Book Review

Technology in America: A History of Individuals and Ideas—Carroll Pursell, Ed. (Cambridge, MA, USA: MIT Press, 2018, 3rd ed., 360 pp.)

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Reading the 26 essays of this well-regarded book now in its third edition was such a pleasurable experience that I wanted to teach a course in which I might assign it to my students. The text would be of particular interest to engineering students—it is about their profession—as well as of interest to people in the field of the history of technology. The main strength of the work is its sometimes novel choice of topics. Its occasional weakness is the failure of some important subjects to appear. Historians of technology will recognize some familiar names in the list of essayists. Merritt Roe Smith writes about Eli Whitney's role in the American system of manufacturing and demolishes the notion that Whitney pioneered manufacturing with interchangeable parts. Thomas Parke Hughes writes on Thomas Edison, and Ruth Schwartz Cowan on Ellen Swallow Richards, in 1870, the first woman to graduate from MIT and the driving force behind the establishment of the discipline of home economics.

America came into existence at the dawn of the Industrial Revolution, and its flourishing was inextricably tied to that revolution. The sheer size of America abetted certain technologies: the vast distances in the new country welcomed the adoption of the steamboat, and the great size of farms contributed to the invention and use of the reaper. There is an entire chapter by Carroll Pursell, the collection's editor, on its inventor, Cyrus McCormick. The abundance of wood led to the popularity of the balloon frame house that became popular and easier to build than the traditional post and beam home.

Among the more novel topics taken up in this volume is an essay by Pursell on the life of A. C. Gilbert. For readers of a certain generation, his name will evoke The Erector Set, a kit, first introduced at a toy fair in 1913, consisting of hand-size metal girders, nuts, bolts, cranks, pulleys, and in the more expensive versions, a small electric motor. With these, a boy might construct working mechanical models of cranes, hoists, elevators, and so on. I say "boys" because the advertising was directed entirely toward boys and their parents. One advertisement ran "hello boys, make lots of toys." Surprisingly, Gilbert was educated as a medical doctor at Yale, graduating in 1909, but soon turned to selling boxes of magic tricks and in a few years brought out the Erector set, modeled on the English Meccano toy. By the mid-1930s,

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Gilbert had sold 30 million Erectors and was the biggest employer in New Haven, CT, USA. He also built and sold American Flyer electric trains. Gilbert claimed that Erector users performed real engineering and though he did not invent the trope of the boy engineer, he used it to his advantage. During World War II, he produced a nurse's kit, which of course was marketed to girls. The A. C. Gilbert Company went out of business in 1967 and I wish the essay had dealt with its demise, and I wondered if it had not something to do with the increasing popularity of Legos, another kind of construction set—one not marketed specifically to boys.

Another novel chapter deals with Buster Keaton and Charlie Chaplin—two great film actors who sprang from the silent era. Chaplin's *Modern Times* is a mostly silent film produced during the first decade of sound movies in 1936. Sound is used very sparingly, an acknowledgment of a new technology in a film serving as a critique of technology. Its most memorable scenes are of Chaplin's confusion and suffering as he works on a factory production line; one of its most famous segments juxtaposes animals being sent to slaughter with one of the workers streaming to their jobs. The film acknowledges that the health of thousands of farm boys was being wrecked as they migrated to factory assembly lines. Buster Keaton's *Steamboat Bill* (1928), set on an ocean liner, served to show, as he later remarked, "people must be wary of the machines they love." The essay's author, George Basalla, helpfully points out that it is no accident that the two greatest film stars of the silent era used that medium to explore—and perhaps warn of—the perils of technology at precisely the time that film itself was being upended by the new technology of sound.

A very welcome chapter by Carroll Pursell is about a Black inventor, Lewis Latimer (1848–1928), whose career spanned a period in which many engineers were not the products of engineering schools but learned their craft while working in industry and offices. Born in New England, the son of escaped slaves, Latimer's career began as a draftsman working for a firm of patent lawyers. Learning the intertwined skills of drafting and invention, he achieved his first patent, a water closet for installation on trains, in 1874 when he was 26 years old. In the period 1874–1905, working for several employers, he was granted eight patents.

Black inventors were still rare but not unknown in Latimer's era. The first Black student entered MIT in 1888, and the American Institute of Electrical Engineers did not have a Black applicant until 1903. Latimer did work for some of the invention pioneers of his era: Hiram Maxim, famous as the inventor of the machine gun, and notably Thomas Edison (or General Electric, the company that took over his patents and assets), in the period 1885–1911. In 1881, Maxim, who made incandescent lighting, sent him to England to set up a lamp factory. While working for the Edison Electric Light Company, he frequently appeared as an expert witness in patent cases involving lighting. Toward the end of the life of the legendary Edison, Latimer was invited to join the Edison Pioneers, a group of former employees of the great man who had worked closely with him.

No anthology treating the history of technology in America would be complete without a discussion of the intersection of technology and labor. The book does not disappoint: a chapter is devoted to an essay by Gail Cooper on Frederick Winslow Taylor (1856–1915) and his theory of scientific management. The movement toward Taylorism (as it was called) emerged at the end of the 19th and first two decades of the 20th century, a period of considerable labor unrest in the United States. Taylor, who had worked as a laborer in a steel works, later earned a degree in mechanical engineering from Stevens Institute. He soon achieved some acclaim for discovering, while working for Bethlehem Steel, that "high-speed steel" containing small amounts of tungsten could be used in cutting tools to allow machinists to cut at higher speeds and remove 200% or 300% more metal in the time customarily used for ordinary steel tools. As Cooper puts it, the experience led to Taylor's conviction "that management, not the workforce, was best able to control even skilled work in the factory." This conflicted with a practice used in many industries: the skilled craftsman provided the technical understanding while management focused on the financial side of running a business. Formulating his thesis into a book, Taylor published *The Principles of Scientific Management* in 1911. Applying the principles involved an efficiency expert studying and recording a factory worker's movements together with the time required for each activity. This could lead to piece work: a laborer's pay was based on the number of products he produced per day; the book appeared just as a mania for efficiency gripped the

nation together with an exaltation of the engineer. In 1909, one of Taylor's acolytes, Carl Barth, sought to bring scientific management to the Watertown, MA, USA, Federal Arsenal. The workers were not happy to see their motions observed and timed by an outside agent, and they rightly imagined the imposition of new demands on their labor. In consequence, a bill was passed by the U.S. Congress to ban the use of Taylorism on government contracts.

A chapter describing Taylor and his theory that privileges management and its engineers over labor in controlling skilled work in a factory calls out for at least one Marxist analysis of technology. Unfortunately, there is none presented here. A likely candidate should have been an essay by David F. Noble or at least a portion of his well-regarded book, *Forces of Production* (1984). Noble died in 2010, and the second edition of *Technology in America* appeared in 1990, so he could have been invited to contribute an essay based on his work. Although business historian Alfred Chandler criticized Noble for his Marxist slant, it was hailed by the economist Robert Heilbroner as a work "that makes us see technology as a force that shapes management in industrial capitalist society." Noble's starting point is the development of "numerical control" of machinery that mostly sprang from MIT in the 1950s, was widely adopted by industry in that period, and achieved preference over competing methods because it placed control of the forces of production in management or their engineers/programmers rather than in the hands of skilled workers and, significantly, their unions.

John William Ward's essay on Charles A. Lindbergh, *His Flight and the American Ideal,* is worth reading as it deals with the question of why Lindbergh "fired the American imagination." He helpfully reminds us that there was nothing especially novel about flying from North America to Europe before Lindbergh's solo flight in 1927. In 1919, a Brit and an American, John Alcock and Arthur Browne, flew from Newfoundland to Ireland. They landed in a peat bog to little public response although they did win a cash prize bigger than Lindbergh's. This was eight years before Lindbergh's attention-grabbing historic solo venture—the first by a lone airman—which landed him in Paris to a reception of great crowds. He returned to America by ship and received a hero's welcome from a crowd of 400,000 people.

Why was Lindbergh lionized in the U.S.? Ward offers two explanations: One is that because Lindbergh made the flight alone. He reawakened the American trope of the lone adventurer, for example, Daniel Boone and Davy Crockett, possessing "the stuff out of which have been made the pioneers that opened up the wilderness." And Ward remarks on the irony of this: the airplane was "the achievement of a highly organized and advanced technology." *The New York Times* went overboard in a juxtaposition quoted by Ward: "The mechanical genius which is discerned in Henry Ford as well as in Charles Lindbergh is in the very atmosphere of the country." Whether Lindbergh, a pilot, was a mechanical genius is debatable. Not touched on in Ward's essay, but a rich topic, is a character failing of both men: they embraced the Nazis in the 1930s and shared in German anti-Semitism.

I and my colleagues at the University of Massachusetts in Lowell, MA, USA, can step out of our offices, gaze on the Merrimac River, and see an assortment of 19th-century textile mills once powered by the Francis turbine, a remarkable breakthrough in water power, invented by the Englishman, James B. Francis, who came to Lowell and revolutionized the source of water power in this industry. This chapter on Francis is one of several treasures to be found here.

THERE IS SOMETHING to interest almost anyone in this book. This third edition published in 2018 has added material, not covered in the second, on a Black inventor, and on Rachel Carson's alarming masterpiece of ecology, *Silent Spring*. The time is ripe for a fourth edition, dealing with developments of the last three decades, such as the Internet and cell phones. ■

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