CHAPTER TWENTY-ONE

TOWARD MODERN ARCHITECTURE:

NEW TECHNOLOGIES AND THE ADVENT OF THE SKYSCRAPER, 1850–1900

While commercial and industrial building was not the sole agent active in the rise of modern architectural styles, it undoubtedly played a major role. The world of American business was sufficiently free and adventurous to try new things without being restricted to historical styles. Business, too, had its own demands—such as cost-effectiveness, expediency, and utilitarianism—with which it challenged architects and engineers. Yankee ingenuity in engineering and technology was often more important than a cultural élitism founded on Beaux-Arts theory and revived historic styles. Factories and railroad bridges demanded new solutions, and a new breed of engineer-builders arose to meet the need.

From 1870 to 1900, the American industrial-commercial-financial complex grew mighty, outdistancing the rest of the world. It is not surprising that this new force asserted itself in nearly every aspect of American culture, including architecture.

This was the period of the founding of Rockefeller's Standard Oil Company in 1870. Two years later, the mailorder house of Montgomery Ward published its first catalogue, and F. W. Woolworth opened his first dimestore in 1879. For railroads, this exciting era was inaugurated in 1870 with the arrival in New York City of the first through car from California. Meanwhile, Cornelius Vanderbilt, Jay Gould, and Daniel Drew fought for control of the New York Central and other expanding lines. Andrew Carnegie's steelmills were straining under capacity production, and in 1893 Henry Ford made his first automobile.

Examples of the new requirements imposed upon builders are James Buchanan Eads's steel arch bridge, the first of its kind, which spanned the Mississippi River at St. Louis in 1874; and the Brooklyn Bridge, which, completed in 1883, demonstrated the principle of the steel-cable suspension bridge. Then there was the rise of America's first skyscraper—the Home Insurance Company Building in Chicago in 1884—which towered to a height of ten stories, constructed of a steel frame instead of masonry; and thousands of other examples of railroad trestles and terminals, factories and mills, office buildings, department stores, and warehouses.

Other factors contributed to the building boom. The Great Fire of 1871 destroyed huge portions of Chicago. Combined with that city's emergence as a major financial and trade center, this created a need for an enormous number of commercial buildings. There were many indications of Chicago's growth. Culturally, the Art Institute was founded in 1879, the Symphony Orchestra was established in 1891, the University of Chicago dates from 1892, and the Field Museum of Natural History two years after that. Also in 1892, Chicago inaugurated an elevated railroad system for moving masses of people through the city with minimal interference to road traffic. This innovative engineering response to urban growth in size, population, and commercial activity further established Chicago as a center for exciting engineering projects.

American engineers were organized into professional societies during this period, following the lead of Great Britain's Institution of Civil Engineers, founded in 1818 for the dissemination of knowledge and maintenance of standards. The American Society of Civil Engineers was established in 1852, the American Society of Mechanical Engineers in 1880, and the Institute of Electrical and Electronics Engineers in 1884. College curricula began to reflect the need for specialized training. Some schools oriented their programs toward engineering, such as Purdue University in Lafayette, Indiana (opened 1874), and Lehigh University in Bethlehem, Pennsylvania (chartered 1866), where the great Bethlehem Steel Works were erected in 1873. The Massachusetts Institute of Technology was chartered in 1861, Georgia Institute of Technology opened in 1888, and California Institute of Technology was founded in 1891. The Cooper Union, established as an art and engineering school in New York City in 1859, was founded by Peter Cooper, the inventor and industrialist who built the Tom Thumb, the first successful railway locomotive in

America. In Chicago, the Armour Institute of Technology and the Lewis Institute of Technology were founded in 1892 and 1896 respectively (later to be merged in 1940 to form the Illinois Institute of Technology).

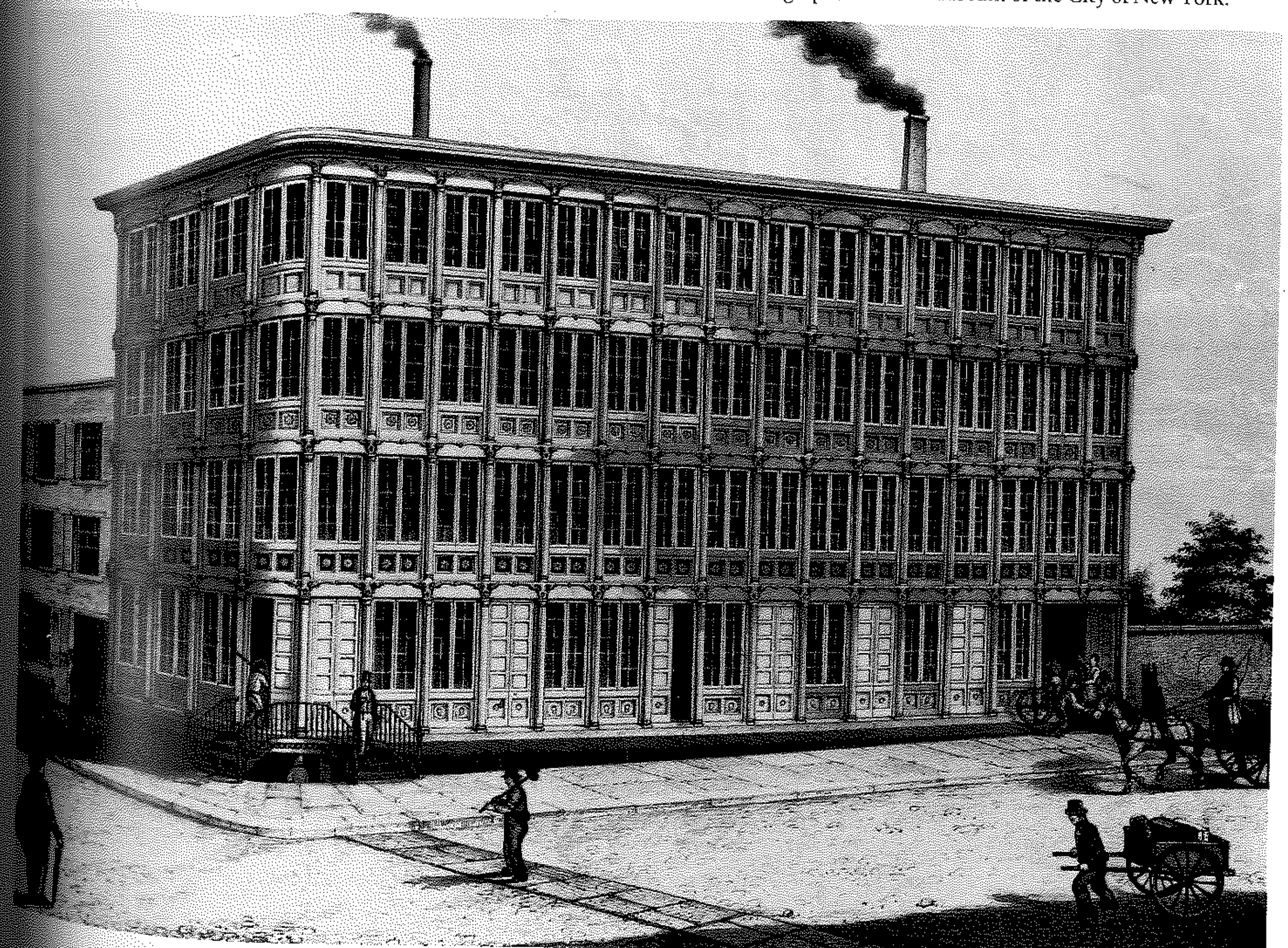
IRON FRAMES AND ELEVATORS

Technological advances such as the steel skeletal frame and the elevator now made it possible to build ever upward in the cities, where the square-footage costs of land ran high, and cost-effectiveness demanded the maximum number of floors to a given site. Necessity, financial considerations, and technology gave birth to the skyscraper. The industrial-commercial-financial complex set about with the engineer-builders to define a new set of aesthetics that grew directly out of the demands of the age.

A new architectural style was born in response to the modern world. The style had begun in industrialized England in the last quarter of the eighteenth century with cast-iron bridges. By the early nineteenth century, large, multistoried factories were being erected with cast-iron components in a skeletal system, and by the 1840s cast iron was being used for storefronts. In the mid-nineteenth century, however, many felt that iron used in a building disqualified it as architecture in the noblest sense. For example, John Ruskin's sensibilities were offended by the crassness of iron. In *Seven Lamps of Architecture* (1849) he declared that "architecture" does not admit iron, even as a hidden, constructive material. Although mid-century America tended to genuflect to Ruskin's theories, there were many who saw the practical possibilities of building with cast iron—even if they were as a group inventors, gadget-makers, mechanics, blacksmiths, foundrymen, and engineers, rather than architects.

The new way of building, dating from around 1850, was both faster and less expensive. It offered options that were not possible with either masonry (such as spanning great distances) or wood (which was combustible). Cast-iron trusses for factory roofs were probably used in American milltowns like Lowell, Massachusetts, in the first half of the nineteenth century. It was not until mid-century, however, that prefabricated cast-iron parts were employed

21.1 James Bogardus, The Bogardus Factory, *The First Cast Iron House Erected*, Lithograph, c. 1850. Museum of the City of New York.



throughout to construct an entire building, with wall areas increasingly freed of supporting responsibilities and given over to glass. James Bogardus began to put into practice in America what had culminated in England with the Crystal Palace (London, 1851), which housed Prince Albert's great international trade exhibition.

ARCHITECT IN IRON

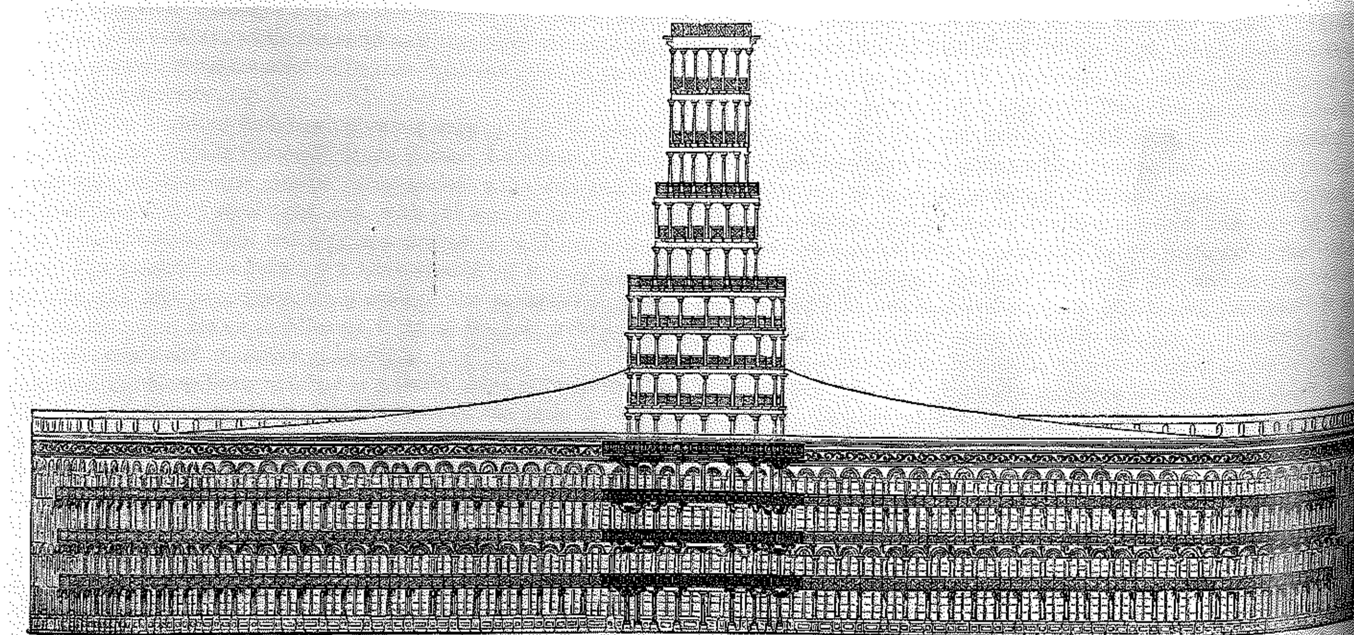
James Bogardus (1800–74), a selftaught engineer and founder who referred to himself as "an architect in iron," was a manufacturer of milling machines for lead and grain. In 1848, he established a foundry in New York City for the production of cast-iron structural and decorative architectural parts. The next year, Bogardus was awarded a patent for the first cast-iron-constructed building. About that time, he erected his own factory, employing the principle of prefabricated, interchangeable, modular cast-iron parts (Fig. 21.1). This was the first all-iron building in America, and its advantages were immediately apparent to the commercial sector. Bogardus executed several buildings using his new cast-iron skeletal system, among them the Laing Stores (c. 1849) and Harper and Brothers (1854), after the design of John B. Corlies. Both were in New York City.

When it was decided to hold a great trade fair in New York City, the requirements of the huge exhibition hall presented a great opportunity to show off the new method of construction. A competition was held, there being other individuals and firms in the cast-iron architecture business by 1852 besides Bogardus.

Bogardus's design called for a cast-iron frame enclosed with glass exterior walls. This was of absolutely astounding dimensions, possible only with the new technology: 1200 feet (366 m) in diameter, with a 300-foot (91.4-m) tall tower (Fig. 21.2). Bogardus claimed that after the fair was over, the structure could be disassembled and the parts reused in another building. But he did not win the competition: The prize instead went to the team of Georg Carstensen (1812–57) and Charles Gildemeister (1820–69) for their Greek-cross greenhouse design, with its great dome. They claimed, in a display of bravado, that this was second in size only to the dome of St. Peter's in Rome. The cast-iron exterior was painted olive green, with touches of gilding. The glass sheathing enclosed an enormous, virtually unobstructed interior space for the international exhibition, which contained everything from Hiram Powers's *Greek Slave* (Fig. 18.4) to a newly devised threshing machine. Here was proof to America of the enormous potential of cast-iron architecture. Inside, the cast iron was brilliantly polychromed, with grand staircases, broad galleries, and ornate cast-iron ornamental work (Fig. 21.3).

Although a new material and a new technology were at hand, no form had suggested itself to establish its shape and style. Therefore, architects such as Bogardus and Carstensen and Gildemeister turned to historic styles—such as Roman, Gothic, or Renaissance—especially in the decorative parts of their structures. In their final report Carstensen and Gildemeister explained that they turned to the Venetian Gothic style for the mode of cast-iron decoration, for it was "the most favorable for lightness and elegance." In time, the new materials and technologies would suggest an aesthetic of their own, as seen in, say, the Seagram Building in New York (Fig. 33.11).

21.2 James Bogardus, Project for the New York World's Fair of 1853. From Benjamin Silliman and C. R. Goodrich, *The World of Science, Art, and Industry* (New York, 1853). Morris Library, University of Delaware, Newark, Delaware.



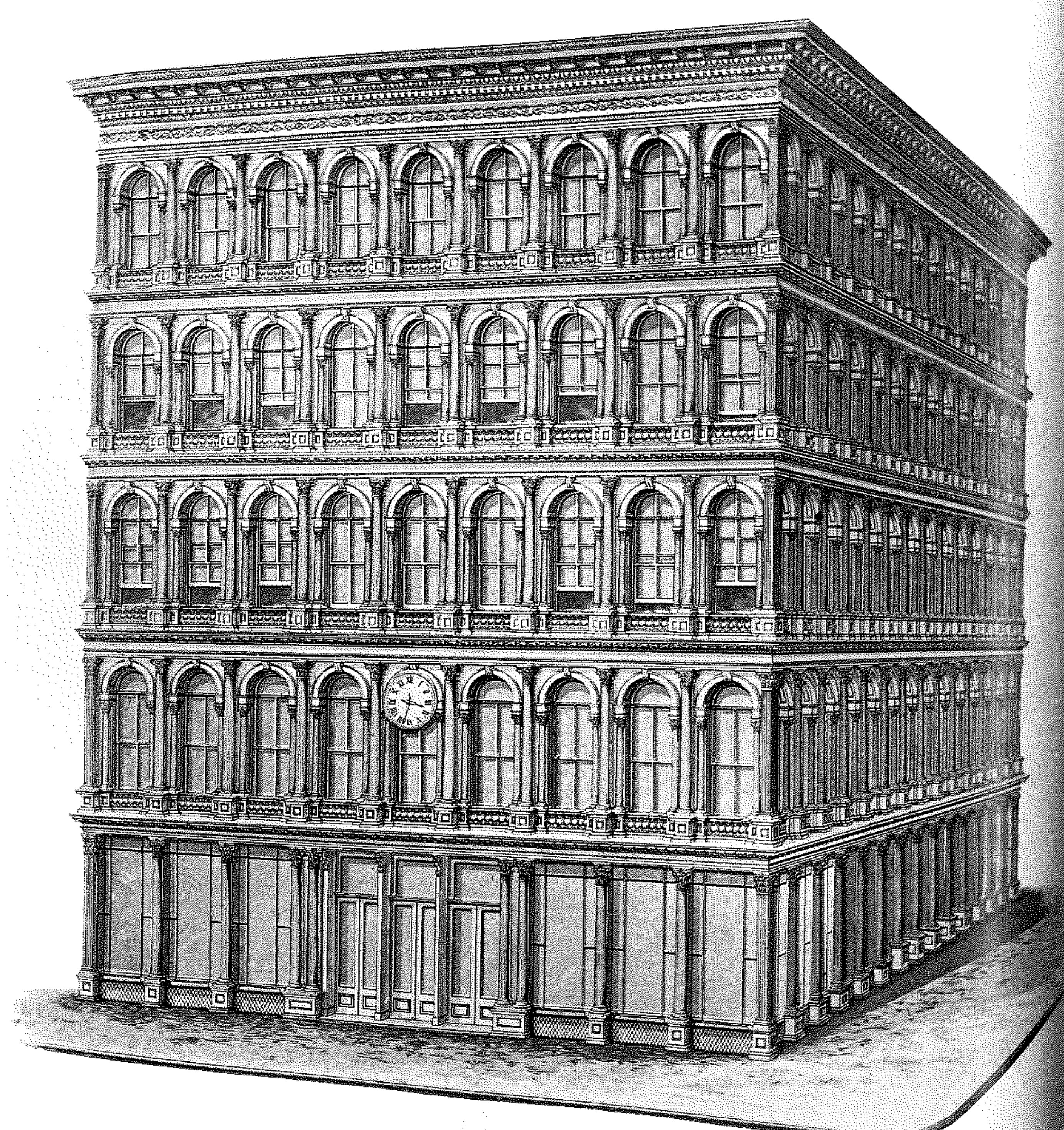
21.3 New York Crystal Palace, 1853. Interior.

Finally, the New York Crystal Palace exposition (1853) saw an event of great importance for the evolution of the tall building: E. G. Otis's safety elevator was introduced to the world there. Heretofore, the human capacity to climb stairs had limited the height of buildings to about five stories. The sky was now, indeed, the limit.

By the mid-1850s, several firms were producing cast-iron parts according to specification. Foremost among these was Daniel Badger's Architectural Iron Works of New York City. Badger (1806–84), a blacksmith from Boston, settled in New York City in 1846 and began producing cast-iron storefronts. His big opportunity came when he was given the contract for the façade of A. T. Stewart's huge new department store. Probably Badger's most famous effort, however, was the E. V. Haughwout Store, with its bold, handsome grid of cast-iron columns, capitals, and cornices that in the design of the bay unit is reminiscent of the Colosseum in Rome (Fig. 21.4). John P. Gaynor (c. 1826–89), an engineer-architect from Ireland who arrived in New York in 1849, is credited with the design of this five-story building. A special feature is that one of the first safety elevators produced by Elisha Graves Otis, founder of the Otis Elevator Company, was installed.

The new technology spread rapidly. Bogardus reportedly shipped a storefront by boat to Havana, where it was assembled, while Badger sent one to Chicago by rail. All along the riverfront in St. Louis rose cast-iron storefronts, creations of selftaught foundrymen who styled themselves architects. The next important step came in the 1870s, when the cast-iron components were encased in terracotta. They had initially been praised for being incombustible but were then discovered to be susceptible to heat. The technique was first developed in Chicago, where people were especially conscious of the necessity for fireproofing after the disastrous conflagrations of 1871 and 1874.

By 1875, most of the basic essentials for the modern, highrise commercial building were in practice, thanks mainly to blacksmiths, founders, and engineers. The next stage was for trained architects to recognize the new technology, and to explore the design aesthetic inherent within it.



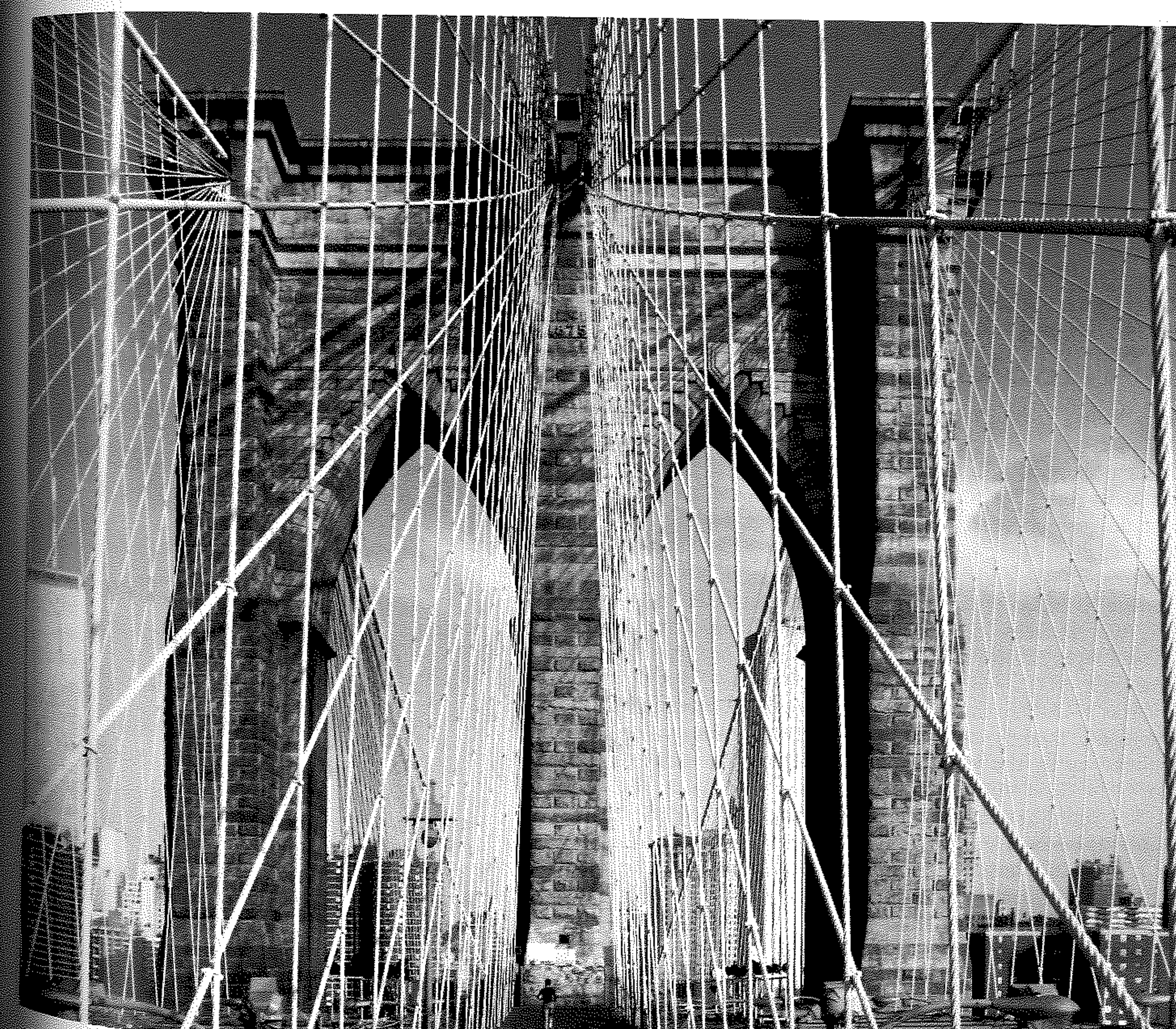
21.4 John P. Gaynor and Daniel Badger, Haughwout Store, New York, c. 1857. From *Badger's Illustrated Catalogue of Cast Iron Architecture* (New York, 1865). Morris Library, University of Delaware, Newark, Delaware.

JOHN ROEBLING AND THE BROOKLYN BRIDGE

An example of the adventurousness of the men who pioneered the new course for architecture can be seen in the Brooklyn Bridge (1869–83), designed by John A. Roebling (Fig. 21.5). After training at the Royal Polytechnic Institute, Berlin, in his native Germany, Roebling (1806–69) emigrated to the United States in 1831. He became State Engineer in Pennsylvania, in charge of canal construction. By 1841 he had invented the twisted-wire cable, which he soon began to manufacture. Its chief advantage was its strength, for it proved much stronger than the iron chains that had been used previously for suspension bridges. Roebling soon was acknowledged as the authority on this type of construction. His wire cable made possible such remarkable accomplishments as the bridges across the Ohio River at Wheeling, West Virginia (1854), across the Niagara River at Buffalo, New York (1851–5), and across the Allegheny River at Pittsburgh (1857–60).

Iron bridges had been known since the erection of the Coalbrookdale Bridge across England's Severn River in 1777. Thomas Telford had introduced the suspension bridge with his Menai Bridge of 1819–26, in North Wales. Now, great distances could be spanned without the need to construct intermediate supports—often difficult to do in the middle of a river or over a great gorge. Chains or cables support the platform of the bridge, which is suspended from

21.5 John A. Roebling, Brooklyn Bridge, New York City, 1869–83. Peter Aaron/Esto.



massive towers, rather than held up from below. Roebling's twisted-wire cable allowed the construction of suspension bridges able to carry railroads, where previously such enormous weight had been a problem.

In 1867, Roebling was appointed chief engineer of the project to build the bridge across the East River, connecting Manhattan with Brooklyn. While the design was his, he saw only the beginning of the work, for he died in 1869. His plan was carried out by his son, Washington Augustus Roebling (1837–1926), an engineer and a graduate of Rensselaer Polytechnic Institute in Troy, New York. The main span of the Brooklyn Bridge reached nearly 1600 feet (488 m) across open space and water. At that time, this was the greatest suspension span ever created, a technological breakthrough that deservedly attracted the admiration of the world. Interestingly, the form of the two great masonry towers reveals a lingering influence of historic styles, for the openings are in the shape of Gothic lancet windows. Otherwise, the Roeblings's bridge looks to the future as much as the Eiffel Tower in Paris did when completed in 1889—six years after the Brooklyn Bridge. Today, the Verrazano-Narrows and the George Washington bridges in New York span 4260 and 3500 feet (1298 and 1067 m) respectively, while the Golden Gate Bridge in San Francisco reaches 4200 feet (1280 m) under suspension. But such figures in no way diminish Roebling's triumph.

CHICAGO AND THE RISE OF THE SKYSCRAPER

Once trained architects began to take the potential of the new materials and technologies seriously, the story of the skyscraper begins to unfold. It occurred mainly in Chicago and New York City in the 1880s. In the latter, George B. Post, designer of the New York Stock Exchange (Fig. 20.22), was one of the first to design buildings that would reach heavenward—for example, his Mills Building (1881–3) and Produce Exchange (1881–4). But Post, a Beaux-Arts architect, was strongly tied to the old Renaissance-Baroque Revival style, which he tended to apply to his highrise structures.

It was in Chicago that the early skyscraper was most fully developed. Indeed, the early tall building is one vision conjured up by the term "the Chicago school of architecture." The Great Fire in 1871 had left much of Chicago in ashes, creating a need for rebuilding that was unprecedented in America. Moreover, Chicago was entering a boom period, as it rose to preeminence as the agricultural, financial, merchandising, and industrial hub of the Midwest.

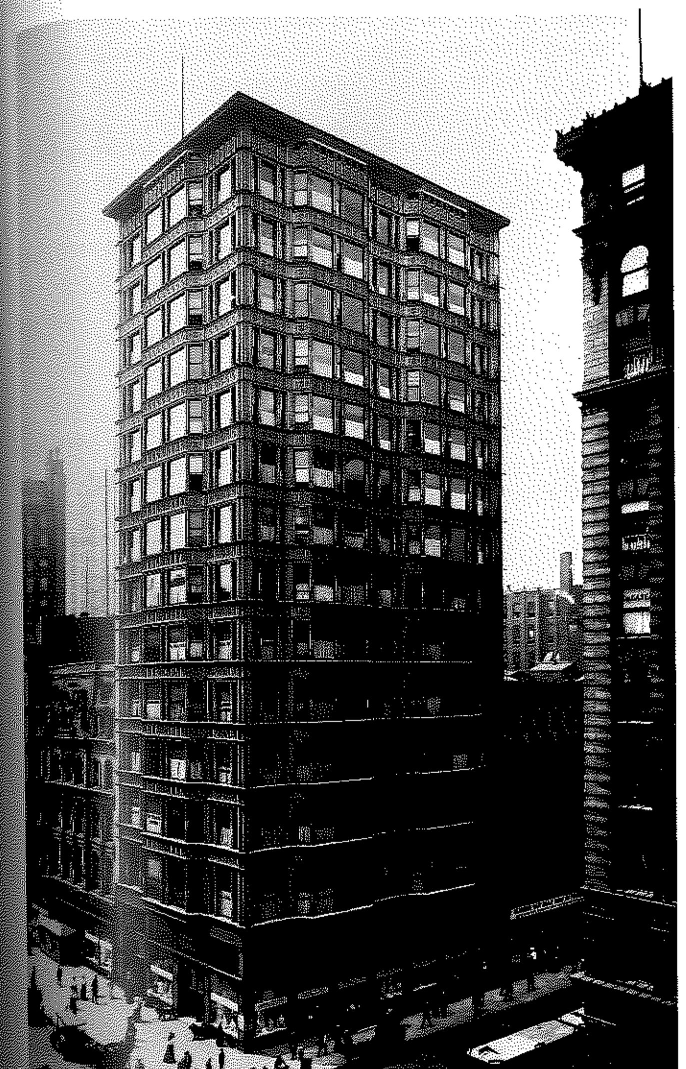
WILLIAM LE BARON JENNEY

The leading figure in the emergence of the Chicago school was William Le Baron Jenney (1832–1907). A native of Massachusetts, he entered the Harvard University engineering program in 1850. Dissatisfied, he left to go to Paris, where he attended the Ecole Centrale des Arts et Manufactures. During Jenney's years in France, he learned much about the engineering possibilities of cast iron, and also about architectural theory. He served briefly as an engineer on a project building a railroad across southern Mexico. After the Civil War he settled in Chicago, where he opened an architectural office.

The structural grid of the cast-iron skeletal system is clearly reflected in the Leitner Building (Chicago, 1879), the geometric logic of its design being of greater importance to Jenney than decoration derived from one of the historic revival styles. A more mature statement of this came a few years later in his bestknown work—the Home Insurance Building (Fig. 21.6). Originally nine stories high, with two more added in 1891, the structural system consisted of cast- and wrought-iron columns with cast-iron girders in the first six floors, but steel girders in the upper stories—the first use of steel girders in a building.

Part of the supporting work is in the form of masonry piers, so it is not actually the first instance of a skyscraper erected entirely on a cast-iron or steel support system.

21.6 William Le Baron Jenney, Home Insurance Building (destroyed), Chicago, Illinois, 1884–5.



21.7 Daniel H. Burnham, Reliance Building, Chicago, 1894–5.

Moreover, the metal frame is concealed on the exterior by a stone veneer, probably because monumental buildings were traditionally of stone. Iron and steel were then considered base metals, too inelegant for exposure. Nevertheless, Jenney's design is a handsome grid, with vertical sections reflecting the underlying structure and emphasizing height as they extend from ground level to the top floor.

DANIEL BURNHAM

Jenney was influential, not only through his buildings but also through his work with younger men who passed through his office, such as Daniel Burnham, William Holabird, Martin Roche, and Louis Sullivan. When Holabird (1854–1923) and Roche (1855–1927) formed a partnership, one of their first commissions was an architectural masterpiece of the era—the Tacoma Building, erected in Chicago in 1886. Daniel H. Burnham (1846–1912) had worked in Jenney's office in 1867–8, and teamed up with John Wellborn Root (1850–91) to form one of the most successful architectural firms of the period. Root died just as the commission for the Reliance Building was received, and in Burnham's design, developed in collaboration with his new partner Charles B. Atwood (1849–95), yet another step is taken in the development of the modern commercial building (Fig. 21.7). It rises fourteen stories on a steel, not iron, skeletal system, and reportedly the top ten floors were erected in fifteen days—a phenomenal achievement for that time. The design freely admits that the exterior wall is not loadbearing, and is only a thin veneer, mostly of glass. The metal cage is lithe and elegant: Richardson's Marshall Field Wholesale Store (Fig. 20.28), of masonry, seems heavy, ponderous, and of another era by comparison—yet only eight years separate their completion dates. The Reliance Building is a milestone on the road to modern architecture and the development of the skyscraper.

Daniel Burnham was a man of diverse talents, ranging from architectural designer to organizer of vast projects. His ability as a designer ranged from the tall, lean Flatiron Building (New York, 1903; see Fig. 31.5) to the thoroughly Beaux-Arts, neo-Roman giant, Union Station (1907) in Washington, D.C. Burnham was also the coordinating consultant for the World's Columbian Exposition in Chicago in 1893. This was far more a triumph of East Coast preference for Beaux-Arts classicism than the inauguration of the Chicago school's new architectural style as presented by Burnham and Atwood in the Reliance Building. Many—among them Louis Sullivan—saw the neoclassical White City that rose on the shore of Lake Michigan as a setback in the progress of modern architecture.

LOUIS SULLIVAN: FIRST MODERN ARCHITECT

The man credited with giving form to the tall building and establishing a theoretical foundation for modern architecture in the United States is Louis Sullivan (1856–1924). One of Sullivan's avowed purposes was to break with those who in his opinion were still imposing historic styles on architecture, instead of letting the new materials, technologies, and the spirit of the age evolve a new style of their own. Insofar as he was successful, Sullivan deserves to be called the first modern architect in America.

Born in Boston, Sullivan briefly attended the Massachusetts Institute of Technology (MIT), but soon left to work in the architectural office of Frank Furness in Philadelphia. By the fall of 1873, he had moved to Chicago and entered the office of William Le Baron Jenney. The next summer he went to Paris and to the Ecole des Beaux-Arts. Restless and dissatisfied, Sullivan found that his career did not really take off until after he returned to Chicago, when in 1879 he became an architectural draftsman for Dankmar Adler (1844–1900). By 1883, he had become a partner in the firm

of Adler and Sullivan, the older man concentrating on business affairs and engineering while Sullivan devoted himself mainly to architectural design.

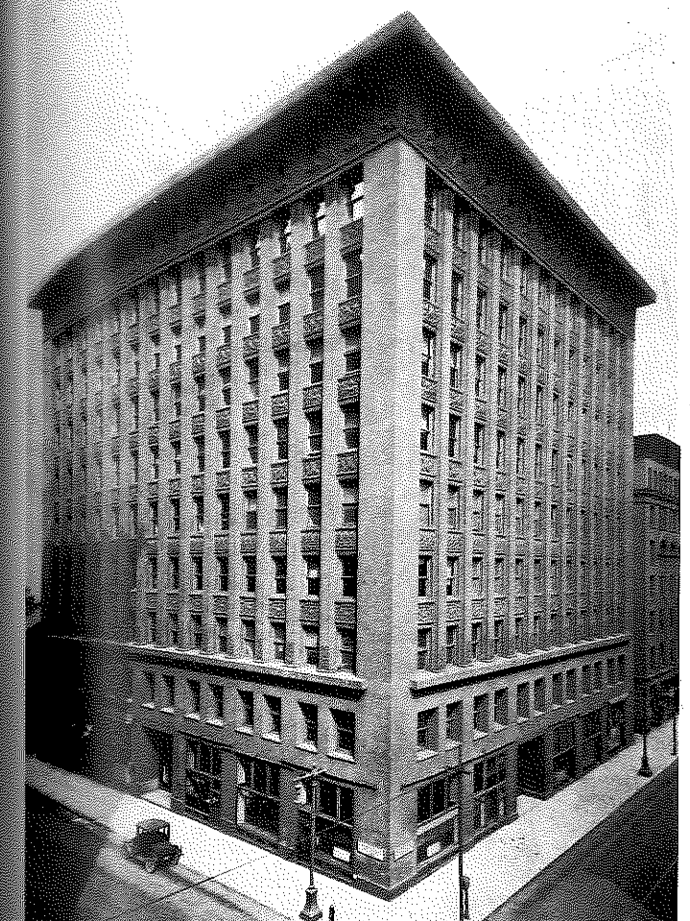
Auditorium Building Probably the most important commission the firm of Adler and Sullivan received during its early years was for the Auditorium Building of 1886–9—an office building, hotel, and theater for grand opera for an increasingly culture-conscious Chicago. Sullivan was impressed by H. H. Richardson's Marshall Field Wholesale Store, then being constructed in Chicago, and the debt to that building is obvious. Sullivan's search for a new mode of expression, however, is demonstrated in the interior, especially in the theater (Fig. **21.8**). When finished, the 4237-seat theater was acclaimed for its splendid acoustics—moreover, it was the first theater in America to be airconditioned. But it is the striking decoration that is perhaps most impressive of all. In it, Sullivan sought an architectural enrichment that was independent of classical, medieval, and Renaissance motifs, and turned instead to nature and to geometric patterns.

Richness of decoration became one of the trademarks of Sullivan's architecture, and its extensive use, as seen here, puts Sullivan's famous phrase—"form follows function"—into perspective. Sullivan did not mean by this that architecture should be reduced to a barren, utilitarian machine—rather, that the functions of any edifice should be expressed in its form. Once this form was achieved, there was no reason to leave it unadorned.

Wainwright Building These principles reached a mature expression in the Wainwright Building, a huge step toward the twentieth-century skyscraper (Fig. **21.9**). Here, Sullivan established a tripartite division of the façade: a bold lower section, then a vertically oriented middle section, and, finally, the grand, projecting cornice, richly ornamented with **foliate** motifs. Although the exterior of the building is of masonry construction, the brick clearly takes on the form of the skeletal system within. Unity of design is achieved in part by eliminating the usual rustication of the lower floors and using a smooth facing throughout. The strength of the corner piers carries from ground level to cornice, uniting the three sections. The intermediate piers contribute to this unity while stressing the vertical rose of the building. It was this that Sullivan declared as being the formal hallmark of the new type of building known as the skyscraper. Horizontals—such as the **spandrels**, with their foliate motifs that echo the floral design of the cornice—are relegated to minor chords in an otherwise vertical symphony.

World's Columbian Exposition Nowhere was Sullivan's pioneering effort to break the grip of the historic styles and establish a fresh, modern mode of architectural expression more apparent than at the World's Columbian Exposition of 1893 (Fig. **20.23**). When given the task of designing the Transportation Building for the great fair, Sullivan's response was predictable (Fig. **21.10**). As the site of the building was remote from the grand concourses, its style would not disrupt the homogeneous classicism of the buildings surrounding the Lagoon of Honor. Sullivan therefore sought total independence, in both architectural form and decoration. The entrance was a *tour de force*, an elaboration upon the proscenium area of the theater in the Auditorium Building (Fig. **21.8**). The forms and the decorative motifs were

21.8 Adler and Sullivan, The Auditorium Building, Chicago, 1889. Interior.



21.9 (above) Louis Sullivan, Wainwright Building, St. Louis, Missouri, 1890–1.

21.10 Louis Sullivan, Transportation Building (destroyed), World's Columbian Exposition, Chicago, Illinois, 1893.

deliberately nonclassical, and, in contrast to the other buildings of the Great White City, Sullivan's structure was defiantly polychromed in red, orange, blue, yellow, and green. A more willful challenge to the architectural traditions of the past could hardly be imagined.

Guaranty Building Adler and Sullivan dissolved their partnership in 1895. One of their last joint efforts was the Guaranty Building (Fig. 21.11). A reworking of the design that had evolved in the Wainwright Building, this has a two-story foundation level, a ten-story middle section that emphasizes verticality, and a most unusual cornice. The latter—unlike any classical cornice, yet serving the same purpose—has a row of large oculi, or round windows, which form a transition from the arches below it to the flaring ridge above. It is an imaginative new design for an old architectural form. Refinement is the key principle, for the cornice has become slight in comparison with that of the Wainwright Building. The piers—at the corners and separating the bays—are more svelte and attenuated, and the bold, smooth surfaces of the earlier work have given way to delicate decoration. The Wainwright Building represents the powerful classic stage in this early evolution of the tall building, while the Guaranty Building becomes a display of virtuosity, a variation upon a theme that had been worked out in the St. Louis building.

21.11 Adler and Sullivan, Guaranty Building, Buffalo, New York, 1895.

21.12 Louis Sullivan, Schlesinger and Mayer Department Store (now Carson, Pirie, Scott and Company), Chicago, Illinois, 1899.

Sullivan's Grid In his design for the Schlesinger and Mayer Department Store (now Carson, Pirie, Scott) in Chicago (1899), Sullivan presented a new and forthright architectural statement that emphasizes the verticals and horizontals of the building's structural system (Fig. 21.12). A simple, honest grid emphasizes the materials employed in its construction. Most of the wall is given over to glass wherever structure is not involved, and ornamentation is confined to restricted areas.

By limiting the exceedingly rich ornamentation to a couple of horizontal bands and the area around the doorway, Sullivan allowed the vertical and horizontal elements to assert themselves as the sources of functionalism as well as of architectural aesthetics. This dynamic, innovative development was seized upon by architects of the next generation. To counterbalance any sterility that might arise, Sullivan provided a lush floral design to surround and give emphasis to the entrance of the building (Fig. 21.13). Nature-based, curvilinear decorations such as this have been described as an American version of the Art Nouveau style that was in vogue in Europe in the 1890s. Neither Art Nouveau nor Sullivan's art were the ultimate aesthetic solution for modern architecture, but both were indispensable in effecting the break with the Beaux-Arts past.

21.13 Louis Sullivan, Schlesinger and Mayer Department Store, Chicago. Detail of entrance.

By 1900, the major portion of Sullivan's career was behind him. There were no more tall buildings, only cubic blocks—a series of small Midwestern banks—delicately ornamented with his special brand of decoration. Sullivan's influence, however, was considerable, especially on younger architects. Frank Lloyd Wright, for example, spent nearly six years with the firm of Adler and Sullivan from 1888 to 1893, during which time Sullivan was designing or completing the Auditorium Building, the Wainwright Building, and the Transportation Building, among other commissions. Sullivan spread his ideas through the printed word as well in a number of important articles. "The Tall Office Building Artistically Considered" is one example, in which he denounced the revival styles and advocated an aesthetic that grew out of the functions, materials, and technologies of the buildings that were then beginning to dot the urban skyline in America.[1] There would be a timelag of a few years, during which the revival styles enjoyed their last hurrah—but before long the originality and potential of Sullivan's contribution was recognized.