THE MADMAN WHO MADE RUBBER USEFUL

Raw rubber, unfortunately, also had some major flaws. In cold weather, it became stiff and brittle. In hot weather, it softened and lost its shape. It was sticky, too, especially when wet. It was not very durable. And it was soluble in many organic liquids. These characteristics seriously limited its usefulness.

Products made from rubber became a fad in the U.S. during the early 1830s. Several factories were set up in New England and elsewhere to turn out overshoes, boots, rain gear, and other items. But the boom was short-lived. The products performed poorly. Demand collapsed. By the late 1830s, most of the new companies had shut down, with great loss to their investors. It was during this period that rubber came to the attention of Goodyear.

Goodyear was born in Connecticut in 1800, the eldest son of a Yankee farmer, merchant, and small-time inventor. In 1826, Goodyear and his brother Robert set out for Philadelphia to establish a hardware store that would sell, among other things, goods made by their father. Initially, the business prospered and the Goodyears probably were better off than they would ever be again. The firm overexpanded, however, and had trouble collecting on its accounts. By 1830, the store was bankrupt and Goodyear was saddled with debt that would plague him throughout most of the rest of his life. As would happen several times again, he was jailed briefly for failing to pay off his creditors.

Goodyear then decided to carve out a career as an inventor—as Korman points out, a risky, highly speculative move, to be sure. He tinkered with one thing or another—new types of faucets, an air pump, a method for making spoons. Nothing much came of his efforts. Then, in 1834, he happened into a store in New York City operated by Roxbury India Rubber Co. and examined a rubber life preserver. He decided that the valve used to inflate it was inadequate and returned later with an improved one of his own design. A company agent pointed out that it was not the valve that was the problem with the preserver so much as the poor properties of the rubber itself. Goodyear's interest was excited.

The quest for a way to improve...
crude rubber soon became his obsession. He tried mixing rubber with all manner of substances, to little avail. He did find, however, that treating rubber with nitric acid fumes reduced its surface stickiness, although it did nothing to reduce its sensitivity to temperature change.

In 1838, Goodyear met Nathaniel Hayward, who ran the largely dormant Eagle India Rubber Co. in Woburn, Mass. Also interested in improving rubber, Hayward in 1834 devised a method—it came to him in a dream, he claimed—for modifying rubber with sulfur. This, too, he found, reduced tackiness. The two men worked together, combining their processes. Then Goodyear got the idea of heating the rubber-sulfur mixture, an approach that would lead to his breakthrough discovery of 1839.

Goodyear continued to fiddle with his procedure, varying the quantities of rubber and sulfur (and usually adding a lead compound) and the temperature, to determine optimum conditions. The rubber he perfected was unaffected by hot or cold weather, was tough, and was not sticky. Strapped for money, as usual, he tried to find investors, Korman writes. But rubber’s reputation had sunk so low that he had little success. Hoping to spark interest in Europe, he sent some samples of what he called “cured” or “tanned” rubber to England in 1842. There, some of them fell into the hands of Thomas Hancock.

Hancock, a mechanical engineer, had become interested in rubber in about 1820. He had developed a masticator with revolving teeth for working bits of the material into a solid mass, as well as rollers for making rubber sheets. He made rubber threads and rubber bands. Hancock teamed up with Charles Macintosh, a Scottish chemist who earlier had found a way to sandwich a layer of rubber between two sheets of cloth for use in raincoats. (Macintosh is still a synonym for raincoat in Britain.) The effect of heat and cold on rubber, however, still hurt the quality of the garments.

When Hancock inspected his samples of Goodyear’s treated rubber, he detected an odor of brimstone and, on at least one, a dusting of sulfur. He had also been seeking a way to enhance rubber’s properties and soon began experimenting with sulfur. He came up with a different technique: dipping strips of rubber into a bath of molten sulfur. At the suggestion of a friend, he named his process “vulcanization,” after Vulcan, the Roman god of fire. Hancock, who knew nothing of Goodyear’s work, received a British patent on his process in 1843 and quickly began producing a variety of rubber goods.

For his part, Goodyear continued to work on perfecting his method and, perhaps lacking funds, did not obtain a U.S. patent until 1844. License fees and royal-

With no real knowledge of chemistry or any other field of science, Goodyear set out to invent, by hit-or-miss experimentation, a new type of material.

ties brought him a limited income for the first time in many years, Korman notes. But he also had to battle patent infringers, the most notorious of whom was Horace H. Day. Day contended that Goodyear’s patent was invalid because several others, including Haywood, had treated rubber with sulfur earlier.

Goodyear sued Day in federal court in Trenton, N.J., in 1851 in what became the patent trial of the century. Defending Day was Rufus Choate, the eloquent former Massachusetts member of Congress who was renowned as the “Wizard of the Law.” To plead his case, Goodyear hired Daniel Webster, then serving as secretary of state in the Millard Fillmore Administration. Webster’s famed rhetorical skills prevailed, and Goodyear’s patent was upheld.

Goodyear left for England to promote his process in Europe. He was thwarted in Britain by Hancock’s prior patent, which he unsuccessfully sued to have overturned in London in 1855.

Korman doesn’t really come to grips with the long-running debate over whether Goodyear or Hancock played the more important role in founding the modern rubber industry. Certainly, Goodyear was the first to observe vulcanization. But certainly, too, machinery developed by Hancock was a key factor in processing the material. And did Hancock independently discover the significance of sulfur in vulcanizing, or did he pirate the invention after studying Goodyear’s samples? Opinions differ. Historians with a British bent tend to give credit to their countryman. Americans generally give more credit to Goodyear.

Goodyear’s health, long frail, deteriorated in the 1850s. Korman speculates that his work with lead compounds may have aggravated his condition. He also suffered from gout. He died in New York City in 1860 while on a trip from Washington, D.C., to New Haven to be at the bedside of his dying daughter, Cynthia.

He died relatively poor. He received modest funds from licensing his process, yet he continued to spend heavily developing and promoting new uses for rubber and had a huge backlog of long-standing debts. He paid Webster a princely $15,000 to successfully defend his patent, a sum that probably was greater than what he himself ever earned from his discovery. While many rubber manufacturers became wealthy, moreover, Goodyear himself never produced rubber on an appreciable scale. (The giant Goodyear Tire & Rubber Co., formed in 1898 by Akron, Ohio, entrepreneur Frank Sieberling, merely appropriated the Goodyear name because of its obvious publicity and marketing value.)

Korman, who is a senior editor on the staff of Engineering News Record, a weekly construction magazine, spins his absorbing story well. He writes with style and clarity. He appears to have left no available source unexamined, and his depiction of Goodyear’s financial and legal struggles is exhaustive—if not, indeed, also exhausting.

Korman points out that information about Goodyear’s personal life is elusive; there are no known letters between family members, for example. To add color and substance to his tale, therefore, he sometimes fabricates details about what people did, said, and thought “based on their characters as described by others and the customs of the time.” For instance, Korman presents a tragic bedroom scene at the death of Goodyear’s first wife, Clarissa, that is not based on any recorded account of the event. These speculative passages do fill in what would otherwise be blanks in the story, but purists might raise a skeptical eyebrow and question the book’s overall credibility.

Korman’s grasp of chemistry, especially polymer chemistry, is a bit vague and shaky on occasion. Nevertheless, this hardly detracts from the interest of the book as a whole. It is, after all, not about a chemical process but about a man who met disaster and triumph with fortitude and stoicism—truly an original in the pantheon of great Yankee tinkerers.

Since his retirement from C&EN in 1991, David M. Kiefer has written frequently about the history of the chemical industry for Today’s Chemist at Work and other publications.