite expanding production to 650,000 barrels per year, Miller hardly approached Pabst and Schlitz at Prohibition.

During Prohibition, which Miller survived by selling near beer, malt syrups, and soda water, two of Fred Miller's daughters were instrumental in running the firm. At Repeal Clara Miller was vice-president, and Elsie Miller John was secretary-treasurer; Elsie then served as president 1938 to 1946, her daughter Lorraine as vice-president and treasurer later. In the mid-1940s, under another Fred Miller, grandson of the founder, the brewery began a period of tremendous growth, adding $12.5 million in new buildings, doubling production twice, and creating a totally modern plant by its centennial in 1955. It rapidly rose from 20th to 9th largest in the nation. In the later 1950s and 1960s, Miller acquired other plants to ease shipping costs and to avoid strikes, absorbing the former A. Gettelman Brewing Co. in 1961. That plant, just west of the Miller plant, is now dubbed the "Plank Road Brewery", the original name for the Miller plant when first established by Charles Best.

Miller remained in family hands until 1966, when it was taken over by W. R. Grace & Co., which in 1969 sold it to Philip Morris. In 2002 the Miller Brewing Co. was bought by South African Breweries PLC, now known as SABMiller PLC, which in 2003 was the world's second largest brewer. The only operating Milwaukee brewery with roots stretching back to the 19th century, Miller now distributes its own products, as well as such international brands as Pilsner Urquell (Czech Republic), Peroni (Italy), and Foster's (Australia).

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Photo courtesy of Susan Appel

Susan Appel

MILWAUKEE CYLINDER

5877 S. Pennsylvania Avenue. Cudahy, Wisconsin

Milwaukee Cylinder currently produces a full line of NFPA cylinders (the National Fluid Power Association sets standards for this field) to fit most cylinder applications. It also offers experience in the design and manufacture of custom cylinders, both hydraulic and pneumatic, which call for special operating or design characteristics.

Milwaukee Cylinder evolved from a job shop named L & M Machine Company, founded in 1956, into a cylinder business that manufactured square head tie rod cylinders. These are often used as actuators to control mechanical equipment or to provide linear reciprocating motion in assembly line machinery and operations.

In 1967 Milwaukee Cylinder Corporation was formed for the purpose of buying L & M Machine Company with James E. Mohrhauser as President. In 1969 Milwaukee Cylinder bought a controlling interest in the Plastics Corporation of America. Plastics Corporation of America was dissolved in 1970 and Versa Technologies Inc. (Versa/Tek) was formed out of Milwaukee Cylinder, Moxness Products Inc. of Racine, Wisconsin, a maker of molded and extruded silicone and synthetic rubber parts, and Stearns Manufacturing Company in St. Cloud, Minnesota, which had started making frost shields for automobile windows and moved into products for other outdoor activities, eventually building a strong line of personal flotation devices. Stearns was spun off as a separate corporation in 1977 due to its consumer orientation. Milwaukee Cylinder's and Moxness' focus on manufacturing concerns made them a better fit with each other.

In about 1980 Versa/Tek acquired the Power Gear product line from the defunct Central Hydraulics of Dubuque, Iowa, and purchased Eder Industries of Oak Creek, Wisconsin, a provider of electronics manufacturing services, such as inventory control, in 1996. In 1997 Versa/Tek itself was acquired by Applied Power of Butler, Wisconsin, a company that began as American Grinder and Manufacturing in 1910. Applied Power separated its industrial and electronics divisions and re-organized its industrial segment under the name Actuant Corporation, the current parent company of Milwaukee Cylinder.

Photo courtesy of Milwaukee Cylinder

MILWAUKEE SOLVAY COKE CO.

311 E. Greenfield Avenue. Milwaukee, Wisconsin

The former site of the Milwaukee Solvay Coke Company on the Kinnickinnic River has been fascinating passing Amtrak passengers for years. It became even more intriguing when used as a yard by the Wisconsin Wrecking Company—coal cars were turned upside down and topped with barbed wire for fencing and cranes towered over the derelict blackened hulks of the coke ovens. The 45-acre site is now undergoing an environmental cleanup overseen by the U.S. Environmental Protection Agency, and much of what remained is being demolished in preparation for redevelopment.

The coke works has a tangled ownership history that begins with Armin Schlesinger of the Schlesinger Interests who incorporated the Milwaukee Coke and Gas Company on December 9, 1902. In 1905 the company constructed a plant and supplied Solvay gas under contract to the Milwaukee Gas Light Company which supplied gas for public use. Through the early 1920s Milwaukee Coke and Gas was operated as a subsidiary of the Newport Company, also controlled by the Schlesinger Interests. The Koppers Company, a Chicago-based coke and manufactured gas conglomerate, acquired Milwaukee Coke and Gas in the mid-1920s and changed its name to Milwaukee Solvay Coke Company in 1942. In 1947 the company was purchased by its client, the Milwaukee Gas Light Company. The utility switched to the use of natural gas in 1949, although Milwaukee Solvay continued to produce manufactured gas in case of an interruption in the natural gas supply. Pickands, Mather and Company began operating Milwaukee Solvay in 1973. Pickands, Mather, an iron mining and shipping company, had served as sales agents and shippers of Milwaukee Solvay's products since 1911.

The works of Milwaukee Solvay Coke Company was closed in 1983. During its 80 years of operation, the company produced metallurgical coke for use in steel production, foundry coke for use in castings manufacture, and various byproducts, such as coal gas and coal tar. Coke is the carbon residue of coal that is burned slowly with little air to release volatile compounds, which can be condensed for illuminating gas and other uses. At its peak, the company operated 200 coke ovens, employed 370 workers, and conducted operations around the clock.

Thomas Short, the current owner and developer of the site, purchased it from Cleveland-Cliffs, Inc., an iron mining corporation, which had purchased Pickands, Mather. The original facilities of the coke works have been largely demolished and much of the environmental remediation is reportedly complete at this writing. Many of the original compressor engines remain on their foundations, but will eventually be removed, possibly to museum settings. The walls of the compressor house that surrounded them are already gone. An extant engineering laboratory still contains testing equipment and hazardous materials and will be torn down. The plant's original administration building still stands on Greenfield Avenue and is likely to be incorporated into the future development, which is to include condominiums, senior citizen housing, a marina, and driving range.

Photo courtesy of Tom Fehring

Mary Habstritt

PABST BREWING COMPANY

917 W. Juneau Avenue. Milwaukee, Wisconsin

Milwaukee's largest pre-Prohibition brewery began small. Best & Company's 1844 Empire Brewery (German-born Jacob Best and four sons) initially produced only 300 barrels per year. Significantly, it also brewed the city's first lager in 1851. By 1860 Philip Best was sole owner, producing more than 7,200 barrels. Ambitious, he expanded the brewery, exporting beer first to Chicago, then partnering with son-in-law Frederick Pabst, whose extraordinary business abilities blossomed at the brewery. When Best retired in 1865, Pabst and another son-in-law, Emil Schandein, took over. Unsatisfied with a then-remarkable 11,000 barrels per year, in 1868 they purchased the South Side Brewery as a second plant. Production jumped to over 37,000 barrels in 1870, and then to more than 100,000 barrels in 1873, when the firm incorporated as the Philip Best Brewing Company (capitalization $300,000).

Architecturally and technologically, the 1870s Empire brewery grew dramatically. Like Blatz, Best began bottling in 1875. By 1877 two-thirds of its business lay beyond Milwaukee, helped by two branches in Chicago, others in New York and Philadelphia. Among the first American brewers to use artificial refrigeration, Best also seized on other 1870s improvements. An 1879 fire destroyed several buildings, but provided opportunity to build more grandly: office building, boiler house with Corliss engine, and architect Charles Hoffman's great malt house. Cited as the world's largest, the malt house, with its pneumatic malting and self-turning and -dumping kilns, evidenced increasingly technological and scientific approaches to brewing.

Constant experimentation put Best on the cutting edge of the industry. Already called the largest U.S. lager brewer by 1880, its new Empire brew house (1885-86, Hoffman) pushed capacity to one million barrels per year. Operations consolidated there and the South Side Brewery was abandoned.

Reorganized in 1889, the new Pabst Brewing Company (capitalization $4 million), produced over 585,000 barrels and nearly 14 million bottles. Depots, branches, hotels, and entertainment places created demand nationwide and internationally. In 1892 the brew house's three great kettles became six, brewing capacity spiking to two million barrels per year, and Pabst absorbed the burned-out Falk, Jung & Borchert Brewing Company. The firms' combined sales exceeded one million barrels for the first time anywhere, Pabst's capitalization soaring to $10 million. Of this same period is architect George Ferry's luxurious Frederick Pabst Mansion (2000 W. Wisconsin Avenue), extended with a conservatory which originally served as the brewery's pavilion for Chicago's World's Columbian Exposition. After Fred Pabst's death in 1904, his mansion became the residence of the city's Archbishop, the pavilion his chapel.

Under Pabst's sons the brewery expanded until Prohibition, their prudent experiments with non-alcoholic beers sustaining it, along with soft drinks and cheese. Post-Repeal, Pabst rebounded, buoyed by additional plants (Peoria, Newark, Los Angeles) and was still the third largest American brewery (behind Anheuser-Busch and Miller) as late as 1975. Then management problems, intense competition, and industry consolidations weakened it steadily into the 1980s, and Pabst fell into other hands, closing in 1996. Since 2000 extensive plans have sought to renovate the former Empire brewery as a vibrant mixed-use complex, but recent revisions to the plans now threaten many buildings. Although the brewery is a local historic district and listed on the National Register of Historic Places, what will happen here remains unclear.

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Cochran, T. C. *The Pabst Brewing Company: The History of an American Business.* New York: New York University Press, 1948.

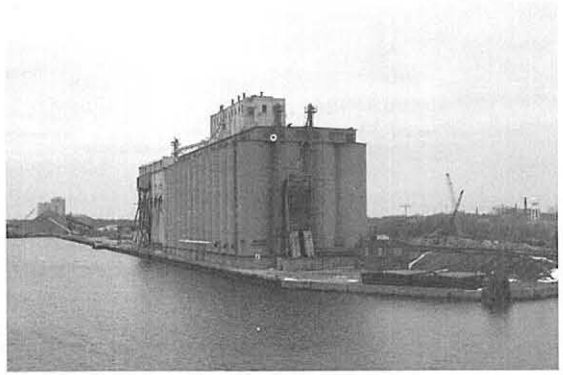
Photo courtesy of Susan Appel

Susan Appel

PORT OF MILWAUKEE

2323 S. Lincoln Memorial Drive, Milwaukee, Wisconsin

The first trading vessel called at the new village of Milwaukee in 1832. The confluence of the Milwaukee, and Menomonee and Kinnickinnic Rivers that flow into it, had provided access to the interior from Lake Michigan for fur traders. Settlers later recognized its potential as a port and until the advent of the railroads in 1850, the Great Lakes offered Milwaukee its only communication with the world.



The number of arriving ships rose from 82 in 1835 to nearly 1,000 in 1845. The first wheat was shipped out in the early 1840s with schooners carrying the grain overseas via the St. Lawrence River. The rise of that trade was an impetus for harbor improvements. The natural harbor at the Milwaukee River south of Jones Island provided scant protection when gales blew and the long private piers that were extended into the lake near Clybourn (then Huron) Street were dangerously exposed to storms.

An inner harbor in the Milwaukee River was the obvious solution and plans for a straight cut through the sandbar at its mouth to deep water just inside seemed logical. The federal government under President John Tyler authorized funds in 1843, but Army engineers dredged a channel and built piers at the existing mouth instead of pursuing the straight cut. Work on the project resumed and in 1857 the new harbor entrance was completed as originally conceived.

Shipping disasters along the shore of Lake Michigan led Congress to authorize construction of a "Harbor of Refuge," a breakwater-protected outer harbor in 1881. This concept was pioneered by Britain and France in the early 19th century to shelter their shipping from coastal storms and each other's navies.

With the rivers becoming increasingly crowded in 1900 the mayor asked the Corps to construct deep water docks and terminals outside of Jones Island, however the Corps' opposition to the plan was supported by the Secretary of War. There followed many years of proposals and counterproposals including a recommendation by a special committee of the Common Council to purchase Jones Island, which was defeated, and the creation of a Harbor Commission which was declared illegal. A new Harbor Commission was formed and convinced the city's Common Council in 1913 to authorize funds for the purchase of Jones Island for waterfront terminals while the Sewerage Commission got monies to purchase the north end for a new disposal plant.

In 1920 a new Board of Harbor Commissioners was created. Projects that went forward in the following decade included ceding of property by the Illinois Steel Company for rail connections, building new anchorages, and filling for construction of a carferry terminal. The new harbor constructed by the Corps of Engineers consists of a mile of breakwaters built on timber cribbing 600 ft. out from the shore.

The port now consists of 16 berths capable of taking the maximum Seaway vessel with dimensions of 740 ft. long, 78 ft. beam, and 26 ft. draft. Over 300,000 square ft. of warehouses for steel and general cargoes, storage domes that can hold 50,000 tons of dry bulk materials and 300,000 barrels of liquid bulk storage are provided. Intermodal connections are supplied by the Canadian Pacific/Soo Line and the Union Pacific railroads. Through inland river connections, barges can reach the Gulf coast in 30 days. In the past two years the port handled more than three million tons of cargo.

Photo courtesy of
Eric Bonow

PORT WASHINGTON LIGHT STATION

311 JOHNSON STREET. PORT WASHINGTON, WISCONSIN

Port Washington's first coastal lighthouse was constructed on the present site in 1849. The keeper's dwelling and freestanding light were of masonry construction and the lantern housed a 14-in. reflector and five fixed lamps. In 1856 this lighthouse was refitted with a sixth-order lens.

In 1860 the freestanding tower was demolished and the dwelling rebuilt, incorporating one or more original exterior walls into the new dwelling and lighthouse, creating a single structure that served the dual function of housing and navigational aid. This style of Great Lakes coastal or shore lighthouse was utilized extensively from the late 1850s to about 1870. Site location and accessibility, importance to navigation, and available building materials created similar yet distinct structures.

The Port Washington 1860 Light Station is built of cream city brick. The interior wood framing uses mortise and tenon joints. The tower and lantern support system begins in the basement, with three of the original four brick pillars still in existence. Eight-by-eight-in. cross members are mortared into these pillars and the front foundation. Bearing walls serve as support on the first and second floors. In the attic 8-in. beams create a cradle of cross beams and vertical posts that extend upward 14 ft. to support the parapet and the wood, cast iron, and copper nine-sided lantern. A sixth-order Fresnel lens was to be used in the new lantern but it is not known if a sixth-order was ever installed. It is clear that in later years fourth-order Fresnel lenses were in use at the station

This lighthouse served as an active aid to navigation from 1860 to 1903. The city's first pierhead light was constructed in 1889, marking the entrance to what was the first completely artificial harbor on the Great Lakes, dug in 1870. This early harbor project was a navigational nightmare and the U.S. Army Corps of Engineers spent the next 25 years trying to improve a poorly conceived project. From 1889 to 1903 the lightkeeper and a part-time assistant manned both lights. From 1903 to 1934 the wood pierhead light was the city's sole functioning beacon.

1930 marked the beginning of great changes to Port Washington's lakefront. During the next five years the U. S. Light House Service (USLHS), the Corps of Engineers, the Works Progress Administration (WPA), and The Milwaukee Electric Railway and Light Company (TMER&LCo.) worked side by side as a new outer harbor was created. The work included building a state-of-the-art coal-fired power plant, coal bridge and docking facilities; converting the 1860 lighthouse into a duplex, sans tower and lantern; and erecting an Art Deco lighthouse on the north pier and candlestick light on the south pier.

In the fall of 2000 the Port Washington Historical Society, leasing the 1860 duplex from the City as a local history museum, embarked on a partial restoration and re-creation of the lighthouse with a most unique partner, the Grand Duchy of Luxembourg. Under the watchful eyes of the National Park Service, which retains oversight of this National Register site, the State Historic Preservation Office, and state and local building inspectors, volunteers and paid contractors gutted over half the building and reconfigured the interior to the 1860 floor plan. In Luxembourg, craftsmen built the replacement tower and lantern, eventually accompanying it to Port Washington for installation.

For Further Reading:

Hyde, Charles K. *The Northern Lights: Lighthouses of the Upper Great Lakes.* Detroit: Wayne State University Press, 1995.

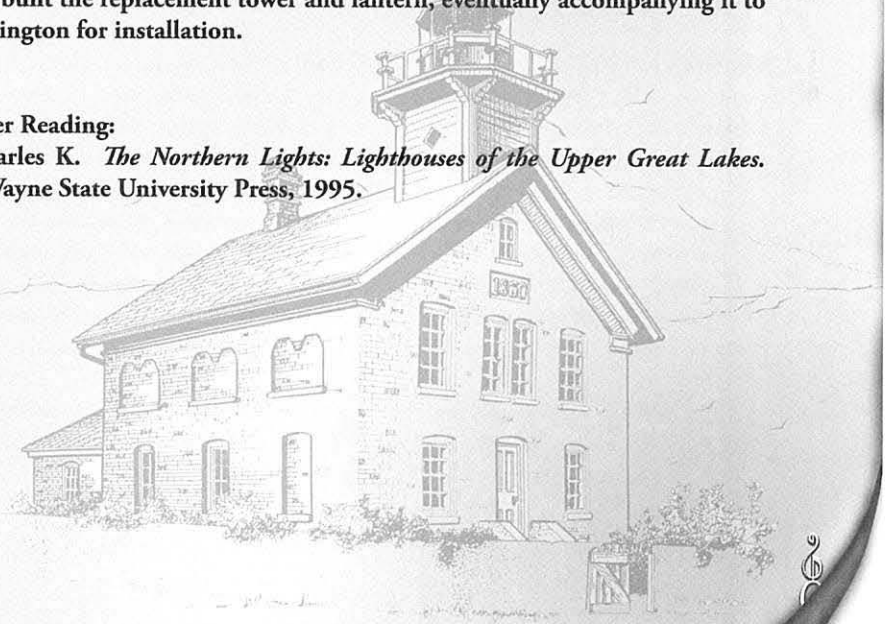
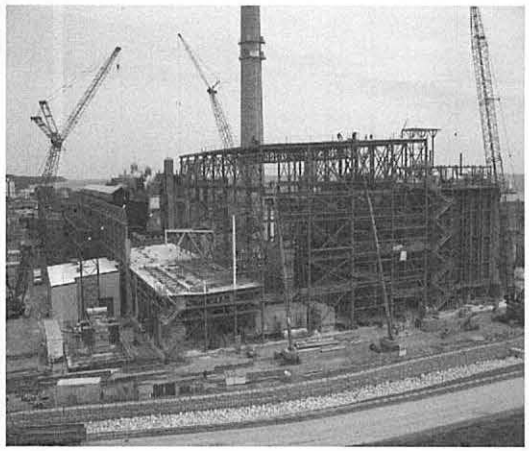


Photo courtesy of Port Washington Historical Society

Linda Nenn

PORT WASHINGTON POWER PLANT

146 S. Wisconsin Street. Port Washington, Wisconsin



The Port Washington Power Plant of Wisconsin Electric was the most thermally efficient steam power plant in the world for many years following its initial operation. Its design reflected the cumulative experience of the utility's engineers in burning pulverized coal at the Oneida Street Plant (later known as the East Wells Street Power Plant) and the Lakeside Power Plant in St. Francis. Both the Oneida Street and the Port Washington power plants were declared Historic Mechanical Engineering Landmarks by the American Society of Mechanical Engineers in 1980.

Construction on the Port Washington Power Plant began on May 26, 1930 but took more than five years to complete due to the Depression. The more notable achievements incorporated into the Port Washington plant design included enhancements in the burning of pulverized coal, the successful use of 1,200-pound-pressure steam and the introduction of radiant superheating surfaces into the furnace. One of the most important improvements made was the design of the unit itself. There was only one boiler for the single turbine-generator, along with a single set of transformers, one 132,000-volt transmission line and one set of auxiliaries. The plant designers determined that simplification of the plant's design through this unitized arrangement would simplify its operation.

In 1931 construction began on what was then the largest high-pressure boiler ever built—a Combustion Engineering unit with a capacity of 690,000 pounds of steam an hour and a design pressure of 1,390 pounds per sq. in. The lower furnace was shielded by a water screen, another company innovation developed at East Wells. Steam temperatures of 825 degrees Fahrenheit at the turbine throttle and the use of a reheat cycle conserved fuel by generating a given electrical output with lower heat input than any other unit in existence. In the turbine room was an 80,000 kilowatt tandem-compound Allis-Chalmers turbine, operating at 1,800 rpm. The generator was air-cooled and operated at 22,000 volts to reduce the amount of copper required for cable, switches and the bus structure. Transformers boosted that voltage to 138,000 volts. Finally, the cold water of Lake Michigan, used to condense the steam in the Rankine cycle, allowed maximum use of the available energy. The plant produced a kilowatt-hour of electricity with 10,800 BTUs energy input, at a time when the national average for electric power efficiency was well over 18,000 BTUs per kilowatt-hour. Eventually, five units were built bringing total plant capacity to 400 megawatts.

Record efficiency and increasing reliability continued at the plant until newer plants surpassed it in 1948. The success of the Port Washington plant, with its unitized design, accelerated adoption throughout the industry. As testament to its success, the first unit continued in operation in its original configuration for almost 70 years, until being shut down in 2004 to be repowered by the installation of combined cycle technology.

In 2003 construction started on the first of two natural gas-fueled, combined-cycle generating units. The first unit will go into service in the summer of 2005, followed by the second unit in 2008. The original service building, switch-house and -yard, circulating water tunnel, and the west wall of the turbine building are being maintained, although the original power generating equipment is being replaced in its entirety.

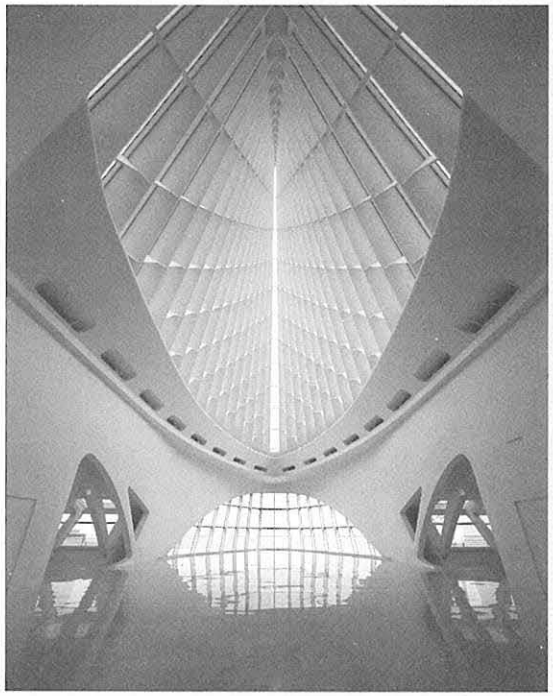
Photo courtesy of
Tom Fehring

Tom Fehring

QUADRACCI PAVILION

MILWAUKEE ART MUSEUM. 700 N. ART MUSEUM DRIVE. MILWAUKEE, WISCONSIN

The Milwaukee Art Museum opened its 142,050-sq.-ft. Quadracci Pavilion on May 4, 2001. The first Santiago Calatrava-designed building to be completed in the U. S., this expansion gave the museum new exhibition space, an enlarged museum store, and a 500-seat auditorium. The project also included renovation of existing space in the 1955-57 Eero Saarinen Building, now a modern classic, and its 1975 addition by architect David Kahler, as well as new public gardens designed by landscape architect Dan Kiley.



The pavilion is named for the project's major donors, Betty and Harry V. "Larry" Quadracci, founder of Quad/Graphics, the largest privately held printing company in the country. Larry was following in the footsteps of his father Harry R. Quadracci who began Standard Printing Company as a 16-year-old in 1930. The elder Quadracci sold Standard Printing to William A. Krueger and Larry joined that firm as a lawyer in 1962. Disenchanted with the company's adversarial relationship with its employees, he started his own company in Pewaukee, Wisconsin in 1971. Quad/Graphics has gone on to become the printer of such major newsweeklies as *Newsweek* and *People* and to serve more than 1,000 magazine, catalog, retail insert, and direct mail clients. It has expanded by re-using a plant in a former Kearney and Trecker machine shop in West Allis, Wisconsin, revitalizing a vacant printing plant in New Berlin, Wisconsin, and building new plants in The Rock, Georgia, and Martinsburg, West Virginia and an automated distribution facility in Sussex, Wisconsin.

The American Society of Civil Engineers recognized the pavilion with its Outstanding Civil Engineering Achievement Award in 2003 citing its free-form concrete arches, the 90-ft. cantilevered arch that supports the glass and steel reception hall, and its swooping concrete canopy, along with its visually arresting sunscreen and cable-stayed pedestrian bridge.

Santiago Calatrava is trained both as an architect and a civil engineer. His special interest in the mobility of structural forms is reflected in the design of the Burke Brise Soleil, a 110-ton movable wing-like sunscreen that can be raised and lowered to control light and temperature in the pavilion's vaulted glass-enclosed reception hall. Each wing of the sunscreen is comprised of 36 steel fins that vary in length from 26 to 105 ft. and are rigidly connected with steel spacers to work as one unit. The overall wingspan of 217 ft. rivals that of a Boeing 747-400. Twenty-two hydraulic actuators rotate each spine allowing the sunscreen to be fully closed or opened in three minutes.

The Reiman Pedestrian Bridge linking the pavilion directly to downtown Milwaukee and Lake Michigan is 252 ft. long. The suspension bridge is supported by a 192-ft.-long angled mast and 27 cables, the longest of which is 352 ft. Eighteen backstays attach the mast to the pavilion. The walkway is made up of 8-ft. steel sections welded into 16-ft. lengths that were bent to shape in order to minimize the number of joints. The deck surface is gray granite, rough-textured to provide safe footing for pedestrians being carried over the traffic of Lincoln Memorial Drive.

Photo courtesy of
Milwaukee Art Museum/
Timothy Horsley

Mary Habstritt

SCHLITZ BREWING COMPANY

N. (NOW. M. L. KING) THIRD STREET, BETWEEN WALNUT AND CHERRY. MILWAUKEE, WISCONSIN

The Schlitz Brewing Company began modestly in 1849, when German-born August Krug started brewing on Chestnut (now Juneau) Street to supply his restaurant. In 1850 Krug hired a young, but soon indispensable German, Joseph Schlitz as bookkeeper. Krug, being childless, was also strongly attached to his sister's children back in Germany. Between 1850 and 1882, all seven of her sons emigrated to Milwaukee, associating with the firm that evolved from Krug's. After Krug's death in 1856, Schlitz ran the brewery for Krug's widow, then bought it in 1858, marrying Mrs. Krug. He honored the bonds between August Krug and his nephews, the Uihleins, who inherited the brewery after Joseph Schlitz was lost at sea in 1875, developing it into a major industrial power.

In the mid-1860s the brewery's growth pushed its relocation to Third Street. Schlitz drew further strength from adversity following Chicago's Great Fire in 1871, Schlitz's trains of beer replaced the brews of burned-out Chicago producers, a gesture resulting in the firm's motto, "The Beer That Made Milwaukee Famous." Impressive growth led to the firm's 1874 incorporation as the Joseph Schlitz Brewing Company (Joseph Schlitz, president, with August Uihlein and his brothers serving as the other officers). With Schlitz's untimely death, control of the brewery passed to the able Uihleins and it boomed further. Its 1870 production of 8,700 barrels of beer soared to 160,000 barrels per year by 1880. In 1878 it had surpassed Best's Empire Brewery making Schlitz the largest single brewery in Milwaukee (if the second largest firm). Bottling from 1877, Schlitz soon shipped coast to coast and beyond, even to Germany by 1883. While running second to Best/Pabst, Schlitz's importance was inescapable. The two firms, the giants of Milwaukee, were both so well known worldwide in the 1890s that their products "became synonymous with Milwaukee."

Also growing from the 1870s was Schlitz's association with noted Chicago brewery architects Fred W. Wolf and Louis Lehle, who designed nearly every Schlitz building before Prohibition. Their striking, architecturally unified brewery plant featured walls of cream-colored brick above limestone, elegant details such as the 1884 cupola above Third Street, and a consistent Romanesque Revival style echoed in the 1890 office building by Milwaukee architect, Alfred B. Class. Dramatic growth, constant innovations, and additional new buildings continued until Prohibition cut them short in 1920.

Schlitz survived making malt syrups and alternative drinks, even candy (unsuccessfully), but the plant remained functional and ready to resume brewing. At Repeal in 1933, still in Uihlein hands, Schlitz quickly outstripped pre-Prohibition production, becoming the fourth largest American brewer in 1937, the second largest in 1943. New buildings at the Milwaukee plant followed World War II with production further spurred by breweries acquired elsewhere. In the 1960s, the family's hold on the firm's stock loosened, but they retained control. Fierce competition among Milwaukee brewers, however, weakened them all in the 1970s, and Schlitz closed in 1981. Acquired by the Stroh Brewing Company, the home plant was sold to developers in 1982. Since then, although substantial buildings have given way, other original structures have been effectively renovated and adapted as offices in the renamed Schlitz Park.

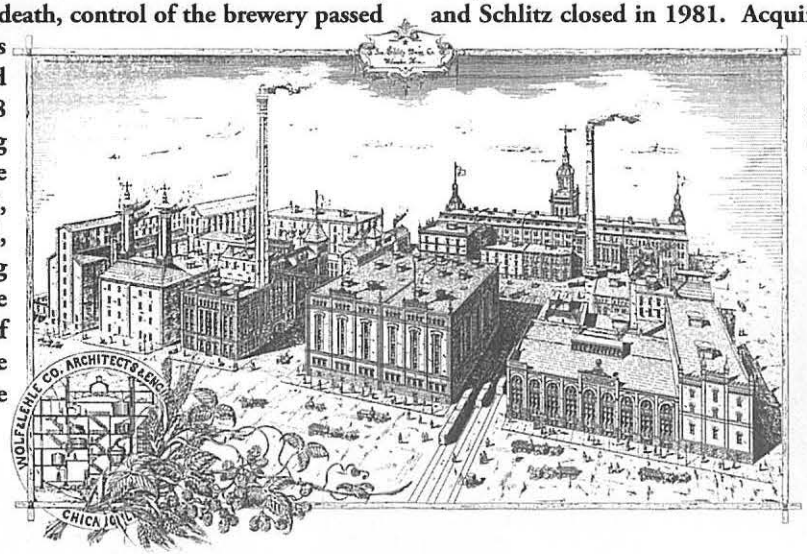


Photo courtesy of
Susan Appel

Susan Appel

SIMPLICITY MANUFACTURING INC.

500 N. Spring Street. Port Washington, Wisconsin

Simplicity's beginnings can be traced to Milwaukee where the Western Malleable and Gray Iron Manufacturing Company was established to produce gray iron castings in 1872. It later made gasoline-powered engines for the automobile industry under the Simplicity brand name. Western was purchased in 1911 by L. M. Turner, renamed Turner Manufacturing, and moved to Port Washington. Turner added farm tractors to its line of engines. The company borrowed heavily to fund expansion during World War I to meet the country's food production needs. It purchased raw materials at wartime prices, only to be left with costly inventories when prices fell after the war. In addition, Henry Ford entered the tractor market after the war, putting several competitors out of business. Turner went into receivership in 1920.

William J. Niederkorn was then Turner's sales manager. He had begun at the company as a bookkeeper in 1907. When Turner closed its doors, Niederkorn's ambition did not wane. He was approached with an idea for a portable cylinder boring and grinding machine for rebuilding automobile and truck engines. He put together the financing—boldly going back to the same investor he had talked into funding Turner's expansion—and had a local shop make ten machines to sell to service stations. When they proved successful, Simplicity Manufacturing Company was organized in 1922.

The company managed to carry on through the Depression with this popular product, but saw its market collapse when Detroit automakers began rebuilding and selling engines themselves. In 1937, Simplicity was approached by Montgomery Ward to produce a two-wheel walking garden tractor. An instant success, it could be fitted with a wide range of attachments, including a cultivator and plow. In 1939, a "sulky attachment" was introduced which converted the walker into a rudimentary riding garden mower.

World War II brought government restrictions on the number of tractors that could be produced so Simplicity made electric fence controllers and surface grinders. It resumed production of lawn and garden equipment just as the post-war development of the suburbs took hold. In 1955, Simplicity developed a snow throwing attachment for its walker. This led to a walk-behind rotary snowthrower with a 3.5 hp engine in 1961. Its first four-wheel riding tractor, the 700 Wonder-Boy was produced in 1959. The three-speed 19.5 hp PowrMax was introduced in 1972. Larger than a lawn tractor, but smaller than a farm tractor, it created a new industry category: the compact tractor.

Sales of outdoor power equipment peaked in the 1970s and dozens of companies, including Toro, John Deere, and Honda had entered the market. Simplicity looked at acquisitions as a way to expand and, between 1989 and 2002, purchased several companies that improved its market share. These included Tornado Products Company, manufacturer of stand-alone chippers and shredders; Ferris Industries, successful in commercial mowers; and Snapper, with its line of walk-behind mowers.

Simplicity also looked to new technology to lower production costs. Welding robots were added in the mid-1990s. A laser cutting machine, capable of cutting through steel sheets measuring four by eight ft. and as thick as three-quarters of an inch, was added in 1998. A 165-ton hydraulic press to bend the cut steel for tractor frames and lawnmower decks was also added. Previously, parts were cut with a punch press requiring a die to be fashioned for each individual part. The laser cutter can be programmed to cut parts without the need for dies and can continue to work unstaffed over weekends.

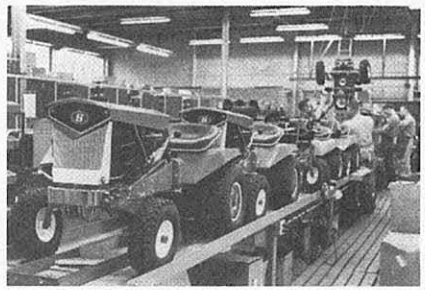


Photo courtesy of
Simplicity Manufacturing Inc.

For further reading:
The Story of William J. Niederkorn, prepared for the Ozaukee Historical Society and the W. J. Niederkorn Library, Port Washington, Wisconsin, in collaboration with Charles Larson, Judge of Ozaukee County, Branch No. 1, State of Wisconsin. Milwaukee: Marquette University Press, 1967.

Mary Habstritt

SIXTH STREET VIADUCT

MILWAUKEE, WISCONSIN

The award-winning Sixth Street Viaduct spans almost three-quarters of a mile from West Clybourn Street on the north to West Virginia Street on the south. It crosses over the Menomonee River and South Menomonee Canal, connecting downtown Milwaukee to the Menomonee River Valley in Milwaukee's near south side. The bridge was completed in 2002 and replaces a 1908 viaduct. It is Wisconsin's first cable-stayed bridge for vehicular traffic.

The bridge was designed by HNTB Corporation of Milwaukee and constructed by Zenith Tech Inc. of Waukesha and Lunda Construction Company of Black River Falls. The Milwaukee office of Long Beach, California-based Earth Tech Inc. served as the consulting engineers.

The viaduct includes a pair of double-leaf bascules that are fully automated and can be operated remotely from the Water Street Bridge house, a third of a mile downstream. The viaduct has a pair of two-way, post-tensioned, cable-stayed spans that are 574 and 665 ft. in length. The main spans are supported by a pair of 142-ft.-high inclined concrete pylons. The transverse width of the structures ranges from 81 to 96 ft. The viaduct is supported on over 50,000 ft. of piling with a large portion being high capacity, 12-in.-diameter, cast-in-place piles, some reaching 185-ton bearing. The north approach is a 270-ft., two-way, post-tensioned structure. The viaduct has four driving lanes, two bicycle lanes, and two sidewalks.

The viaduct received a Federal Highway Administration "Excellence in Highway Design Award" in 2004 and the National Steel Bridge Alliance 2003 Prize Bridge Award in the Movable Span category.

This project marked the Wisconsin Department of Transportation's first use of the design/build process, which allowed a mid-course change in the pylons. Originally, the design called for hollow pylons that were as tall as the cabling. The final design had solid, taller pylons, resulting in an $80,000 savings. The design/build process also shaved a year off the original construction schedule.

A new high performance concrete mix was created and used in all superstructures. Sacrificial microsilica overlays were used to surface the post-tensioned decks to permit future removal and resurfacing. A lightweight, high-performance concrete (HPC) was cantilevered onto the sides of the bascule spans for the sidewalks, which is the first use of glass fiber-reinforced polymer concrete on the deck of a movable bridge. The project also incorporates the state's first double-lane roundabout.

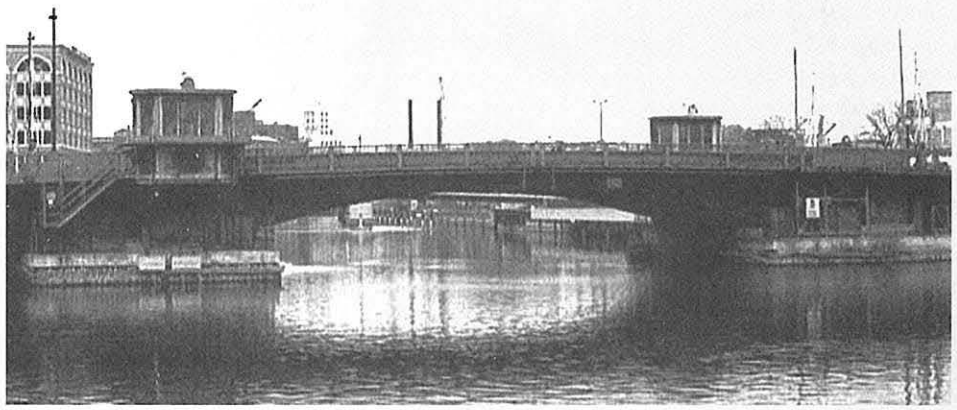
Photo courtesy of Mead & Hunt

Katy Holmer

STATE STREET BASCULE

STATE STREET AT MILWAUKEE RIVER. MILWAUKEE, WISCONSIN

The State Street Bascule Bridge is located in the northern end of Milwaukee's commercial district where it carries State Street over the Milwaukee River. The overall length is 271 ft. and the clear navigation channel is 90 ft. Constructed in 1924, it is the earliest Milwaukee Type bascule of the five surviving in the city (four are operating and one is locked in place).



The State Street bridge was modeled after the bascule prototype developed by the Milwaukee Bridge Company for Milwaukee's Muskego Avenue (Emmber Lane) Bascule Bridge in 1904. The Muskego Avenue Bridge has been replaced, but it was recorded to HAER standards and its key structural elements salvaged for future display. Commonly referred to as the "Milwaukee Type" bascule, this bridge type is characterized by movable leaves, each supported by built-up plate girders that pivot on simple trunnions riding in massive bearings. Concrete or iron counterweights are fixed to the girder ends and descend into concrete pits as the leaf is raised. Each leaf is raised and lowered by moving cast-steel segmental racks mounted on the underside of the girders, using electric motors, a reduction gear train, and pinions. The advantage of the Milwaukee Type over other bascule designs was in keeping the large counterweights, leaf superstructures, and operating mechanisms below the deck, out of sight, and out of the vehicular traffic area. Extending above the roadway are the operator's houses that contain the controls for operating the leaves.

After its successful use at Muskego Avenue, this technology was repeated in the 13 bascule spans built by the City of Milwaukee before World War II. The operator's houses, originally conceived as utilitarian boxes, received an architectural treatment for the first time in the State Street bridge. Recently restored to their original appearance, State Street's two operator's houses are wood-framed, hipped-roof structures, cantilevered on metal brackets. The roofs and walls are clad in copper, which has pressed Neoclassical panels.

Originally, each bascule leaf had a separate control requiring an operator in each house. In the 1970s, the controls were modified to allow simultaneous control of both leaves by a single operator. At the same time, the original AC motors and open-spur-gear machinery were replaced with a DC-driven system largely utilizing enclosed reduction gears.

The city plans to restore the State Street bridge and its operator's houses beginning in 2005.

For Further Reading:

Hess, Jeffrey A. and Robert M. Frame III. *Historic Highway Bridges in Wisconsin.* Volume 3, *Historical Survey of Wisconsin Movable Bridges.* Madison: Wisconsin Department of Transportation, 1996.

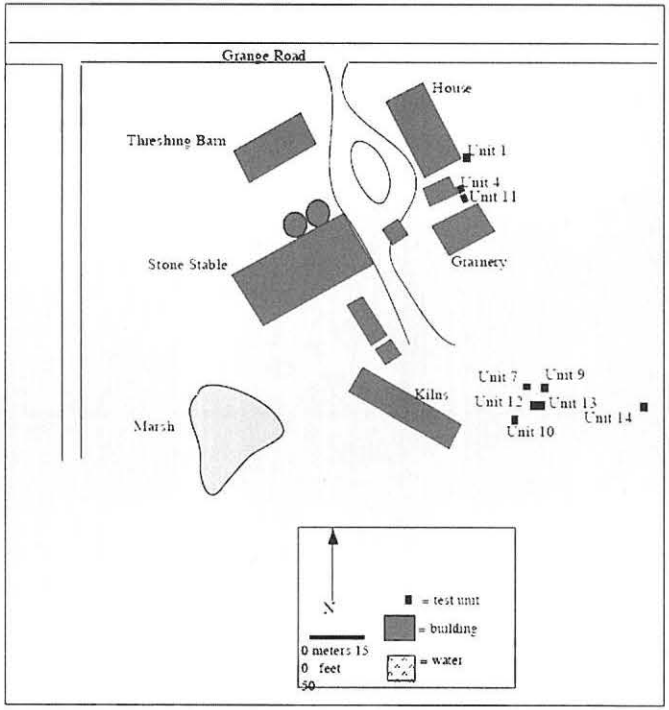
Photo courtesy of Mead & Hunt

Bob Frame

TRIMBORN FARM

8881 W. Grange Avenue. Greendale, Wisconsin

Werner Trimborn emigrated from Prussia in 1847 and after spending some years as a teamster and carter bought the site with his partner Jacob Kier in 1850. There was already a single lime kiln on the property dating from about 1847 and limestone bedrock that rose to the surface close at hand. The limestone could be sold in blocks for foundations and retaining walls, crushed for use in roads and railbeds, but it was especially useful if burned to make lime for mortar, plaster, and whitewash. By 1860 Trimborn was sole proprietor and this pioneer operation grew to 500 acres at its peak in the 1870s and was employing 40 people and producing 30,000 barrels of lime per year. It became the largest supplier of lime in southeastern Wisconsin and remained so through the turn of the century.



By 1900 Portland cement had come into wide use and demand for lime mortar declined. The Trimborn family sold off the farm in 1911 and operations on the property shifted to crop and dairy farming and horse boarding. In 1936 the property was acquired by the federal government as part of its Greenbelt towns project. The Resettlement Administration wished to demonstrate a new kind of suburban community planning and provide affordable homes to families and construction jobs to unemployed workers. When the village development opened in 1938, there were 572 residential units in 366 buildings.

The 7.5 acres comprising the heart of the Trimborn estate was preserved and became Milwaukee County's only historic park in 1980. The farm was listed on the National Register of Historic Places the same year. It is maintained by The Park People, a non-profit group, and the Milwaukee County Historical Society manages educational programming. In 1998 the Trimborn Farm Archaeology Project was begun to conduct an archeological investigation that would also serve as an educational outreach program under the supervision of archeologists from the University of Wisconsin-Milwaukee.

Nine original buildings still stand on the site, including the farmhouse, the granary, the threshing barn, the stone stable, and the lime kiln which all date from before 1876. The four independent side-by-side pot kilns are themselves faced with limestone and are lined with granite field stones. The exterior of the building and one kiln have been restored.

Limestone consists mostly of calcium carbonate ($CaCO_3$). When limestone is burned at high temperatures it releases carbon dioxide (CO_2) and yields lime (CaO) which is porous and easily crushed to powder. The local dolomitic limestone also contains magnesium ($CaMg(CO_3)_2$). To burn lime in these kilns, workers built a rack of alternating layers of wood and limestone and continued to charge the kiln with stone and fuel from the top. When the stone glowed a bluish white, it had become lime. The warm lime was raked out and separated from slag and ash and loaded into barrels for storage and distribution.

Photo courtesy of
University of Milwaukee
Anthropology Department

Mary Habstritt

WEST KILBOURN AVENUE BASCULE

KILBOURN AVENUE W. AT MILWAUKEE RIVER. DOWNTOWN MILWAUKEE

The West Kilbourn Avenue Bascule Bridge, completed in 1929, is the most architecturally complex and sophisticated of Milwaukee's surviving bascule bridges. Originally planned with two copper-clad operator's houses almost identical to the State Street Bascule Bridge, the Public Works Commissioner desired a grander statement for the avenue that would serve as the main thoroughfare to City Hall on the east. To this end, he selected a Neoclassical style executed in limestone, constituting a dramatic change from the State Street design. A 1940 history stated that "The bridge was designed along the ornamental lines of certain European spans rather than the type of bascule bridge previously built."

Technologically, the bridge is a Milwaukee Type bascule similar to the State Street Bascule Bridge and based on the 1904 Muskego Avenue prototype. It is a double-leaf, plate-girder, simple trunnion-type span. Each leaf has two pairs of built-up girders. Each girder pair shares a counterweight comprised of a concrete-filled metal-plate box that descends into a pit when the leaf is raised. The structure's overall length is approximately 250 ft., with a clear navigation channel of 100 ft.

The most prominent architectural feature is the design and symmetrical placement of the four identical two-story structures at the outside corners of the leaves. The northwest and southeast structures originally contained the controls for their respective leaves and were termed "operator's houses." The southwest and northeast buildings, included for architectural symmetry in the Neoclassical scheme, contained no equipment and were termed "pylons." All four are constructed of poured concrete with a Bedford limestone veneer. Since the conversion to single-operator status, the southeast house controls the operation of both leaves.

An innovation noted in 1929 was the use of grooved rubber blocks for deck paving, a technique previously used on Chicago bridges but not in Milwaukee. Similar rubber blocks were used as the sidewalk surface. The deck and sidewalks were replaced in 1974 with the present steel open-grid deck and the diamond-tread metal-plate sidewalks.

The operator's houses, like those on all of Milwaukee's early bascule bridges, had navigation signal balls riding on poles that were mounted on the house roofs. When the bascule was in the closed position, the ball was raised and visible to vessels. When the bridge was opened for river navigation the ball was lowered behind a section of roof cornice and not visible. Bells mounted on the operator's houses alerted motorists that the bridge was being opened.

Rehabilitation of the West Kilbourn Avenue Bascule Bridge is scheduled to begin in 2007.

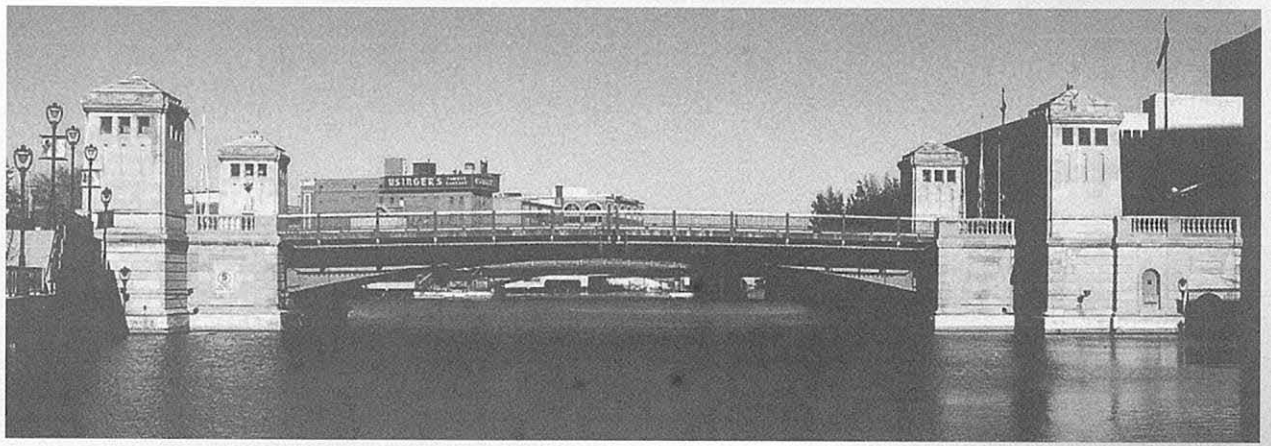


Photo courtesy of Mead & Hunt

Bob Frame

WEST ALLIS WORKS OF

WEST ALLIS, WISCONSIN

Allis-Chalmers had its beginning when Edward P. Allis, in 1861, purchased Decker and Seville, a millstone-manufacturing firm founded in 1847 in Milwaukee. E. P. Allis joined with three companies in 1901 including a merger with Fraser & Chalmers, which resulted in the company taking the name the Allis-Chalmers Company. This was followed almost immediately by the construction of a new, massive, scientifically designed plant on land at the west edge of Milwaukee, now known as the City of West Allis due to its location west of the original Allis works. Its chief engineer Edwin Reynolds was determined to avoid the inefficiency found in most plants of the day which had grown up in a haphazard manner. He and C. Edwin Search went to Europe to observe the latest factory planning and production techniques, and their findings were incorporated into the final construction.

The West Allis Works of Allis-Chalmers Manufacturing Company opened its doors in September 1902 when the foundry poured its first heat. The West Allis Works was so planned that all work, from blueprint to finished product, moved in one direction – eastward toward shipping. This plant, which was designed to eventually employ 10,000, was a model of 20th-century efficiency. By 1905 it provided 1.41 million sq. ft. of floor space, covered 113 acres, and employed more than 3,000 workers. It is doubtful whether any other plant in the United States at the time was better designed, tooled, and equipped for building heavy machinery.

Photo courtesy of
Tom Fehring

The plant was like a small city. Utility services required for the manufacturing complex were equal to those needed to supply a large community. There were 21 miles of railroad tracks and five miles of roadways in the plant's 160 acres. The complex included hospital units equipped to provide first aid, and a main hospital, which offered complex physical examinations supervised by full-time physicians. In addition, the company maintained a fire department, which was operated by trained members of the plant production force.

The West Allis Works was the largest steam engine production facility in the U.S. when it opened. Many of the large steam engines at that time drove electric dynamos, which were spreading the availability of electricity across the country. Once Allis-Chalmers shifted focus to the steam turbine, it built over 5,000 steam turbine-generators from 1904 to 1962. Many of these units are still active in power generation today. The manufacturing complex

ALLIS-CHALMERS

also produced farm and construction machinery, wheel and crawler tractors, hydro turbines, transformers, circuit breakers, metal-clad switchgear, pumps and military equipment (during the wars). It also played a significant role in providing equipment for the Manhattan Project.

Allis-Chalmers left the new steam turbine-generator business in 1962, only to re-enter it in 1970 under a new and separate company name, Allis-Chalmers Power Systems, Inc. The joint venture between Allis-Chalmers and Siemens Power Generation, manufactured all or part of nearly 20 fossil and nuclear steam turbine-generators between 400 and 1,300 megawatts. By 1974 the situation had changed to the point that actual manufacturing was transferred to Siemens in Germany, but repair services continued at the West Allis facility under the name A-C Equipment Services.

In 1991, Siemens purchased A-C Equipment Services. This acquisition combined the resources of both the original Allis-Chalmers and Siemens turbine-generator businesses back in West Allis. The Siemens name brought with it expertise in Siemens gas and steam turbines to add to a fast growing service business for General Electric and Westinghouse turbine generators. During February 1999 Siemens announced the closure of the West Allis facility along with others as a result of its acquisition and integration of the Westinghouse Fossil Power Generation Business Unit.

When Allis-Chalmers declared bankruptcy in the mid-1980s, significant portions of the massive complex were abandoned. In the decades since, the facilities have undergone a transformation—and the changes continue. At the same time that portions of the facility continued to be used for the manufacture of electric generating equipment, the southern part of the complex was becoming a retail center, with a successful shopping center. Some of the office buildings have been converted into educational space for several schools. Other parts of the complex have been converted into office space, including the Summit Place investment by Richard Carlson, a former Siemens executive who was responsible for its manufacturing business in West Allis.

A number of manufacturing companies now occupy portions of the original manufacturing space. One of these is ReGENco Services LLC which currently occupies the famous Allis-Chalmers main erecting bay where all A-C steam & hydroelectric turbines were manufactured. Since its inception in November 1999, ReGENco has provided service on over 30 Allis-Chalmers units. The company now offers complete maintenance, repair and overhaul services for utility and industrial power generation equipment, including steam and combustion turbines and generators, manufactured by any original equipment manufacturer, as well as manufacture of components.

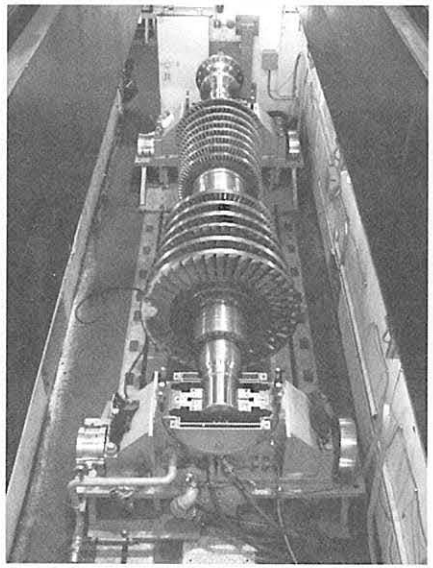


Photo courtesy of Tom Fehring

Tom Fehring

One of ReGENco's unique capabilities is a high-speed balance and overspeed facility using the Allis-Chalmers original balance pit, now refurbished. Such a facility is a critical element of ReGENco's operation because it helps to assure that the very heavy generator rotors that the company repairs are properly balanced before they are restored to service. Failure to properly balance the generator rotor can result in significant rotor and bearing vibration, which may result in mechanical damage and a costly forced outage. There are currently only six comparable facilities in the United States.

For Further Reading:

Peterson, Walter F. *An Industrial Heritage: the Allis-Chalmers Corporation.* Milwaukee: Milwaukee County Historical Society, 1978.