RUBBER MIRROR

Henry J. Inman

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REFLECTIONS OF THE RUBBER DIVISION'S FIRST 100 YEARS

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CONTENTS

LIST OF ILLUSTRATIONS

For our children,
Gina (Jason), Michelle (Justin), Lara,
Rebecca, and Bryan, and our grandchildren Dylan,
Travis, Jack and Ayden.

PREFACE

People tend to forget that the word "history" contains the word "story."

KEN BURNS

It was late in September 1978 when I first moved to Akron, Ohio, from Oklahoma. Oklahoma! Remember? "Where the wind comes sweeping down the plains?" I arrived fresh from the newspaper business and was making the transition to the corporate world. A former college classmate and longtime friend, Gaylon White, encouraged me to move to Akron. He said it wasn't a bad place to live—in the summer. He didn't tell me about the ferocity and length of the winters in northeastern Ohio. I would have to experience that on my own. So partly out of naïveté, or just plain ignorance, I welcomed the challenge.

I took a deep breath when I got out of my car in the Seiberling Field parking lot of the Goodyear Tire & Rubber Company and received a pungent reminder of my surroundings. I thought to myself, What the hell is that smell? Is that burnt rubber? Coincidence never was far from me, and neither was a fellow employee. I asked him the same question that was bouncing in my brain, and I'll never forget his response. He laughed and said, "That's not rubber burning. That's the smell of money!" And so I received my introductory lesson in Rubber 101.

The last thirty years at Goodyear and in the rubber industry have been a great education for me, and there were many people who, whether

they realized it or not, were mentors to me and played a role in the development of this book.

Working my way back in time from the most recent, Chris Laursen, the latest in the line of great librarians for the American Chemical Society's Rubber Division, provided invaluable help in my research. I could not have done it without him. "Goog" (a shortened version of Google, the online search engine) was the greatest help whenever I needed it. Equally valuable to my efforts was Ben Kastein, who in his early nineties is the sage of the Rubber Division. I beat a path between Cuyahoga Falls and his home in Silver Lake—it used to be called the Ohio Canal. Another great contributor was the legendary Ralph Graff. Thanks to him, I can write off hundreds of minutes of long distance phone calls. He was another great "go-to" guy.

The other Rubber Division people who were invaluable to my research efforts were Charles Rader, Melanie Avdeyev, Karen May, and, of course, Ed Miller, who not only shared some personal thoughts with me but also reviewed each chapter along the way. I also owe a great deal of gratitude to the many present and former Rubber Division members who willingly spent their valuable time with me to pass along their past knowledge. At the top of that list is Marge Bauer.

Contributors from the University of Akron also were numerous. Kent Marsden provided me with access to his personal thoughts and also served as a source of contacts within the university. Frank Kelly, Marsden's former boss, was a conduit of information, and Mark Bowles, author of *Chains of Opportunity* (University of Akron Press, 2008), gave me some great advice: "Just start writing!" Other University of Akron motivators were Kathleen Endres and David Ritchey, professors extraordinaire in the Department of Communication, and graphic designer Dave Szalay.

Other academics of note are Nancy Martin, University of Rochester archivist and Rochester collections librarian, and a University of Notre Dame undergraduate student, Bryan Fair, who will likely one day make his own mark in the world of the written word.

Several members of the Fourth Estate provided assistance, knowledge, and a critical eye to several chapters. They are Don Smith, editor of *Rubber World*; Bruce Meyer, managing editor of *Rubber & Plastics*

News; Ed Noga, editor of *Rubber & Plastics News*; Jack Sweeney, publisher of the *Houston Chronicle*; Cynthia Bates of the *Houston Chronicle*; and Dave Giffels and Steve Love, former *Akron Beacon Journal* writers and coauthors of *Wheels of Fortune* (University of Akron Press, 1999).

My appreciation also is extended to UK resident P. Graham Willis, retired Goodyear plantations expert, who reviewed the early chapters on rubber to ensure their accuracy. Another former Goodyear associate I mentioned earlier was Gaylon White. I can't mention him enough. He was a classmate of mine at the University of Oklahoma who was not only my mentor but also a very good friend and one the best writers I've ever known. Gaylon and I also owe a great deal of our enthusiasm of the written word to the late Harold Keith, sports information director emeritus at Oklahoma, who nurtured our creative growth. The other individual who gave me guidance early on was Sister Mary Martina, OSM, my high school journalism and chemistry teacher at Mount St. Mary's in Oklahoma City, who knew all along what path I should pursue.

Then, of course, I cannot forget my mother, Olga, and my late father, Henry R. They gave me encouragement, support, love, and a strong set of principles, not to mention a great sister, Jeanette, and two exceptional brothers, Johnny and Dennis.

Finally, the support and love from my wife Karen has helped me through not only this project but also some personal road bumps all along the way.

INTRODUCTION

In 1909, a courageous group of twenty-eight rubber chemists, members of the American Chemical Society (ACS), made a bold move and formed a subsection of the society—the India Rubber Chemistry Section—to discuss issues more pertinent to the industries for which they worked. While it took them another ten years to further define their identity as a division, the impetus for their almost rebel-like decision was not self-aggrandizement but a simple desire to share information about the properties of rubber. Foremost in their minds was the improvement of the quality of rubber coming from the wild jungles and plantations of the world's tropical zones. There was no consistency in quality or price, and they reasoned that *collective* minds working in harmony would help solve the problems or at least give them a better chance to deal with the issues. Furthermore, with a veil of secrecy draped over most industries at the junction of the nineteenth and twentieth centuries, there was no forum that offered them the opportunity to exchange data and thoughts without fear of reprisal.

The Rubber Division pioneers were right: Collective minds could indeed help their causes. One hundred years later, their success and the legacy they passed to those who followed can be seen in virtually every rubber or plastic product on the market today. From the tires that travel the world's roads to the vehicles that traverse outer space, rubber chemists and their professional organization, the Rubber Division of the ACS, continue to provide valuable information and support to a variety of industries in the interest of continuous improvement. Their mantra exists

today: "To promote the education, professional growth and betterment of those individuals associated with the rubber and associated industries."

This book is not an attempt to reinterpret history, nor is it an attempt to enumerate the many events or mention all the individuals who were an integral part of the Rubber Division's past. A few publications already have gone into great technical detail about many of the elements noteworthy to the division's growth. In particular, *Rubber World*, originally called *India Rubber World*, has been documenting the division's actual development and activities for more than one hundred years. In relatively recent times, two particular issues were extremely valuable in the research of this book. Beginning with the October 1966 issue, four writers—Editor Otto Scott, Managing Editor Bill Mulligan, Technical Editor Joseph Del Gatto, and Engineering Editor Ken Allison—authored an excellent series of articles concluding in February 1967. The series was titled "The Division of Rubber Chemistry: Catalyst of an Industry." And in 1984, *Rubber World* published an equally impressive special issue commemorating the seventh-fifth anniversary of the division.

A competing publication to *Rubber World* was the now-defunct *Rubber Age*. Its longtime editor, Mel Lerner, not only provided solid editorial material about the division but also attended most biannual meetings and was one of the most active supporters of its efforts. Another publication that documented division activities in great detail is Crain Communications' *Rubber & Plastics News* (*RPN*). Founded in 1971 by Ernie Zielasko (who became familiar with the division when he was at *Rubber World* magazine), *RPN* also was an active division supporter. In 1984, *RPN* published a special about the division's seventy-fifth anniversary: *In Tribute to the Chemists Who Tame Rubber: Celebrating the 75th Anniversary of the ACS Rubber Division*. The following year, the division honored Zielasko with its Distinguished Service Award.

The final publication that recorded division events, *Rubber Chemistry and Technology* (*RC&T*), is the most complete. Founded in 1928, there is no periodical that covers the technical side of the division better than *RC&T*. The editors who solicited, collated, edited, and published thousands of technical papers contributed more to the industry's success than they realize.

The above-mentioned journals, as well as books on specific subjects (e.g., Maurice Morton's *Rubber Technology* and G. Stafford Whitby's *Synthetic Rubber*), are great contributions to any rubber chemist's library. This book cannot come close to replicating the knowledge and years of research devoted to such extremely worthwhile endeavors. Rather, it offers the nontechnical reader a morsel of information on rubber—its past, present, and future—and a condensed chronicle of some of the many individuals who made up the Rubber Division. After all, the division is comprised of people. My intent is to help the reader understand the lives of some of those people and provide an insight into the key events that drove the division and had an impact on the industry.

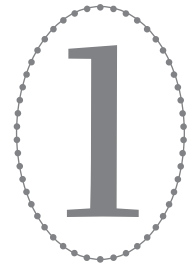
Great people often come from simple backgrounds, and it is in understanding this that we can better appreciate their individual and collective achievements. Through this book, as it reveals a little of their identities—often not at all related to rubber—the reader can come to know those members of the Rubber Division and their contributions to the industry.

The Rubber Division of the American Chemical Society did not conduct research into rubber or develop the compounds or the products. However, the division and its structure provided many rubber chemists with a collaborative "think tank" that fostered the ideas to help many individuals develop those creations so vital to our lives today. In a December 10, 2007, edition of *Rubber & Plastics News*, Managing Editor Bruce Meyer wrote of Daniel L. Hertz Jr., the seventy-seven-year-old president of Seals Eastern, Inc., "Hertz is a self-educated scientist who got much of his education through ACS Rubber Division courses, attending conferences and reading the hundreds of science and technology books in the library outside his office." Hertz was selected that year as the publication's Rubber Industry Executive of the Year.

But longtime division historian Ben Kastein said it best. Recalling the many technical papers contributed by division members, he said, "The division is all about relationships, information. The papers reflected the current interest at that time. If you look at the papers that had been published, that gives you a trend of what was important in the rubber industry. So the Rubber Division was kind of a mirror of what was (and is) going on in the rubber industry."

PART ONE

IN THE BEGINNING



KING OF THE JUNGLE

The most beautiful thing we can experience is the mysterious. It is the source of all true art and science.

ALBERT EINSTEIN

In the jungles that cover the earth's tropical zones like broccoli heaped on a salad, there are trees that ooze a milky substance when lanced by a spear, a rock, a knife, or any other sharp object. Indigenous people of those areas were the first to notice that the liquid would gradually harden and turn black on exposure to air.

As near as anyone can determine, the French were the first civilized group to conduct a study, of sorts, on this unique material. In 1735, under the leadership of mathematician Charles-Marie de la Condamine, surveyor Pierre

Bouguer, and scientist Louis Godin, the Académie Royale des Sciences in Paris dispatched an expedition to Peru, ostensibly to calculate the size of a degree of latitude at the equator. They found that the country contained something more than mountains and people.

Strangely, the three men finished the journey to their ultimate destination by different routes, Bouguer and Godin sailing to Quito and de la Condamine traveling overland from Manta. The three converged at Quito and were soon arguing, something of a modus operandi for scientists. Godin wanted to work on his own, while Bouguer was content to work with de la Condamine. Bouguer proceeded to measure the density of the earth using the instruments of his time—a plumb line and a mountain. He and de la Condamine eventually talked to each other, and the two later collaborated on a published account of their work, *La Figure de la terre* (1749).[1]

The odd triumvirate completed their measurements in 1743, and to none of the three's surprise, they returned to France by different routes. Before he left Peru, de la Condamine had found something else in his expedition that he wanted to share with colleagues back at the academy in Paris. Intrigued with some substance the natives were manipulating, he had gathered a sample from them and sent it back to the academy with a note titled "Caoutchouc:"[2]

> There grows in the province of Esmeraldas, a tree called by the natives of the country "Heve." There flows from it, by simple incision, a [liquid], which hardens gradually and blackens in the air. The inhabitants make flambeaux of it, which burns very well without wicks, and gives rather of a fine light. . . . In the province of Quito, sheets of linen are coated with it, and are used for the same purpose as we use wax cloth. . . .
>
> The same tree grows along the banks of the Amazon and the Mainas (Mayan) Indians call the resin which they extract from it "cahuchu." They make boots of it, which do not draw water, which after being blackened by being held in the smoke, have all the appearance of leather. They coat earthen molds in the shape of a bottle with it, and when the resin has hardened, they break the mold and force out the pieces through the neck and mouth: thus they get a non-fragile bottle, capable of containing all kinds of liquid.

The Peruvians, the other South Americans, and their inquisitive European visitors were dealing with what we call today natural rubber. They named it "caoutchouc."

Before de la Condamine departed, and likely tired of measuring mountains, he made a side trip to Cayenne, the capital of French Guyana in northeast South America, where he met fellow Frenchman François Fresneau, with whom he shared his experiences, including the material the Peruvian natives were manipulating. Fresneau became intrigued by de la Condamine's stories and, in particular, by the new substance, caoutchouc, that he was shown. About ten years later, Fresneau gave de la Condamine a report to present to the Académie Royale. This was the first methodical paper on rubber, published in 1755. De la Condamine used Fresneau's report as a basis for a paper he delivered to the academy titled "Memoir on an Elastic Resin Newly Discovered in Cayenne by Monsieur Fresneau, and on the Use of Various Milky Juices of Trees of Guiana of Equinoctial France."[3] In spite of its lengthy title, the report is one of the first known documents by a European who considered the substance as a potential industrial material.

De la Condamine wasn't as interested in the new substance as Fresneau, who spent the next ten years studying rubber, using exploration and scrutiny as his research tools, documenting his observations along the way. His later-published papers describing his findings didn't make any strong scientific claims, but Fresneau at least saw the budding possibilities of rubber after studying its properties for so long.

While the French are believed to be the first to study caoutchouc, or rubber, their neighbors to the south, the Spaniards and Portuguese, were aware of the substance much sooner. Some historians note that about 1519, a Spanish writer, Antonio de Herrera-Tordesillas, reported on Aztec children playing games with balls made "from a black resin, obtained from a tree called by the natives 'ulaquhuil.' " The name seems to have been a derivation of a tree, the *Castilla elastica*, or *ule*, which still grows in parts of Mexico and Central America. Other chroniclers of events point out that Pierre Martyr d'Anghiera, another Spanish writer from Madrid on a visit to Mexico in 1525, also published a description of some children playing with balls made of that substance.

Normally, given the era and its absence of today's sophisticated communications tools, media, and so on, either of the authors' writings might be interpreted as purely anecdotal. However, the credibility curve is enhanced by knowledge of Anghiera's background. He was employed as a tutor to the children of King Ferdinand II of Aragón and Queen Isabella of Spain and became prominent as a writer with two major works: *Opus Epistularum* and *De Orbe Nouo*. Most pertinent to his documentations about rubber balls in Mexico, *De Orbe Nouo* is a work that has extremely important historical value in U.S. history, as it documents Christopher Columbus's discovery of America. Anghiera had access to more than 816 letters addressed from Columbus to the royal court, as well as many of the individuals who made the journey. It is unknown if he actually talked directly to Columbus.

On his second voyage to the New World, Columbus also reported some natives of Haiti playing with a ball made from the sap of a tree. Regardless of who—or what country—first mentioned "rubber," no one will dispute the expeditions by the French, Spanish, and Portuguese pioneers that brought about the substance's introduction to the rest of the world. However, for almost three hundred years after Columbus, there was still no commercial use for natural rubber and it was, for the most part, just like the surroundings of its source—very primitive, uncontrollable, and not travel-friendly. Other than rubber balls and other items quickly molded in the jungle, no one saw the potential for the substance. It would thicken fairly rapidly in the air, making it virtually impossible to transform it into anything more marketable and usable than those rubber balls.

In the latter part of the eighteenth century, however, the English got into the game big time. On April 15, 1770, British philosopher and self-taught chemist Joseph Priestley, who would later be recognized for his discovery of oxygen, and other compounds, discovered that caoutchouc rubbed out lead pencil marks. In one swift moment, he invented the eraser and then gave the material the name "rubber." About that same time, Priestley's new name acquired a one-word prefix, "India." In early English trading circles of that era, caoutchouc was classified as an "exotic." Exotics were likely the name given to what we today call commodities. As such, all exotics were directed to a section in the southeast

corner of London, near Seething, Mark, and Mincing lanes, that was the port of entry for ships of the East India Company, the largest commercial venture in the world at that time. Any savvy salesman who wanted to sell exotics knew he had to deal with the East India merchants. So, probably in the cockney sort of way, to give a quick description of the product to potential buyers, and because it came from the East India Company (not India), it became known as India rubber.[4]

The product now had a new name, but to reach the point of practical usage—a viable application—early rubber chemists and researchers of the day knew they had to spend the majority of their time trying to find a good solvent for this new substance, something they could transform into a workable substance.[5] As de la Condamine and others later discovered, as soon as you take it out of the jungle, it coagulates quickly. The first solvents tried were turpentine and ether. Two Frenchmen, a chemist, Pierre Joseph Macquer, and a physician, Jean Thomas Herissant, tried turpentine, but soon discovered that their efforts were greatly affected by temperature; in hot weather, the rubber became sticky, and in cold weather it became hard and stiff. In 1773, Macquer tried to make some riding boots for Frederick the Great by coating a wax cylinder with rubber dissolved in ether. The ether evaporated quickly, and the wax, of course, melted in hot water.

In 1791, another French chemist, Antoine François de Fourcroy, discovered that "fixed and volatile oils" turned rubber into a "varnish" that could be easily spread on fabrics.[6] A year later, the first rubber patent was issued to Samuel Peal of England, using turpentine as a solvent to waterproof fabrics. In 1818, a Scottish surgeon, James Symes, distilled coal tar to get a straw-colored liquid that provided a better solvent—essentially naphtha. It was cheaper than turpentine and enabled the rubber to dry better. Five years later, a patent was issued to another Scot, Charles Macintosh of Glasgow, for a waterproof fabric of two pieces of wool held together with rubber using Symes's naphtha solvent. Its application? A coat to repel rain. Today, the British still call the raincoat a "macintosh" or "mac."

Initially, Macintosh's product wasn't as successful as he wanted it to be, but a London coach maker, Thomas Hancock, thought Macintosh's product worthy enough to use on the top of his carriages and acceptable

for other things, such as curtains, pant-pocket edges, shoe tops, and so on. Hancock became so enamored—and successful—with his new diversion that he quit the coach business and went into producing more of the new rubber material. He later would manufacture some solid rubber covers to serve as cushions for the wheels of Queen Victoria's carriage and be credited, in many historical circles, as the catalyst of today's tire industry.

For the next two decades rubber chemical discoveries took an unintentional sabbatical—until Charles A. Goodyear's revelation of vulcanization in 1839. But even then, Goodyear didn't reap any monetary benefits from his discovery because Hancock had beaten him to the patent punch by securing rights in England to a sulfur-heat rubber treatment. Goodyear eventually received a U.S. patent on June 15, 1844, but by that time, natural rubber already had developed a significant amount of attention throughout the world.

With Macintosh's application and the influx of rubber shoes from Brazil, natural rubber had a couple of its first marketable products. But even by the middle of the nineteenth century, demand for the product hadn't yet forced the jungle workers—primarily in the lower Amazon region of Brazil—into overtime. There were a few reasons this substance took its time in developing. For one, the process of gathering the material—essentially from the tropical forests in South America's Amazon basin—and transporting it by canoes to the ships was very time-consuming. Then the voyage across the ocean was equally lengthy. The other chink in the process was in the trees themselves. From seed to tapping, it took seven years for a tree to mature. In spite of those relatively small hurdles, the demand for natural rubber started to increase about 1860 primarily because of a civil war developing in the United States. That sent the price of natural rubber up to more than one dollar a pound in 1865.[7] It wouldn't be the last price squeeze, nor would it be the last regional or world conflict that would have a significant impact on rubber's supply and demand.

In spite of the increase in demand, the supply of Brazilian rubber, *Hevea brasiliensis*, continued to grow and it precipitated the dividing of the Maranhão and (Belém do) Pará regions and the formation of Amazonas where a higher quality of hevea existed. The problem for the Ama-

zonas, though, was that it was several hundred miles up-river from Belém, and overtapping and slashing of trees to meet the increase in demand would have an obvious and negative long-term impact.

In 1866, one leader, Don Pedro II of Brazil, thought he could mitigate some of the country's problems. He had the foresight to capitalize on Brazil's natural resource and opened the Amazon River to ocean-going steamships that enabled those vessels to travel as far as fifteen hundred miles inland to load their products. The likely unfortunate aftermath of this decision, however, was the increase in production that forced more inexperienced tappers (called *seringueiros*, or "men of the syringe tree") into the harvesting process, which killed thousands of trees because of improper tapping.

In spite of his efforts, Don Pedro's prudence was short-lived because the problems experienced in the jungles of South America became opportunities to those outside of that continent. One individual prominent in the development of other geographical sources of natural rubber was Sir Clements Markham, a former officer in the Royal Navy turned geographer, entrepreneur, and opportunist. Through Markham's prior success in transplanting cinchona (quinine) seeds from Peru to India, he knew he could do the same with hevea seeds from Brazil.

In 1873, through James Collins, curator of Physic Gardens of London Apothecaries Company, Markham enlisted the assistance of Brazilian-based Henry Wickham to procure the seeds. Wickham hired some natives to collect, pack (between layers of banana leaves in wicker baskets), and hang the seeds in the hold of a ship to allow air to circulate and prevent them from turning rancid. On June 14, 1876, the ship docked at Liverpool, England, and the seeds were transported by rail to the Royal Botanical Gardens at Kew, outside London.[8] By 1880, the seeds that had been successfully planted in Kew were sprouting and thriving in small experimental plots on estates in southern India, Ceylon, Singapore, and Java. Later, that list would include Central Africa. *Hevea brasiliensis*, natural rubber, had now truly become global.