23

The Revolution in Energy and Industry

1760–1850

While the revolutions of the Atlantic world and in France were opening a new political era, another revolution was beginning to transform economic and social life. The Industrial Revolution began in Great Britain around the 1780s and started to influence continental Europe after 1815. Quite possibly only the development of agriculture during Neolithic times had a comparable impact and significance. Non-European nations began to industrialize after 1860, with the United States and Japan taking an early lead.

The Industrial Revolution profoundly modified much of human experience. It changed patterns of work, transformed the social class structure and the way people thought about class, and eventually altered the international balance of political power. The Industrial Revolution also helped ordinary people gain a higher standard of living as the widespread poverty of the preindustrial world was gradually reduced.

Unfortunately, improvement in the European standard of living was limited until about 1850 for at least two reasons. First, even in Britain, only a few key industries experienced a technological revolution. Many more industries continued to use old methods. Second, rapid growth in population, which began in the eighteenth century, threatened to eat up the growth in production and to leave most individuals poorer than ever. Industrialization drew on British profits from Atlantic trade, including slavery. Even more important were the consequences of early industrialization in Britain and on the European continent, which allowed Europeans to increase their economic and political dominance over other nations. •

☐ CHAPTER PREVIEW

The Industrial Revolution in Britain

☐ What were the origins of the Industrial Revolution in Britain, and how did it develop between 1780 and 1850?

Industrialization Beyond Britain

☐ How after 1815 did countries outside of Britain respond to the challenge of industrialization?

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The Industrial Revolution in Britain

☐ What were the origins of the Industrial Revolution in Britain, and how did it develop between 1780 and 1850?

The Industrial Revolution began in Britain, the nation created by the formal union of Scotland, Wales, and England in 1707. The transformation in industry was something new in history, and it was unplanned. With no models to copy and no idea of what to expect, Britain pioneered not only in industrial technology but also in social relations and urban living. Just as France was the trailblazer in political change, Britain was the leader in economic development, and it must therefore command special attention.

Origins of the British Industrial Revolution

Although many aspects of the origins of the British Industrial Revolution are still matters for scholarly debate, it is generally agreed that industrial changes grew out of a long process of development. The scientific revolution and Enlightenment fostered a new worldview that embraced progress and the role of research and experimentation in understanding and mastering the natural world. In the economic realm, the seventeenth-century expansion of English woolen cloth exports throughout Europe brought commercial profits and high wages to the detriment of traditional producers in Flanders and Italy. By the eighteenth century the expanding Atlantic economy was also serving Britain well. The mercantilist colonial empire Britain aggressively built, augmented by a strong position in Latin America and in the African slave trade, provided raw materials like cotton and a growing market for British manufactured goods (see Chapter 18).

Agriculture also played an important role in bringing about the Industrial Revolution in Britain. English farmers were second only to the Dutch in productivity in 1700, and they were continually adopting new methods of farming. The result, especially before 1760, was a period of bountiful crops and low food prices. The ordinary English family no longer had to spend almost everything it earned just to buy bread. Thus the family could spend more on manufactured goods — a razor for the man or a shawl for the woman. Moreover, in the eighteenth century the members of the average British family were redirecting their labor away from unpaid work for household consumption toward work for wages that they could spend on goods, a trend reflecting the increasing commercialization of the entire European economy. In Britain, rising urbanization and high wages both reflected these developments and spurred them forward.

As manufacturing expanded to supply both foreign and British customers, the domestic market for raw materials was well-positioned to meet the growing demands of manufacturers. In an age when it was much cheaper to ship goods by water than by land, no part of England was more than fifty miles from navigable water. Beginning in the 1770s a canal-building boom enhanced this advantage. Rivers and canals provided easy movement of England's and Wales's enormous deposits of iron and coal, resources that would be critical raw materials in Europe's early industrial age. Nor were there any tariffs within the country to hinder trade, as there were in France before 1789 and in politically fragmented Germany.

Finally, Britain had long had a large class of hired agricultural laborers, rural proletarians whose numbers were further increased by the second great round of enclosures (the division of common lands into privately held and managed properties) in the late eighteenth century. These rural wage earners were relatively mobile — compared to village-bound peasants in France and western Germany, for example — and along with cottage workers they formed a potential industrial labor force for capitalist entrepreneurs.

Cottage Industry and Transportation in Eighteenth-Century England

CHRONOLOGY

ca. 1765 Hargreaves invents spinning jenny; Arkwright creates water frame

1769 Watt patents modern steam engine

ca. 1780–1850 Industrial Revolution and accompanying population boom in Great Britain

1799 Combination Acts passed in England

1805 Egypt begins process of modernization

1810 Strike of Manchester, England, cotton spinners

ca. 1815 Industrial gap between continental Europe and England widens

1824 British Combination Acts repealed

1830 Stephenson's *Rocket*; first important railroad

1830s Industrial banks promote rapid industrialization of Belgium

1833 Factory Act passed in England

1834 German *Zollverein* created

1842 Mines Act passed in England

1844 Engels, *The Condition of the Working Class in England*

1850s Japan begins to adopt Western technologies; industrial gap widens between the West and the world

1851 Great Exhibition held at Crystal Palace in London

1860s Germany and the United States begin to rapidly industrialize

All these factors combined to initiate the **Industrial Revolution**, a term first coined by awed contemporaries in the 1830s to describe the burst of major inventions and technical changes they had witnessed in certain industries. This technical revolution went hand in hand with an impressive quickening in the annual rate of industrial growth in Britain. Whereas industry had grown at only 0.7 percent between 1700 and 1760 (before the Industrial Revolution), it grew at the much higher rate of 3 percent between 1801 and 1831 (when industrial transformation was in full swing).[1]

The great economic and political revolutions that shaped the modern world occurred almost simultaneously, though they began in different countries. But the Industrial Revolution was a longer process than the political upheavals of the French Revolution. It was not complete in Britain until 1850 at the earliest, and it had no real impact on continental countries until after the end of the Napoleonic wars in 1815. It spread beyond Europe in the second half of the nineteenth century.

The First Factories

The pressures to produce more goods for a growing market and to reduce the labor costs of manufacturing were directly related to the first decisive breakthrough of the Industrial Revolution: the creation of the world's first large factories in the British cotton textile industry. Technological innovations in the manufacture of cotton cloth led to a new system of production and social relationships. The putting-out system involved a merchant who loaned, or "put out," raw materials to cottage workers who processed the raw materials in their own homes and returned the finished products to the merchant.

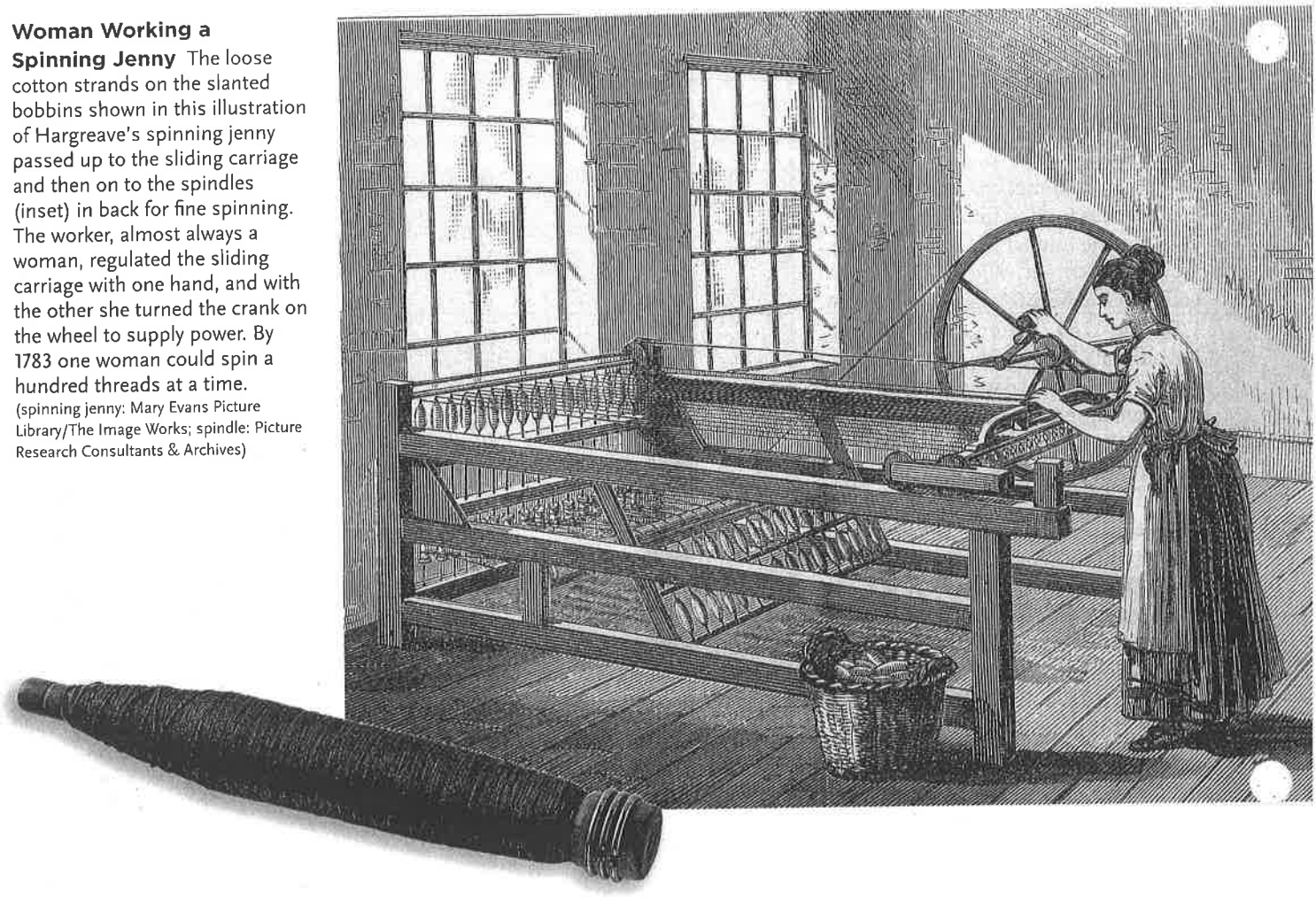
During the eighteenth century this system was used across Europe, but most extensively in Britain. There, pressured by growing demand, the system's limitations began to outweigh its advantages for the first time. This was especially true in the British textile industry after about 1760. There was always a serious imbalance in textile production based on cottage industry: the work of four or five spinners was needed to keep one weaver steadily employed. Cloth weavers constantly had to try to find more thread and more spinners.

Moreover, deep-seated conflicts existed between merchants who put out materials and the workers who processed them. In "The Clothier's Delight, or the Rich Men's Joy and the Poor Men's Sorrow," an English popular song written about 1700, a merchant boasts of the countless tricks he used to "beat down wages":

> We heapeth up riches and treasure great store
> Which we get by griping and grinding the poor.
> And this is a way for to fill up our purse
> Although we do get it with many a curse.[2]

There were constant disputes over the weights of materials and the quality of the cloth. Merchants accused workers of stealing raw materials, and weavers complained that merchants delivered underweight bales.

- **Industrial Revolution** A term first coined in the 1830s to describe the burst of major inventions and economic expansion that took place in certain industries, such as cotton textiles and iron, between 1780 and 1850.



Woman Working a Spinning Jenny The loose cotton strands on the slanted bobbins shown in this illustration of Hargreave's spinning jenny passed up to the sliding carriage and then on to the spindles (inset) in back for fine spinning. The worker, almost always a woman, regulated the sliding carriage with one hand, and with the other she turned the crank on the wheel to supply power. By 1783 one woman could spin a hundred threads at a time.
(spinning jenny: Mary Evans Picture Library/The Image Works; spindle: Picture Research Consultants & Archives)

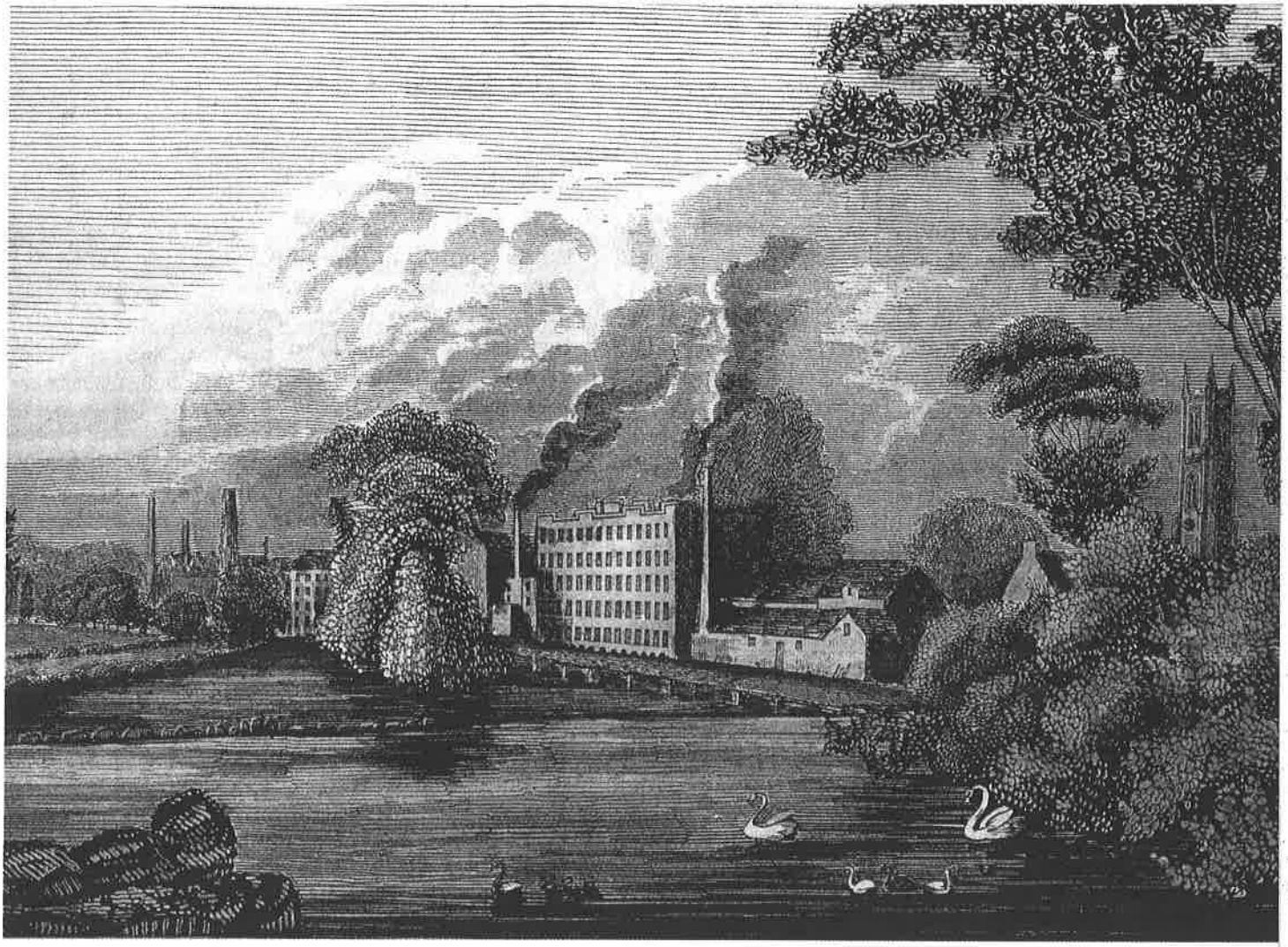
Both were right; each tried to cheat the other, even if only in self-defense.

There was another problem, at least from the merchant-capitalist's point of view. Scattered rural labor was extremely difficult to control. Cottage workers tended to work in spurts. After they got paid on Saturday afternoon, the men in particular tended to drink and carouse for two or three days. Productivity suffered, and by the end of the week many weavers had to work feverishly to make their quota. If they did not succeed, there was little the merchant could do. The merchant-capitalist's search for more efficient methods of production intensified.

Many a tinkering worker knew that a better spinning wheel promised rich rewards. It proved hard to spin the traditional raw materials—wool and flax—with improved machines, but cotton was different. Cotton textiles had first been imported into Britain from India by the East India Company as a rare and delicate luxury for the upper classes, and by 1760 a tiny domestic cotton industry had emerged in northern England. After many experiments over a generation, a gifted carpenter and jack-of-all-trades, James Hargreaves, invented his cotton-spinning jenny about 1765. At almost the same moment, a barber-turned-manufacturer named Richard Arkwright invented (or possibly pirated) another kind of spinning machine, the water frame. These breakthroughs produced an explosion in the infant cotton textile industry in the 1780s, when it was increasing the value of its output at an unprecedented rate of about 13 percent each year. By 1790 the new machines were producing ten times as much cotton yarn as had been made in 1770.

Hargreaves's **spinning jenny** was simple, inexpensive, and powered by hand. In early models from six to twenty-four spindles were mounted on a sliding carriage, and each spindle spun a fine, slender thread. The woman moved the carriage back and forth with one hand and turned a wheel to supply power with the other. Now it was the male weaver who could not keep up with the vastly more efficient female spinner.

Arkwright's **water frame** employed a different principle. It quickly acquired a capacity of several hundred spindles and demanded much more power—waterpower. The water frame thus required large specialized mills, factories that employed as many as one



A Pioneering Silk Mill In the 1600s Italians invented a machine to spin the thread for the silk that rich people loved. Their carefully guarded secret was stolen in 1717 by John Lombe, who then built this enormous silk mill in England. But the factory production of textiles only took off when the spinning of cotton—a fabric for all classes—was mechanized in the later eighteenth century.
(© The Art Gallery Collection/Alamy)

thousand workers from the very beginning. It did not completely replace cottage industry, however, for the water frame could spin only a coarse, strong thread, which was then put out for respinning on hand-powered cottage jennies. Around 1790 a hybrid machine invented by Samuel Crompton proved capable of spinning very fine and strong thread in large quantities. Gradually, all cotton spinning was concentrated in large-scale factories.

The first consequences of these revolutionary developments in the textile industry were more beneficial than is generally believed. Cotton goods became much cheaper, and they were increasingly bought by all classes. Families using cotton in cottage industry were freed from their constant search for adequate yarn from scattered part-time spinners, since all the thread needed could be spun in the cottage on the jenny or obtained from a nearby factory. The wages of weavers, now hard-pressed to keep up with the spinners, rose markedly until about 1792. They were among the best-paid workers in England. As a result, large numbers of agricultural laborers became hand-loom weavers, while mechanics and capitalists sought to invent a power loom to save on labor costs. This Edmund Cartwright achieved in 1785. But the power looms of the factories worked poorly at first, and hand-loom weavers continued to receive good wages until at least 1800.

Unfortunately, working conditions in the early cotton factories were less satisfactory than those of cottage weavers and spinners, and adult workers were reluctant to work in them. Therefore, factory owners often turned to young children who had been abandoned by their parents and put in the care of local parishes. Parish officers often "apprenticed" such

- **spinning jenny** A simple, inexpensive, hand-powered spinning machine created by James Hargreaves in 1765.
- **water frame** A spinning machine created by Richard Arkwright that had a capacity of several hundred spindles and used waterpower; it therefore required a larger and more specialized mill — a factory.

unfortunate foundlings to factory owners. The parish thus saved money, and the factory owners gained workers over whom they exercised almost the authority of slave owners. Apprenticed as young as five or six years of age, boy and girl workers were forced by law to labor for their "masters" for as many as fourteen years. Housed, fed, and locked up nightly in factory dormitories, the young workers labored thirteen or fourteen hours a day for little or no pay. Harsh physical punishment maintained brutal discipline. Hours were appalling—commonly thirteen or fourteen hours a day, six days a week. To be sure, poor children typically worked long hours and frequently outside the home for brutal masters, but the wholesale coercion of orphans as factory apprentices constituted exploitation on a truly unprecedented scale.

The creation of the world's first modern factories in the British cotton textile industry in the 1770s and 1780s, which grew out of the putting-out system of cottage production, was a major historical development. Both symbolically and substantially, the big new cotton mills marked the beginning of the Industrial Revolution in Britain. By 1831 the largely mechanized cotton textile industry accounted for fully 22 percent of the country's entire industrial production.

The Steam Engine Breakthrough

Human beings have long used their toolmaking abilities to construct machines that convert one form of energy into another for their own benefit. In the medieval period Europeans began to adopt water mills to grind their grain and windmills to pump water and drain swamps. More efficient use of water and wind in the sixteenth and seventeenth centuries enabled them to accomplish more. Nevertheless, even into the eighteenth century European society, like other areas of the world, continued to rely mainly on wood for energy, and human beings and animals continued to perform most work. This dependence meant that Europe and the rest of the world remained poor in energy and power.

The shortage of energy had become particularly severe in Britain by the eighteenth century. Wood, a basic raw material and the primary source of heat for all homes and industries, was in ever-shorter supply. Processed wood (charcoal) was the fuel that was mixed with iron ore in the blast furnace to produce pig iron. The iron industry's appetite for wood was enormous, and by 1740 the British iron industry was stagnating. Vast forests enabled Russia in the eighteenth century to become the world's leading producer of iron, much of which was exported to England.

As this early energy crisis grew worse, Britain looked to coal as an alternative to its vanishing wood. Coal was first used in Britain in the late Middle Ages as a source of heat. By 1640 most homes in London were heated with coal, and it was also used in industry to provide heat for making beer, glass, soap, and other products. The breakthrough came when industrialists began to use coal to produce mechanical energy and to power machinery.

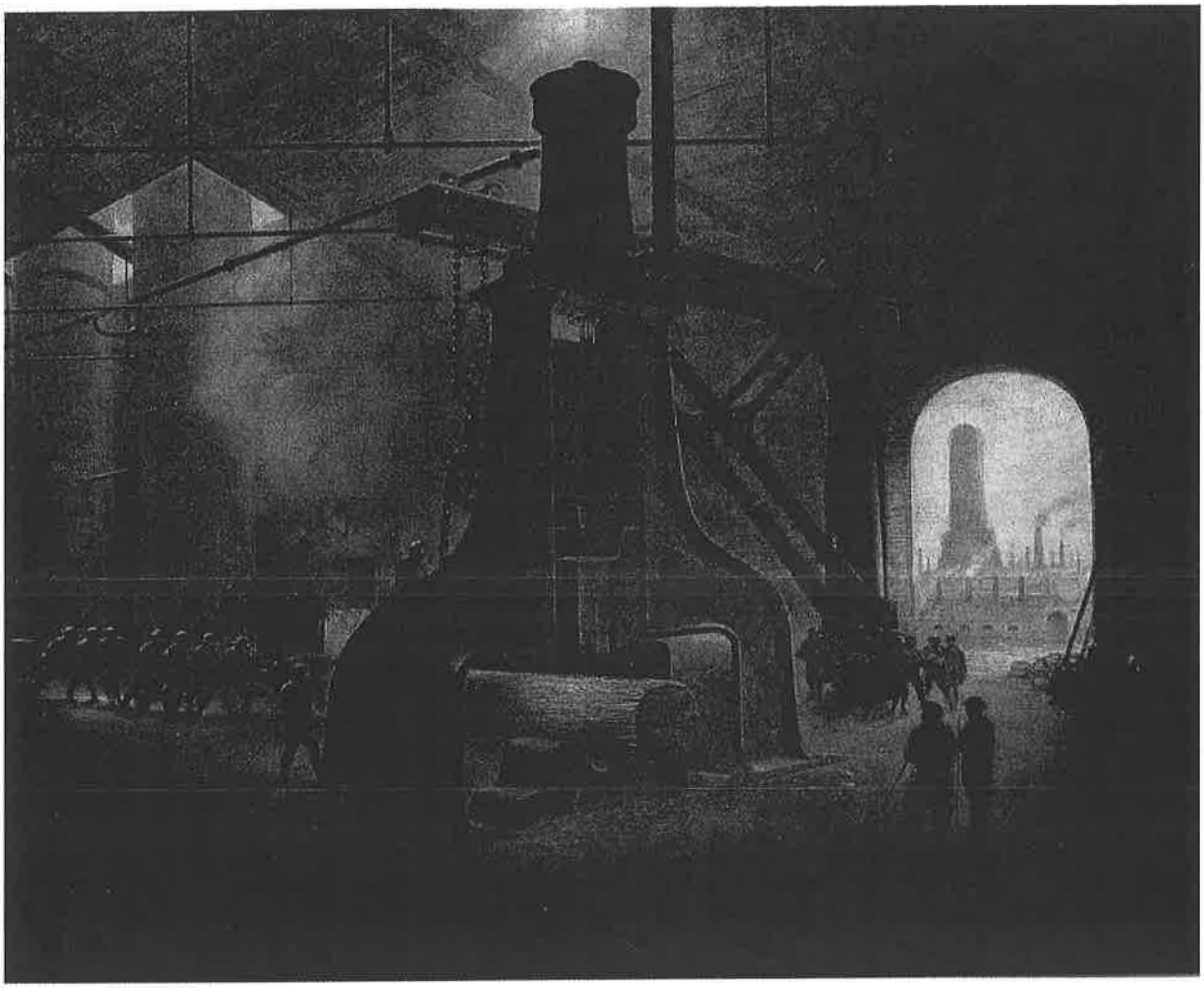
As more coal was produced, mines were dug deeper and deeper and were constantly filling with water. Mechanical pumps, usually powered by animals walking in circles at the surface, had to be installed. Such power was expensive and bothersome. In an attempt to overcome these disadvantages, Thomas Savery in 1698 and Thomas Newcomen in 1705 invented the first primitive **steam engines**. Both engines burned coal to produce steam, which was then used to operate a pump. Although both models were extremely inefficient, by the early 1770s many of the Savery engines and hundreds of the Newcomen engines were operating successfully in English and Scottish mines.

In 1763 a gifted young Scot named James Watt (1736–1819) was drawn to a critical study of the steam engine. Watt was employed at the time by the University of Glasgow as a skilled craftsman making scientific instruments. The Scottish universities were pioneers in practical technical education, and in 1763 Watt was called on to repair a Newcomen engine being used in a physics course. After a series of observations, Watt saw that the Newcomen engine's waste of energy could be reduced by adding a separate condenser. This splendid invention, patented in 1769, greatly increased the efficiency of the steam engine.

To invent something is one thing; to make it a practical success is quite another. Watt needed skilled workers, precision parts, and capital, and the relatively advanced nature of the British economy proved essential. A partnership in 1775 with Matthew Boulton, a wealthy English industrialist, provided Watt with adequate capital and exceptional skills in salesmanship that equaled those of the renowned pottery king, Josiah Wedgwood. (See "Individuals in Society: Josiah Wedgwood," page 692.) In the craft tradition of locksmiths, tinsmiths, and millwrights, Watt found mechanics who could install, regulate, and repair his sophisticated engines. From ingenious manufacturers such as the cannonmaker John Wilkinson, Watt was gradually able to purchase precision parts. By the late 1780s the firm of Boulton and Watt had made the steam engine a practical and commercial success in Britain.

The coal-burning steam engine of Watt and his followers was the Industrial Revolution's most fundamental advance in technology. For the first time in history,

• **steam engines** A breakthrough invention by Thomas Savery in 1698 and Thomas Newcomen in 1705 that burned coal to produce steam, which was then used to operate a pump; the early models were superseded by James Watt's more efficient steam engine, patented in 1769.



James Nasmyth's Mighty Steam Hammer Nasmyth's invention was the forerunner of the modern pile driver, and its successful introduction in 1832 epitomized the rapid development of steam power technology in Britain. In this painting by the inventor himself, workers manipulate a massive iron shaft being hammered into shape at Nasmyth's foundry near Manchester. (Science & Society Picture Library, London)

humanity had, at least for a few generations, almost unlimited power at its disposal. For the first time, inventors and engineers could devise and implement all kinds of power equipment to aid people in their work.

The steam engine was quickly put to use in several industries in Britain. It drained mines and made possible the production of ever more coal to feed steam engines elsewhere. The steam-power plant began to replace waterpower in the cotton-spinning mills during the 1780s, contributing greatly to that industry's phenomenal rise. Steam also took the place of waterpower in flour mills, in the malt mills used in breweries, in the flint mills supplying the pottery industry, and in the mills exported by Britain to the West Indies to crush sugar cane.

Coal and steam power promoted important breakthroughs in other industries. The British iron industry was radically transformed. Originally, the smoke and fumes of coal burning meant that it could not be substituted for charcoal (derived from limited supplies of wood) in smelting iron. Starting around 1710, ironmakers began to use coke — a smokeless and hot-burning fuel produced by heating coal to rid it of water and impurities — to smelt pig iron. After 1770 the adoption of steam-driven bellows in blast furnaces allowed for great increases in the quantity of pig iron produced by British ironmakers. In the 1780s Henry Cort developed the puddling furnace, which allowed pig iron to be refined in turn with coke.

Cort also developed steam-powered rolling mills, which were capable of spewing out finished iron in every shape and form. The economic consequence of these technical innovations was a great boom in the British iron industry. In 1740 annual British iron production was only 17,000 tons. With the spread of coke smelting and the impact of Cort's inventions,

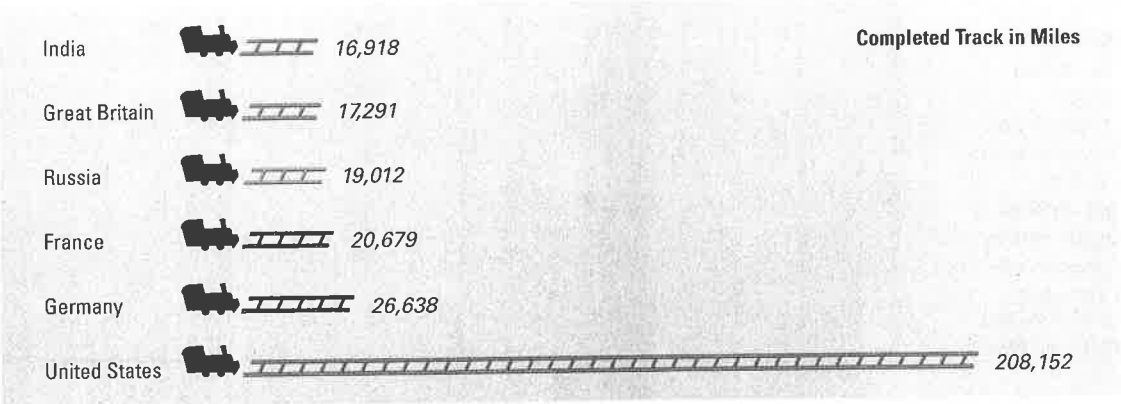


FIGURE 23.1 Railroad Track Mileage, 1890 Steam railroads were first used by the general public for shipping in England in the 1820s, and they quickly spread to other countries. The United States was an early adopter of railroads and by 1890 had surpassed all other countries in miles of track, as shown in this figure.

production had reached 260,000 tons by 1806. In 1844 Britain produced 3 million tons of iron. Once scarce and expensive, iron became the cheap, basic, indispensable building block of the economy.

The Coming of the Railroads

The coal industry had long been using plank roads and rails to move coal wagons within mines and at the surface. Rails reduced friction and allowed a horse or a human being to pull a heavier load. Thus, once a rail capable of supporting a heavy locomotive was developed in 1816, all sorts of experiments with steam engines on rails went forward. In 1825, after ten years of work, George Stephenson built an effective locomotive. In 1830 his ***Rocket*** sped down the track of the just-completed Liverpool and Manchester Railway at sixteen miles per hour. The line from Liverpool to Manchester was a financial as well as a technical success, and many private companies were quickly organized to build more rail lines. Within twenty years they had completed the main trunk lines of Great Britain (Map 23.1). Other countries were quick to follow, with the first steam-powered trains operating in the United States in the 1830s and in Brazil, Chile, Argentina, and the British colonies of Canada, Australia, and India in the 1850s (Figure 23.1).

The significance of the railroad was tremendous. It dramatically reduced the cost and uncertainty of shipping freight over land. This advance had many economic consequences. Previously, markets had tended to be small and local; as the barrier of high transportation costs was lowered, markets became larger and even nationwide. Larger markets encouraged larger factories with more sophisticated machinery in a growing number of industries. Such factories could make goods more cheaply and gradually subjected most cottage workers and many urban artisans to severe competitive pressures. In all countries, the construction of railroads created a strong demand for unskilled labor and contributed to the growth of a class of urban workers.

The railroad changed the outlook and values of the entire society. The last and culminating invention of the Industrial Revolution, the railroad dramatically revealed the power and increased the speed of the new age. Racing down a track at sixteen miles per hour or by 1850 at a phenomenal fifty miles per hour was a new and awesome experience. As a French economist put it after a ride on the Liverpool and Manchester in 1833, "There are certain impressions that one cannot put into words!" Some great painters, notably Joseph M. W. Turner (1775–1851) and Claude Monet (1840–1926), succeeded in expressing this sense of power and awe. So did the massive new train stations, the cathedrals of the industrial age. Leading railway engineers such as Isambard Kingdom Brunel and Thomas Brassey, whose tunnels pierced mountains and whose bridges spanned valleys, became public idols — the astronauts of their day. Everyday speech absorbed the images of railroading. After you got up a "full head of steam," you "highballed" along. And if you didn't "go off the track," you might "toot your own whistle." The railroad fired the imagination.

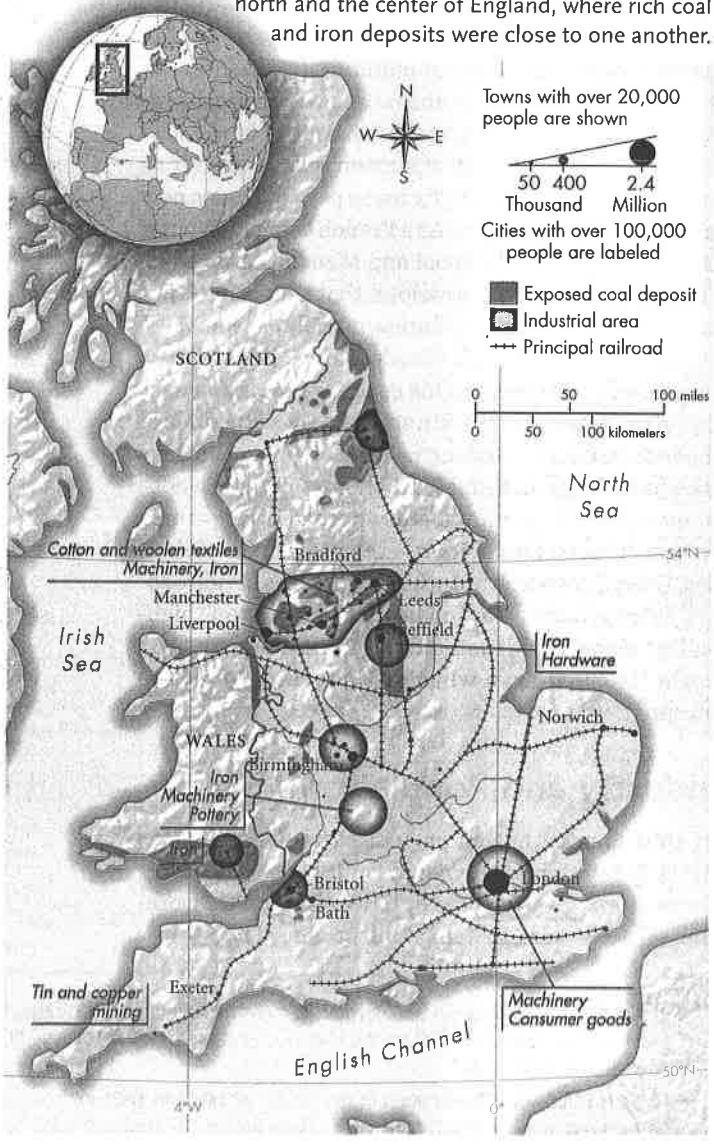
Industry and Population

In 1851 London hosted an industrial fair called the Great Exhibition in the newly built **Crystal Palace**. For visitors, one fact stood out: Britain was the "workshop of the world." Britain alone produced two-thirds

- ***Rocket*** The name given to George Stephenson's effective locomotive that was first tested in 1830 on the Liverpool and Manchester Railway at sixteen miles per hour.
- **Crystal Palace** The location of the Great Exhibition in 1851 in London, an architectural masterpiece made entirely of glass and iron.

Crystal Palace Souvenir More than 6 million visitors from all over Europe marveled at the Great Exhibition of the Works of Industry of All the Nations, popularly known as the Crystal Palace Exhibition. It is no surprise that people bought millions of souvenirs picturing the Crystal Palace. The handsome depiction shown here brightened the lid of a ceramic pot. (Fitzwilliam Museum, Cambridge University, UK/ Bridgeman Giraudon/The Bridgeman Art Library)

MAP 23.1 The Industrial Revolution in England, ca. 1850 Industry concentrated in the rapidly growing cities of the north and the center of England, where rich coal and iron deposits were close to one another.



of the world's coal and more than half of its iron and cotton cloth. More generally, in 1860 Britain produced a remarkable 20 percent of the entire world's output of industrial goods, whereas it had produced only about 2 percent of the world total in 1750.[3] Experiencing revolutionary industrial change, Britain became the first industrial nation (see Map 23.1).

As the British economy significantly increased its production of manufactured goods, the gross national product (GNP) rose roughly fourfold at constant prices between 1780 and 1851. At the same time, the population of Britain boomed, growing from about 9 million in 1780 to almost 21 million in 1851. Thus, growing numbers consumed much of the increase in total production.

Although the question is still debated, many economic historians believe that rapid population growth in Great Britain was not harmful because it facilitated industrial expansion. More people meant a more mobile labor force, with a wealth of young workers in need of employment and ready to go where the jobs were. Contemporaries were much less optimistic. In his *Essay on the Principle of Population* (1798), Thomas Malthus (1766–1834) examined the dynamics of human populations. He argued that

> there are few states in which there is not a constant effort in the population to increase beyond the means of subsistence. This constant effort as constantly tends to subject the lower classes of society to distress, and to prevent any great permanent melioration of these conditions.[4]

Since, in his opinion, population would always tend to grow faster than the food supply, Malthus concluded

French Train Poster The International Sleeping-Car Company was founded in 1872, inspired by the model of the American Pullman night trains. It quickly became the most important operator of sleeping and dining cars in Europe. The company's posters, like the one pictured here, appealed to wealthy and middle-class customers by emphasizing the luxury and spaciousness of its accommodations. The company's most famous line was the Orient Express (1883–2009), which ran from Paris to Istanbul. (Kharbine-Tapabor/The Art Archive)

that the only hope of warding off such "positive checks" to population growth as war, famine, and disease was "prudential restraint." That is, young men and women had to limit the growth of population by marrying late in life. But Malthus was not optimistic about this possibility. The powerful attraction of the sexes would cause most people to marry early and have many children.

Economist David Ricardo (1772–1823) spelled out the pessimistic implications of Malthus's thought. Ricardo's depressing **iron law of wages** posited that because of the pressure of population growth, wages would always sink to subsistence level. That is, wages would be just high enough to keep workers from starving.

Malthus, Ricardo, and their followers were proved wrong in the long run. However, until the 1820s, or even the 1840s, contemporary observers might reasonably have concluded that the economy and the total population were racing neck and neck, with the outcome very much in doubt. There was another problem as well. Perhaps workers, farmers, and ordinary people did not get their rightful share of the new wealth. Perhaps only the rich got richer, while the poor got poorer or made no progress. We turn to this great issue after looking at the process of industrialization outside of Britain.

Industrialization Beyond Britain

- How after 1815 did countries outside of Britain respond to the challenge of industrialization?

As new technologies and organization of labor began to revolutionize production in Britain, other countries took notice and began to emulate its example. Imitating Britain's success was hampered by the particular economic and social conditions of each country, many of whose peoples resisted attempts at drastic change. Yet by the end of the nineteenth century, several European countries as well as the United States and Japan had industrialized their economies to a considerable, but variable, degree.

The process of industrialization proceeded gradually, with uneven jerks and national and regional variations. Scholars are still struggling to explain these variations as well as the dramatic gap that emerged for the first time in history between Western and non-Western levels of economic production. These

- **iron law of wages** Theory proposed by English economist David Ricardo suggesting that the pressure of population growth prevents wages from rising above the subsistence level.