Brown & Sharpe and the Measure of American Industry

Gerald M. Carbone
with the Rhode Island Historical Society
Foreword by Steven Lubar

Joseph Brown, founder of Brown & Sharpe, was a skilled clockmaker who invented new machines, and new ways to make things. Samuel Darling, an eccentric inventor from Maine, joined up and brought with him his engine for marking precise graduations on measuring instruments. Lucian Sharpe, with his son Henry and grandson Henry, Jr., guided the company for more than a century—and along with it the global machine tools industry.

The men and women of Brown & Sharpe produced and marketed a dazzling array of measuring devices, machine tools and precision machinery. They truly helped shape Rhode Island, the nation and the modern world. The history of Brown & Sharpe covers more than 150 years of technological development, labor history and public policy, culminating in history's longest strike.

GERALD M. CARBONE completed a John S. Knight Fellowship at Stanford University, and earned a master's degree in public humanities at Brown University. This is his third book. He lives in Warwick, Rhode Island.

Front cover: *inset* the DigitCal, billed as the first hand tool to embrace microchip technology, introduced by Brown & Sharpe in 1978; *foreground* The three-story "fire proof" factory designed by Frederick W. Howe in 1872 stands in the foreground, next to a foundry that fired for the first time in December 1880. (photographs courtesy Rhode Island Historical Society)

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CARBONE **Brown & Sharpe and the Measure of American Industry**

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Making the Precision Machine Tools That Enabled Manufacturing, 1833–2001

Gerald M. Carbone *with the* Rhode Island Historical Society

Foreword by Steven Lubar

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Acknowledgments

First, thanks to Phil West, a friend and author of *Secrets and Scandals.* Phil knew I was looking for work, and he knew that Henry Sharpe, Jr., and his wife, Peggy, wanted someone to write the story of Brown & Sharpe, the company that the Sharpe family was connected to for 153 years. Phil introduced us. Thanks also to Henry and Peggy Sharpe, who hired me with only one condition: "We do not want a vanity book." They wanted an unvarnished, objective look at the company's history—I hope I have delivered.

The Rhode Island Foundation and the Rhode Island Historical Society were instrumental in bringing this project to fruition. Thanks to RIHS Executive Director Dr. Morgan Grefe, who convened two panels of experts to critique early drafts of this story. The panelists offered valuable commentary, though did not necessarily condone the work—in fact one of them, industrial historian Pat Malone, emphatically told me this was *not* the story he would have written about Brown & Sharpe! Besides Dr. Malone, insightful readers included the late Rick Greenwood, Ted Widmer, Steve Lubar, Jaimie Warren, Steve Proctor, Dr. Grefe, Matt Burriesci, Ned Connors, and Rick Slaney.

The staff at the Rhode Island Historical Society's Mary Elizabeth Robinson Research Center embraced this project, even allowing my research assistant access when the library was closed for emergency repairs. About this research assistant, my sister, Jean Carbone: she is so much a part of this work that I offered her credit as co-author, which she humbly declined. But she was a colleague and generator of ideas, and much of this book is drawn from her work in the archives.

Numerous people gave their time to be interviewed for this story, and again without implying that they condone the final draft, I would like to thank some of them: Velia Constantino, a real Rosie the Riveter who worked at Brown & Sharpe during World War II; machinist Ed Greene; engineers Merrick Leach, Arthur Parrillo, and Larry Webster; former apprentice Bill Nixon; Bruce MacGunnigle, East Greenwich town historian; labor historian Scott Molloy, and labor lawyer Marc Gursky; Dick and Chris Jocelyn from the company's human resources office; sales executive Rudy Bernegger; the children of Henry and Peggy Sharpe: Henry III, Douglas, and Sarah; Susan McGregor and her brother, Bill, who hail from generations of Brown & Sharpe workers, as did the late Maybury Fraser.

Traveling to archives, machine shops, and museums was educating and fun, thanks to: the late Fred Jaggi and the New England Wireless and Steam Museum; Droitcour

Manufacturing Company, which still uses dozens of Brown & Sharpe screw machines in its Warwick, Rhode Island plant; the Starrett Tool Company of Athol, Mass.; the staff and volunteers at the Charles River Museum of Industry and Innovation in Waltham, Mass.; welcoming staff at the Baker Library of the Harvard Business School; familiar faces at the Rhode Island State Archives, particularly Gwen Stern and Ken Carlson, and new faces at the University of Rhode Island archives; patient circulation staff at Brown's Rockefeller Library; and people at the American Precision Museum in Windsor, Vermont, particularly Ann Lawless and John Alexander.

Living near Brown University gave me access to roundtable workshops led by Professor Seth Rockman, where good historians unveiled books that they are currently writing. Seeing established historians such as Michael Zakim and Stephen Mihm in the early phases of wrestling new ideas into manuscripts was somehow bracing. Again, Zakim and Mihm have not even seen this work, much less endorsed it, but I single them out because Zakim is cited in it and Mihm writes about the standardization of things such as currency, weights, and measures, which is all relevant to the story of Brown & Sharpe.

Finally, there is my wife, Mary Preziosi, who not only contributed her technical expertise as a network administrator, but offered a listening ear, good feedback, and high tolerance as the manifold books, articles, and artifacts required to write this spilled out of my home office, onto the dining room table, and beyond. For three years this project and these people shaped my perspective and my life in unforgettable ways, and I am thankful for that.—G.M.C.

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Foreword by Steven Lubar

On one of my first days working as a curator at the Smithsonian's National Museum of American History, I discovered the Brown & Sharpe micrometer No. 1. The museum was planning an exhibition on the American industrial revolution. I was visiting storerooms, looking for artifacts that would tell the story of the hard work and ingenuity that powered America's transition from agricultural colony to industrial juggernaut.

I knew a bit about micrometers. My father had been a sheet-metal worker at the Philadelphia Naval Aircraft Factory. I had briefly worked in a machine shop, as a gofer, and my father had given me his micrometer—a revered symbol of the metal worker's skill. With a twist of the wrist, the micrometer told him the size of a part, the thickness of a sheet of metal, to a thousandth of an inch. But it took that skilled twist of the wrist—it wasn't a digital readout that just presented a number. It required a feel for the tool gained only through use. The twist of the wrist was symbolic of the deep knowledge of tools, measurement, and materials that was embodied in the metal worker's everyday work.

I knew something about Brown & Sharpe, too. It was one of the most important American machine tool firms, and had been, for a very long time. Machine tools were the technological heart of the American economy. They were the tools used to make other tools. A skilled machinist using Brown & Sharpe's machine tools could make just about anything. As a historian of industrial technology, machine tools were central to my work, too. The micrometer was a fine item for the exhibition. It captured, in one small device, entrepreneurial energy, technological innovation, and the skill of workers, all essential elements of the industrial revolution, and of American society.

The Smithsonian had a large amount of other Brown & Sharpe material. The collections included dozens of other measuring tools: the firm got its start by creating—inventing and manufacturing—some of the most accurate, and affordable, rules, scales, and calipers for metal work of all kinds. There were several Willcox & Gibbs sewing machines, an early success for the firm, which adapted the Armory System of making interchangeable parts to produce them. Machine tools in the collection included a gear-cutting machine and two universal milling machines—these were the breakthrough tools that defined Brown & Sharpe in the late nineteenth-century, and that helped make possible the mass production that shaped America's twentieth-century history. The library had hundreds of catalogs from the company, telling the long history

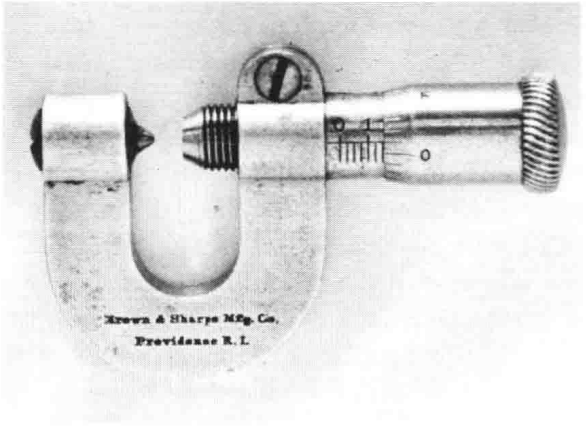
of the firm through the products it had sold. And on "permanent loan" to the museum was the symbolic heart of Brown & Sharpe: a linear dividing engine used to make precision measuring tools, built in 1852, a true national treasure.

Just as the micrometer would allow an object to tell the story of American technology and work, Brown & Sharpe would nicely tell the story of American industry. In the Brown & Sharpe collection were essential elements of the story of American industrial revolution. After all, Brown & Sharpe was at the center of that story, making the machines that made the looms, sewing machines, locomotives, automobiles, and weapons that made America modern.

I moved to Providence a dozen years ago, trading the Smithsonian for Brown University. Exploring the city, I found other traces of Brown & Sharpe. The firm had once been among Providence's largest employers and that history was still visible. Its original factory had been located just blocks from my office; that building was gone now. On the other side of downtown was the massive plant the firm had built starting in 1872, expanding it over the course of 70 years to include more than a dozen red brick factory buildings, spread over several blocks. It was once the largest tool manufacturing factory in the world.

That factory was mostly vacant, slowly being converted into offices and apartments. The neighborhood nearby was in decline. It had been home to many of the skilled workers at Brown & Sharpe, many of them immigrants who through their skills and hard work had been able to live in attractive houses within walking distance of the factory. Brown & Sharpe had moved to the suburbs in 1964, taking its skilled workforce with it. But even that new plant was mostly empty. A 16-year strike, along with a changing economy, management troubles, and international competition, had nearly finished off the firm. Brown & Sharpe was bought by a Swedish competitor in 2001.

I knew something of the machines, and the buildings, and the outline of the history. Behind them, of course, were the people, and that's a story that, until now, has not been so well known. The history of Brown & Sharpe turns out to be not only an important technological and economic story, but also a fascinating human story. Joseph Brown, the founder, was a skilled clockmaker-turned-machine-maker who invented new machines, and new ways to make things, as needed. Samuel Darling was an eccentric inventor from Maine, a one-time competitor who joined the firm and brought with him his prized dividing engine. The Sharpes—Lucian, his son Henry, and grandson Henry Jr.—guided the firm for more than a century, and shaped not only



A one-inch "Pocket Sheet Metal Gauge" that Brown & Sharpe released in 1868, renaming it the "micrometer" in its 1877 catalogue. The micrometer made it possible for every mechanic to have a precise, portable tool for measuring metal thicknesses always at his disposal.

the company, but also the industry, and the city. And apprentices, skilled workers, union leaders, financiers, and family members.

Gerald Carbone's history of Brown & Sharpe tells these stories, bringing the people to life, putting them into the context of Rhode Island's and the nation's history, and the history of technology and the economy. Brown & Sharpe's story is the story of the American Industrial Revolution. But Carbone does much more than tell a dry story of machines and money, of innovative design and engineering, profit and loss. The real story here is the human one, encompassing more than a century-and-a-half of change. How did the owners and managers negotiate the ever-changing economy, rapid technological change, changing expectations about work and pay? How did the men and women who worked at the firm learn their skills and organize their work to produce and market a dazzling array of measuring devices, sewing machines, machine tools? How did the firm help shape the city, and the nation?

That micrometer in the Smithsonian storeroom helped me connect with that work, those lives, a remarkable set of stories of entrepreneurship, corporate management, and skilled work. Carbone tell those stories with verve. He brings the history of Brown & Sharpe to life. It turns out that it's not only a rousing good history, but also a story with lessons for us today. The tools may change, the technologies differ, but smart people, working hard, trying new things, inventing and innovating, organizing production, selling their products; those are universal, as much the story of today's innovative high-tech firms as Brown & Sharpe's story. This is a book to be read not only as history, but also to help understand the present, and the future.

Steve Lubar is a Brown University professor of American studies, history and history of art and architecture, and former chair of the Division of the History of Technology at the Smithsonian's National Museum of American History.

Preface

On a fall day in 1849, a young mechanic's apprentice strolled to the northern edge of Providence to tour the old army campgrounds where hive-like depressions still pocked the earth. Here in the waning days of the American Revolution, 4,000 French troops had dug in for temporary lodgings while awaiting transport ships to carry them home after a successful campaign at Yorktown.

"About 4000 encamped here in the winter of 1782," wrote the apprentice, 19-year-old Lucian Sharpe. "A great number of holes remain, over which they pitched their tents." Here was tangible evidence of the American Revolution, essentially a capitalist insurgency fought by rogue colonialists such as George Washington and Nathanael Greene, to stamp out the vestiges of British mercantilism and to appropriate as their own powers and property previously relegated to the aristocracy.[1] Washington felt that the king had no more right to reach into his pocket than did his neighbor. Greene never cared a whit about the troubles with England until a British revenue cutter seized his family company's ship for evading customs—then he became obsessed with the cause. The Revolution's leaders were as motivated by Adam Smith's recently published paean to capitalism, *The Wealth of Nations*, as they were by Thomas Paine's appeal to *Common Sense*.[2]

Lucian Sharpe's grandfather had fought with Washington's troops at the Siege of Boston, but 65 years after the war's end the American Revolution had not fulfilled its promise of a free and equal society for the Sharpe family. Lucian's father, Wilkes, born among the generation that Joyce Appleby says "inherited the revolution" had barely escaped debtor's prison by selling his livery stable at public auction in 1834—horses, tack, sleighs, and all—to pay business debts.[3] The sale had left Wilkes so destitute that for a time he had to send young Lucian out of state to live with relatives while Wilkes got back on his feet as a hostler, a kind of valet for horses ridden to a local hotel.

Joseph Brown, born in 1810, also struggled to find a toehold in the economy of the New Republic. At age 23 he went into business with his father, David, making clocks, watches, and mathematical and nautical instruments such as protractors and sextants using only hand tools. They worked together for eight years, enduring a fire that razed their shop and destroyed most of their tools, before David Brown left his son to fend for himself. Disgusted with a Rhode Island law that restricted voting to an elite group of wealthy property owners, and frustrated in his vain attempts to change it, David moved to Illinois Territory in 1841.

This book traces the development of the political economy of the United States

from the days of the New Republic into the twenty-first century, as seen through the lens of a single Rhode Island metals manufacturer, Brown & Sharpe, that traced its roots to the Brown's shop in 1833. There was nothing in the Constitution that made capitalism's dominance of the American political economy inevitable; but once policy makers favored capitalism over other ways of organizing economies, the standardization of time, currency, and metrology did become inevitable by-products of capitalism. Standardization is necessary for assessing the relative value of commodities, a function of efficient capitalism; and Brown & Sharpe, co-founded by Joseph Brown with his apprentice, Lucian Sharpe, was a key driver of both industrial capitalism and its attendant standardization of currency, time-keeping, metrology, and manufactured goods, defining features of modernity as we live it.

I became interested in the Brown & Sharpe story largely by chance. A friend, Phil West, knew that Henry Sharpe, Jr., and his wife Peggy (both of whom appear in the latter chapters of this book) wanted to hire somebody to write the story of the company that the family had owned for more than 150 years. I was skeptical: I had been a union steward and contract negotiator for the Providence Newspaper Guild, and Brown & Sharpe was infamous in local labor circles as the company that had presided over a long and exceedingly bitter strike—arguably history's longest. But I agreed to meet with the Sharpes to discuss writing this story. They told me their family was not interested in a vanity book to clog up their coffee tables, they wanted a good, objective look at the company's history. After voting to sell the company in 2001, Henry Sharpe, Jr., had spent seven years organizing the firm's files into archives that he then donated to the Rhode Island Historical Society; he and Peggy wanted a writer to look through the 42 linear feet of archives, plus documents and objects, in the family's possession in order to tease out a narrative. We agreed that if there were serious problems in interpretation of the archival material, either one of us could walk away from the project. Happily, Henry Sharpe, Jr., and Peggy never second-guessed any of my conclusions while reading the draft. Peggy did correct a couple of errors I made in writing about her courtship with her husband. Naturally I wonder whether the Sharpe's role in underwriting this story affected my telling of it. I honestly do not believe that it did, though some of my union brethren may feel otherwise.

The principal manuscript sources for this work are housed in the voluminous Brown & Sharpe archive at the Rhode Island Historical Society. One of the reasons for writing this story was to showcase the wide span and deep detail of the archives so that historians may make future use of them. In the book's latter sections I also conducted interviews with people who worked at Brown & Sharpe from the 1940s into the 2000s. For secondary material I consulted more than a hundred books, journal articles, and newspaper stories. The most similar work to this one is Max Holland's *When the Machine Stopped,* which also examines the history of a machine tool company from its founding to its failure; a key difference between the two works is the time span: the company in Holland's story, Berg Tool, was founded in the 1940s, while Brown & Sharpe planted its roots more than a century before. To understand the causes of economic panics from 1837 to the Great Depression, I leaned heavily on Scott Nelson's *Nation of Deadbeats,* which I found to be a good, interesting, and accurate work.

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