

## CHAPTER 26

# Industrial Revolution

1750–1900s

The Industrial Revolution begins in England in the second half of the 18th century and spreads throughout Europe, North America, and British territories worldwide. Continuing through the 19th century and into the 20th with rapid growth and significant urban expansion, societies are transformed from agrarian economies to industrial ones. New developments in transportation, engineering methods, industrial mechanization, factory production, and construction materials create a new integration of art and technology. Changes in ideas, tastes, and attitudes fostered by the Industrial Revolution lead to innovations in the aesthetics of architecture, interiors, and furnishings.

## HISTORICAL AND SOCIAL

Industrialization gradually but profoundly alters economies and societies. Major centers of production such as England, France, and North America see the most significant impact. Improvements in transportation such as expanding railway systems de-

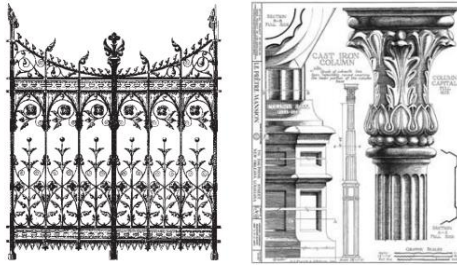
*Buildings, as things made by man, as artifacts, are conditioned by their designer's knowledge and inspiration and by prevailing trends in construction techniques and in aesthetics.*

—Dennis Sharp, *Twentieth Century Architecture: A Visual History*, 1991

crease regionalism, promote homogeneity, and support cultural communication. Factories increase in number, size, and complexity, and mass-produced products become more diverse in number and decrease in price. Urban growth gives rise to larger commercial buildings with more varying types of use. Townhouses and apartment buildings multiply in cities.

The wealthy elites continue as the tastemakers, but society is no longer governed by aristocratic ideals. Old class divisions begin to disappear. Members of the newly rich, rapidly expanding middle class who are avid consumers become the trendsetters. They direct more attention to their work and home environments, creating a greater demand for goods and services. At the same time, improvements in industrialization and transportation help distribute manufactured products to wider segments of society. Consequently, shopping through catalogs, popular magazines, retail boutiques, and department stores becomes a common leisure activity as the century progresses. Greater availability tends to make goods disposable; most people no longer have to reuse or make do.

Society continues to be male dominated, and family units remain important, although they are changing in response to urbanization. Distinct gender-role separations are evident in public and private areas of activity. Men go out to work daily, and legally the sole authority for decisions rests with them. Women remain subservient in the workplace and at home. Regarded as nurturers of the family and guardians of domesticity, they are expected to create homes that are shelters and refuges from the negative effects of industrialization and urbanization. Ideas of home as the expression of the wife's creativity and artistic nature, as well as the



▲ 26-1. Architectural Details: Wrought iron gate and cast iron column details.

culture and character of the family, help organize society, create its rituals, and legitimize shopping.

## CONCEPTS

Besides profoundly changing the economy and society, the Industrial Revolution introduces new materials, techniques, and forms to architecture, interiors, and furnishings. It fosters novelty, innovation, and alteration. Although industrialization makes more goods available, it does not ensure that they are well made or well designed.

Throughout the 19th century, exhibitions and expositions are innovative testing grounds for new design ideas and the introduction of new products. They also are fresh sources for the introduction of new concepts in interior decoration and furnishings. Their displays introduce new styles and trends, which are important to consumers who want to be up-to-date and fashionable. Manufacturers create their finest, most innovative pieces for these exhibitions, and architects design impressive new buildings that affect architectural development. In 1851, the Great Exhibition of the Works of Industry of All Nations held at the Crystal Palace (referred to as the Great Exhibition, and herein as the Crystal Palace Exhibition; Fig. 26-3) in London becomes the largest international exhibition ever held to display machine-made goods as well as handcrafted products. The Great Exhibition establishes Great Britain's industrial supremacy in the world. More exhibitions follow in prominent European and American cities.

Consumer tastes, speed of production, and distribution dictate the look of manufactured goods. Customers want comfort or at least its appearance. Objects must look expensive, which demands visual complexity. Most people are proud of technological advances and regard them as evidence of progress. Despite widespread admiration for the machine and new goods and materials, for most of the 19th century, buildings, interiors, and furnishings look backward in design instead of forward, almost an antithesis of progress. They rarely incorporate new materials and products, but instead rely on those of earlier periods. Old forms, designs, and construction techniques are familiar and therefore less threaten-

ing, so new technology is largely ignored, except to address comfort and production.

Ultimately, a reaction begins as those who recognize the poor design and quality of manufactured goods look for ways to improve them, reform taste, and address social problems. Throughout the 19th century, many reformers advocate rejecting the machine and returning to handmade techniques.

## MOTIFS

■ *Motifs.* Historical features from past styles shape the visual language from the mid-18th century well into the 20th century. Motifs generally relate to the period influences and vary within developments and countries. Details that emphasize technology (Fig. 26-1, 26-14, 26-18) appear later in architecture and interiors, as illustrated on gates, porches, balconies, columns, hardware, chimneypieces, and furnishings.

## ARCHITECTURE

Social, economic, and technical changes in the 19th century lead to new building types, such as railway stations, shopping arcades, office buildings, and factories. These progressive commercial environments require new materials and construction methods and demand the expertise of engineers to achieve the necessary wide expanses of free open space. A split emerges between engineering and architecture as the century evolves. Engineers focus on the new, functional, and innovative structures, whereas most architects continue designing with traditional styles, materials, and techniques.

Engineering feats provide landmarks and set the stage for significant changes in the direction of design throughout the 19th century. Reflecting improvements in transportation and new



▲ 26-2. Iron bridge, 1779; Coalbrookdale, Shropshire, England; Thomas F. Pritchard and Abraham Darby III.

construction materials, England leads the transformation. In 1779, the country announces the first iron bridge at Coalbrookdale (Fig. 26-2). In 1825, railway systems begin in England and expand rapidly there and in other countries as the century progresses. In 1851, gardener Joseph Paxton, using his knowledge of greenhouse construction, designs the Crystal Palace Exhibition building (Fig. 26-3) in London with prefabricated parts for construction, standardized sections of iron and glass, and large expanses of open space. In 1889, Gustav Eiffel leaves his mark through the design of the Eiffel Tower for the Paris Exposition (Fig. 26-4).

Throughout the century, new building types and techniques gradually transform the appearance of architecture into one that integrates engineering technology as a part of the built form. Ex-

amples include railway stations (Fig. 26-13), exhibition halls (Fig. 26-3), shopping arcades, department stores, office buildings (Fig. 26-5, 26-11), factories, warehouses, and industrial buildings. Within this evolution, architects design monumental commercial building façades with embellishments of past styles while creating interiors with innovations in structural form and space.

Changes brought by the Industrial Revolution also transform residential construction so that home building becomes an industry after midcentury. Eventually, prefabricated housing comes into being. Both balloon framing and prefabricated housing require standardized parts (Fig. 26-6, 26-7), but use wood construction rather than iron or steel. They offer inexpensive housing alternatives that can be ordered from catalogs, cater to the ex-

#### DESIGN SPOTLIGHT

**Architecture and Interior:** The design concept of the Crystal Palace is new and innovative, and derives from greenhouses and conservatories of the time. The largest building ever constructed of cast iron and glass, it features a modular design and prefabricated parts that allow factories to easily mass-produce the quantity of components needed. Parts arrive at the site pre-assembled, allowing the construction at an unprecedented rate of months instead of years. Promoted and organized by Prince

Albert, husband of England's Queen Victoria, the structure showcases the first international exhibition for the display of machine-made goods and handcrafted products. The Exhibition has more than 10,000 exhibits from many countries. Interior space encompasses the enormous area of 770,000 square feet. Successful, fast construction and public acclaim open the door for more buildings like it. After the fair closes, the Crystal Palace is re-assembled in a park outside of London. Fire destroys it in 1936.



▲ 26-3. Crystal Palace and exhibition hall, 1851; London, England; Sir Joseph Paxton.

panding middle classes, and require no architect for implementation. Both help expansion in Canada and the United States, particularly as settlements move westward.

For most of the century, compositions of all building types display a distinct historical flavor, whether through revivals of past styles, direct quotations from precursors, or applied ornament. But toward the end of the 19th century, commercial buildings appear with little or no reference to past styles and traditional imagery. Often designed by architects, these structures integrate engineering technology, exhibit simplicity in design, emphasize structure and iron or steel-frame construction, and display extreme verticality.

### Public and Private Buildings

■ *Mail-Order Houses*. House designs copied or ordered by mail from pattern books, trade catalogs, architectural journals, and manufacturing companies become more common as the 19th century progresses (Fig. 26-6). Publications feature exterior and interior designs, floor plans, and architectural details. Construction materials to build a complete house can be ordered from a variety of catalogs or companies, including Sears, Roebuck & Company.

#### DESIGN SPOTLIGHT

Architect and designer Owen Jones decorates the interiors with red, blue, yellow, and white. The vast interiors are filled with displays of industry; machinery; manufactured products such as furniture, fabrics, and wallpapers; and numerous con-

sumer goods from England, Europe, and other parts of the world. A series of courts exhibit art and architecture from ancient Egypt to the Renaissance. Among them are the Medieval Court by A. W. N. Pugin, and Alhambra Court by Owen Jones.



▲ 26-3. Continued



▲ 26-4. Eiffel Tower, 1889; Paris, France; A. Gustav Eiffel, with elevators by Elisha Graves Otis.

■ *Site Orientation.* In the 1840s and 1850s, as city centers become overcrowded and overdeveloped, new housing spreads to the suburbs where houses are grouped along smaller streets to create self-contained residential neighborhoods.

■ *Floor Plans.* Plans for factories, railway stations (Fig. 26-13), shopping arcades, and other building types grow out of function. Most buildings continue traditional planning patterns with central vertical circulation cores (Fig. 26-11) and partitioned walls, but large public areas begin to encompass huge open areas of space delineated with iron columns. Classical attributes such as symmetry, regularity, unity, and harmony continue to be important design principles in plans.

Dwellings often have more and differentiated spaces with public and private areas more carefully separated. Large houses frequently have double parlors, a library, and a conservatory. As the century progresses, kitchens (Fig. 26-15) reflect greater attention to appliance selection, better storage, and functional planning. Bathrooms (Fig. 26-16), which become more common throughout the century, incorporate a sink, tub, toilet, and possibly a bidet and shower to add convenience and comfort. Elevators (Fig. 26-11) gradually supplant stairs as the main source of vertical circulation in multistory apartment complexes.

■ *Materials.* New materials include brick in more colors and artificial stone. Improved manufacturing processes increase the use of wrought and cast iron decoratively and structurally (Fig. 26-1, 26-3, 26-4, 26-10, 26-11). New manufacturing techniques, developed in France, increase the availability of glass in many forms, particularly in large sheets.

■ *Construction.* Many commercial buildings use iron and glass for the entire structure or only for roofs and walls. Prefabricated standardized parts derived from the Crystal Palace (Fig. 26-3) are more commonplace as the century progresses. In the 1840s, the cast-iron skeleton essential for tall buildings makes its appearance in New York City. By 1853, Elisha Graves Otis introduces the safety elevator in New York. Toward the end of the 19th century, the Chicago School architects introduce iron and steel structural skeletons covered by masonry façades (Fig. 26-5).

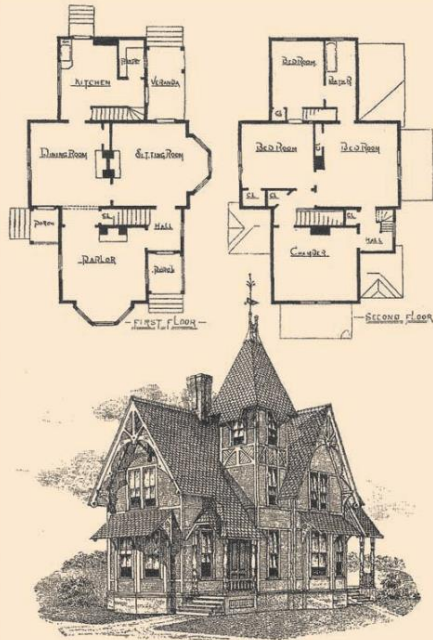
■ *Balloon Frame Construction.* Residential construction methods, primarily in North America, change during the second half of the 19th century from timber framing with mortise and tenon joints or stacked brick methods to balloon frame construction (Fig. 26-7) with prefabricated parts and standardized sizes of lumber. The new technique incorporates a frame of wooden studs that forms the height of the building, rests on floor joists, and is nailed in place.



▲ 26-5. Reliance Building, 1890–1894; Chicago, Illinois; Daniel H. Burnham and John W. Root.

DESIGN SPOTLIGHT

**Architecture:** The Albert Trinler House is a mail-order house, a type of new residential construction prevalent during the late 19th and early 20th centuries. Offered by many companies and illustrated in paperback booklets, this new house type appeals to an expanding middle class seeking inexpensive homes. The Palliser brothers begin their business in Bridgeport, Connecticut, in the 1870s building speculative housing and then begin to offer houses by mail. Their catalogs provide plans, elevations, details, and specifications for a set fee. After purchasing the plans, clients then hire a local builder to construct their new houses. This process becomes common throughout the United States for numerous houses in suburb developments.

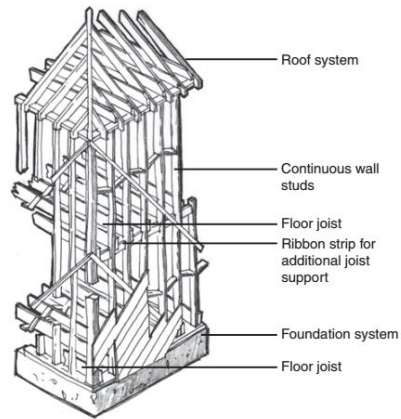


▲ 26-6. Albert Trinler House; New Albany, Indiana; house and plans published in *American Cottage Homes*, 1878; George and Charles Palliser.

■ **Paint.** For most of the 19th century, individuals mix their own paint, either from pastes or dry pigments supplied by manufacturers. Ready-made paint generally is not available until the third quarter of the 19th century because manufacturing, storing, and shipping paint presents many difficulties that must be overcome. Additionally, a great deal of capital is required to make and supply mixed paint. By the late 1860s, manufacturers offer ready-mixed paint in a variety of colors, including earth and stone colors and sanded finishes. Expanded transportation systems bring these products to more consumers. Consequently, color schemes for exteriors and interiors become complex with a multiplicity of colors, and paint makers begin to advertise their products with colorful paint sample cards.

■ **Façades.** Façades of large commercial buildings exhibit architectural features from past styles, classical ordering, design regularity, unity, harmony, and monumental scale (Fig. 26-3, 26-5). Those that develop primarily from engineering concepts reflect diversity in appearance, form, and scale and often lack ornamentation (Fig. 26-4). Windows generally are symmetrical in scale, shape, and placement. Grand, prominent entry doors define the front façade and announce the public circulation path. Houses vary in design, but generally represent the popular historical revival styles and influences common to the period, whether they are architect or builder designed or ordered by mail (Fig. 26-6).

■ **Roofs.** Roof types and heights vary based on the particular building type and location. Office structures have flatter rooflines with cornices, and railway stations display multiple roof heights and forms.



▲ 26-7. Balloon frame construction.

dilettantes, these volumes help in the quest for what is perceived as the correct home decoration. In larger homes, new rooms include double parlors, music and ballrooms, a library, breakfast room, and conservatory. Kitchens and bathrooms gain importance in the house as more attention is given to function, comfort, and appearance.

### Public and Private Buildings

■ *Heating.* Wood-burning fireplaces remain common, but other types of heating appear, such as coal grates, Franklin stoves, and central heating (Fig. 26-14) in public and private buildings. Although stoves are used from the middle of the 18th century onward, they do not supplant fireplaces because of the associated smells. Central heating systems, in which a wood or coal furnace heats several rooms, are invented in the 1830s. Steam heat emerges in the 1850s. Critics favor fireplaces throughout the century, however, believing that stoves and furnaces create bad air.



▲ 26-10. Main lobby, Rookery Building, 1885–1888; Chicago, Illinois; Daniel H. Burnham and John W. Root, with interiors modified or redesigned by Frank Lloyd Wright.

### DESIGN SPOTLIGHT



- Glass oculus or skylight
- Dome in terra cotta tiles
- Cast iron structure
- Arch
- Iron column
- Vault with Pompeian wall decorations
- Built-in bookcase
- Library tables with task-oriented lamps
- Center axis emphasizes symmetrical balance

▲ 26-9. Main Reading Room, *Bibliothèque Nationale*, 1858; Paris, France; Pierre-François-Henri Labrouste.