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Wired for Business: The Roebling Story

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A thesis

presented to

the faculty of the Department of History

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Master of Arts in History

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by

Kelley Marie Hatch-Draper

May 2011

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Dr. Tom Lee, Chair

Dr. Melvin Page

Dr. Emmett Essin

Dr. Stephen Fritz

Keywords: Roebling, Wire Rope, Brooklyn Bridge, Technology, Civil Engineer.

## ABSTRACT

Wired for Business: The Roebling Story

by

Kelley Marie Hatch-Draper

John Augustus Roebling, a classically educated civil engineer and young Hegelian, immigrated to America in 1831 in search of freedom from a repressive political system that afforded him no opportunity for advancement. Arriving in the midst of the American market revolution, his dream of establishing an agrarian farming colony changed in response to societal transformations resulting from mechanization and the rise of industry. Within forty years, Roebling achieved fame as a canal engineer and bridge designer while establishing the American wire rope industry. Without Roebling's innovation in wire-rope, modern suspension bridges, high-rise elevators, construction cranes, and cable cars would not have been possible. Yet historians have virtually ignored Roebling and other civil engineers, entrepreneurs, and inventors who built America's infrastructure. Known primarily, if at all, as the designer of the Brooklyn Bridge, Roebling is an enlightening study of Old World education and training used in the New World.

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## DEDICATION

To my mother, Ava Jackson Marsh, and my father, Roland Walter "Jack" Marsh (1928-2006), thank you for the library of books, the trips to historic venues as a child, and for instilling in me there is no such thing as "I cannot," only, "I will not." To my son, Jeremiah Shaun Johnson (1978-2009) who insisted I return to college and believed in my dream. To my son, Joshua Adam Johnson, and his wife Jamie, the wind beneath my wings, for all you are every day of your lives. To my grandsons, Joshua Dylan and Jordan Matthew, who thought it hysterically funny that their Grammie had to do homework. To my "thesis therapy group" –Kelli, Melody, and Darnell, I love you. To Dr. Richard C. Merritt and his wife Maureen, Dr. Ruth Livingston, Mr. Greg Walters, and Mrs. Judith Celentano there are no words but "thank you." Last, but not least, to Dr. Melvin Page and Dr. Emmett Essin, whose belief in me oftentimes exceeded my own, and who as educators and historians instill in their students every day the value of telling the truth about history.

"This is the vocation of our own and of every age: to grasp the knowledge that already exists, to make it our own, and in so doing to develop it further and raise it to a higher level; in thus appropriating it to ourselves we make it something different than it was before."

Georg Friedrich Wilhelm Hegel (1770-1831)

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## CHAPTER 1

### INTRODUCTION

History is full of folk tales. Johnny Appleseed, Paul Bunyan, and John Henry are but a few of the mythic characters that have inhabited America's collective narrative, but real individual—engineers, entrepreneurs, and inventors—were responsible for canals, roads, bridges, and skyscrapers—ideas, inventions, and infrastructure that drove America's rise to industrial prominence. Their contributions, their patents, and their understanding of technology stood as the cornerstone of an industrialized America. Historians, as detectives searching for clues that deconstruct our past, furthering our knowledge and understanding, have used a model of this period that overlooks an entire class. John Augustus Roebling and his son, Washington Augustus Roebling, are perfect examples. Known largely, if at all, for designing and building the Brooklyn Bridge, John Roebling's innovation of wire rope—"a technology that made possible modern suspension bridges, high-rise elevators, construction cranes, and cable cars"—has barely registered with historians outside the field of engineering.<sup>1</sup> Credited with single-handedly establishing the American wire rope industry, Roebling's story, from immigrant to wealthy inventor and entrepreneur, provides a fascinating look into the expectations of immigrants and the growth of American industrialism. As he embraced the freedom of opportunity his new country would offer, Roebling carried with him his European past and a vision of America and of himself heavily influenced by an eminent German philosopher. John Roebling's story, a story embodying ideals of progress and freedom drawn from Old World philosophy and manifested in the context of America's market revolution, challenges any understanding of nineteenth-century

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<sup>1</sup> Donald Sayenga, outside cover, Washington A. Roebling, *Washington Roebling's Father: A Memoir of John A. Roebling*, ed. by Donald Sayenga, (Reston, VA: American Society of Civil Engineers Press, 2009).

American history that fails to acknowledge the importance of men like Roebling, engineers whose intellectual perspicacity built modern America.

Regrettably, few historians have chosen to study the Roebling story, and most who have examined it have done so only as an ancillary pursuit related to some other inquiry such as the history of the Brooklyn Bridge. In 1931, for instance, Roebling family friend and Trenton, New Jersey native Hamilton Schuyler published *The Roeblings*, a story of three generations of the family. D.B. Steinman grew up in the shadow of the Brooklyn Bridge so fascinated by its marvels that he became a noted bridge-builder and author. He wrote in his 1945 work, *The Builders of the Bridge*, that he drew "upon his imagination" and that he had "taken slight liberties with strict chronology" in the early portions of the book while remaining "faithfully and historically accurate" to the bridge building sections.<sup>2</sup> Liberties such as this have allowed historical inaccuracies and legends concerning the Roebling story to be recounted as fact. Historian David McCullough published *The Great Bridge: The Epic Story of the Building of the Brooklyn Bridge* in 1972. McCullough wrote his purpose for the book was "to tell the story of the most famous bridge in the world and the context of the age from which it sprang."<sup>3</sup> However, McCullough's work, though well researched deals mostly with the Brooklyn Bridge and became Washington Roebling's story. Other works have been published by wire historians such as Donald Sayenga who wrote *Ellet and Roebling*, a comparative case study of the two bridge and canal builders. No previous works have sought to contextualize John Roebling's story and philosophy into the evolving American fabric of the market and industrial revolutions.

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<sup>2</sup> D.B. Steinman, *The Builders of the Bridge: The Story of John Roebling and His Son*, (New York: Harcourt, Brace and Company, 1945), viii.

<sup>3</sup> David McCullough, *The Great Bridge: The Epic Story of the Building of the Brooklyn Bridge*, (New York: Simon and Schuster, 1972), 11.

One explanation for the failure of historians to examine the Roebling story is the types of questions historians have sought to answer about American business. Most historians have focused on the wealth, excess, and ruthlessness of the Robber Barons, seriously neglecting other great men and their accomplishments. In their treatment of this period in American history, progressive historians tend to emphasize the gulf between the wealthy excesses of the captains of industry and the poor conditions of their workers. Caught up in a muckraking fascination with unmasking the immoral business practices of the Robber Barons, historians have failed to account for men such as the Roeblings of Trenton, New Jersey who were as wealthy and influential as their counterparts. Unlike Andrew Carnegie and John D. Rockefeller, the Roeblings were classically educated, trained professionals who invented and engineered their way to wealth.

The histories of business, technology, and engineering are relatively new fields of discipline in the academic world. Their influence, separately and cumulatively, on the emergence of the United States as an industrial power is without question. Vast, complex, and overlapping, business, technology, and engineering encompass a plethora of historical topics from economics and politics to social history and culture. There is also a biographical element, telling the stories of the men and women involved. Historians have so far tended to carve out particular niches, for example focusing on the monopolistic business practices of the Robber Barons. Presenting the historiography of business, technology, and engineering is problematic for several reasons. Each field is a relatively new area of study for scholars who have tended to ignore individuals who actually created something substantive, something other than personal wealth. Historians have excluded the entire class of professionals most responsible for American technological success, the engineer.

To understand the motivating factors of business, technology, and engineering, one must start with the history of corporations in America. The rise of corporate structure in American society initiated a revolution that encroached on every aspect of life. Incorporation, "the emergence of a changed, more tightly structured society with new hierarchies of control" was the catalyst for the Industrial Revolution.<sup>4</sup> Prior to the Civil War businesses that incorporated did so for the public good, building roads, establishing a communal source of water, or constructing canals. Issued by government entities, business charters created corporations that were the equivalent of modern non-profit corporations. With economic growth, and westward expansion, the fabric of American society changed as modern national markets emerged.<sup>5</sup> A new America, rich in resources could only grow with money to harness them. Economically feasible and extremely efficient, selling shares directly to the public for the capital necessary to expand business created a climate through which a new way of doing business emerged.<sup>6</sup> This aspect of American history, incorporation, and its effect on society and culture has fascinated historians such as Alan Trachtenberg. Trachtenberg's analysis of the rise of the corporate structure centers around the theme that United States corporations changed "the face and character of American capitalism...altering politics, education, family life, literature, and the arts."<sup>7</sup> His work provides students of business history with a clear cause and effect road map of how the United States shifted from a society that produced goods for personal use to become a society of mass consumers. Like a social scientist studying the cultural effect of incorporation in America and society's response to it, Trachtenberg argues, "Economic incorporation wrenched American

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<sup>4</sup> Alan Trachtenberg, *Incorporation of America: Culture and Society in the Gilded Age*, (New York: Hill and Wang, 1982), 3.

<sup>5</sup> Trachtenberg, *Incorporation of America*, 6.

<sup>6</sup> Trachtenberg, *Incorporation of America*, 7.

<sup>7</sup> Trachtenberg, *Incorporation of America*, 4-5.

society from the moorings of familiar values, into a time of contradiction and conflict."<sup>8</sup> This negative view of the rise of business in America is a theme that plays out repeatedly in the work of historians.

Coupled with novel business practices, the rise of the American corporate structure spurred historians to investigate businesses with a different focus. Historians were deeply concerned with the effect of this new business culture on American society, and the great wealth and excess of the Gilded Age provided them considerable fodder. Rags-to-riches men such as Andrew Carnegie (Carnegie Steel), and John D. Rockefeller (Standard Oil) became larger-than-life examples of seemingly ruthless men who became wealthy at the expense of others.<sup>9</sup> Progressive historians propounded an image of the Carnegies and Rockefellers in the nineteenth-century that demonstrated little sympathy for the accumulation of the wealth and power that the so-called Robber Barons represented. "With the age of the Robber Barons, another age and another form took shape –that of the giant corporate body," Trachtenberg writes, adding, "The age of celebrated individualism harbored the decisive decline of proprietors, family businesses, and simple partnerships, the familiar forms of capital."<sup>10</sup> Historians began to look more closely at the business practices of the nation's richest men. Negative in connotation, the Robber Baron age of business history saw historians taking wealthy men to task for their accomplishments and personal excesses. Seen by historians as a new ruling class, the power of the Robber Barons to attract press attention with the monumental scale of their homes and their ostentatious lifestyles, allegedly provided little of redeeming value.<sup>11</sup>

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<sup>8</sup> Trachtenberg, *Incorporation of America*, 7.

<sup>9</sup> See David Nasaw, *Andrew Carnegie*, (New York: Penguin Press, 2006); Raymond B. Fosdick, *John D. Rockefeller: A Portrait*, (New York: Harper and Brothers, 1956); Sterling G. Slappegly ed., *Pioneers of American Business*, (New York: Grosset and Dunlap, 1973).

<sup>10</sup> Trachtenberg, *Incorporation of America*, 82.

<sup>11</sup> Trachtenberg, *Incorporation of America*, 87.

One of the first business exposés, authored not by an historian but by investigative journalist, Ida M. Tarbell, vilified John D. Rockefeller and Standard Oil and established a method of writing about business that persists to the present day. Tarbell, labeled "queen of the muckrakers," proffered a history of Standard Oil serialized in *McClure's Magazine*. The serialization brought the practices of big business monopolies to a large public that did not read books, and made John D. Rockefeller "the great whipping boy of capital" and "the favorite ogre of the United States."<sup>12</sup> Tarbell's uniqueness in telling the history of Standard Oil stems from her use of public documents to piece together the inner workings of a major corporation.<sup>13</sup> This exposé method, writing about businesses and the men behind them, became standard practice. Because past historians have concentrated on the negative aspects of business and corporations, early business historiography is limited. Twenty-first century historians such as David B. Sicilia believe "Robber Baron writings of the early 1900s have been largely discredited in recent years by archivally based, rigorously researched biographies of leading entrepreneurs and their firms."<sup>14</sup>

Others looked for balance in their work. Matthew Josephson (*The Robber Barons* 1934), and Frederick Lewis Allen (*The Lords of Creation* 1935), though writing about the Robber Barons, appreciated the need for entrepreneurs capable of building America's infrastructure while recognizing that the methods of these men could be ruthless and unfair.<sup>15</sup> This reflected a type of national ambivalence. As business historian Gary Porter writes, "Americans have always

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<sup>12</sup> Stewart H. Holbrook, *The Age of the Moguls*, (Garden City, NY: Doubleday and Company, 1954), 133.

<sup>13</sup> Steve Weinberg, *Taking on the Trust: How Ida Tarbell Brought Down John D. Rockefeller and Standard Oil*, (New York: W.W. Norton and Company, 2008), Preface, *passim*.

<sup>14</sup> David B. Sicilia, "Industrialization and the Rise of Corporations, 1860-1900." In *A Companion to 19<sup>th</sup> Century America*, ed. William L. Barney (Malden, MA: Blackwell Publishing, 2006), 140.

<sup>15</sup> Matthew Josephson, *The Robber Barons: The Great American Capitalists, 1861-1901*, (New York: Harcourt, Brace and World, Inc., 1934); Frederick Lewis Allen, *The Lords of Creation*, (New York: Harper and Brothers, 1935).

admired giant economic organizations while at the same time fearing them, and the treatment of the rise of big business by American historians has reflected the conflicting popular views."<sup>16</sup> Concentration on business methods as unfair, monopolistic, and underhanded fed into the American public's distrust of big business and was a popular discourse for historians. Three diverse fields of interest emerged: business historians focused on giant industrial enterprises, economic historians focused on the cost of industrialization, and more recently, social and cultural historians investigated social relations, power, and gender within corporations.<sup>17</sup> However, the Robber Baron label continues to affect each of these fields of early business history.

A new field of study, business history lacks a clearly defined scope. In 1927 to implement the first course in "business history," Norman S. B. Gras of the Harvard School of Business prepared his own material because there were no available textbooks.<sup>18</sup> In 1954 social scientist R. Richard Wohl wrote that "even as recently as twenty-five years ago, business history was still a fledging enthusiasm with only a few scholars, who labored to bring it to academic respectability by advancing the claims of research in American economic history."<sup>19</sup> In the early 1900s, American universities offered business history only as a minor aside to economics, not as a specific discipline. As legitimate course work has evolved into a budding field, critics claimed that business historians have so far been academics who chose topics to study that have little

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<sup>16</sup> Gary Porter, *The Rise of Big Business, 1860-1910*, (New York: Thomas Y. Crowell Co., Inc., 1973), 3.

<sup>17</sup> Sicilia, "Industrialization and the Rise of Corporations," 139.

<sup>18</sup> Ralph W. Hidy, "Business History: Present Status and Future Needs," *The Business History Review* 44, no. 4 (Winter 1970): 483.

<sup>19</sup> R. Richard Wohl, "The Significance of Business History," *The Business History Review* 28, no. 2 (June 1954): 128.

relevance to today, and that academia holds "stereotypical images, stilted opinions, and misinformed assumptions."<sup>20</sup>

Early scholars wrote extensively on the administration of the business firm, as opposed to viewing American business history in a broad context of national economic change and growth.<sup>21</sup> According to business historian Ralph Hidy, "The spectrum of content ranges from concentration on the history of business institutions to emphasis on business-government relationships."<sup>22</sup> Authors, hoping to correct misconceptions and fill-in the gaps, have begun churning out new material according to Hidy in a "veritable flood."<sup>23</sup> Studies on labor-management relations, industrial order and community planning, corporate public relations, government-business relations, small enterprises, trade associations, and industrial archaeology are opening new vistas of scholarly research but remain narrow in focus. For some historians, this flood of material is open to criticism because scholars are forming their opinions based on these single aspects of study. Lengthy works on strikes, company towns, and the effects of social Darwinism on business practices, among biographies of individual firms such as Standard Oil and American Tobacco, provide tantalizing views into American business history but are not the whole story. Telling the story of business requires perseverance and the conviction to perform due diligence, and with the wealth of business archives available to researchers, historians have an unusual volume of primary source documents to peruse.

Business history began to change after World War II. David B. Sicilia, a specialist in American business, economic, and technology history, observes that "as American business recaptured much of the stature and respect it had lost as a result of the crippling Great

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<sup>20</sup> Richard Forman, "History Inside Business," *The Public Historian* 3, no. 3 (Summer 1981): 41-42.

<sup>21</sup> Wohl, "Significance of Business History," 130.

<sup>22</sup> Hidy, "Business History," 483.

<sup>23</sup> Hidy, "Business History," 484.

Depression, and as more conservative winds began to blow through the nation, the history of the Gilded Age industrialization received more positive treatment."<sup>24</sup> Rather than study capitalists through a lens focused on wealth and power, scholars began to look more closely using an economic and sociological lens. In 1942 Thomas Cochran and William Miller published *The Age of Enterprise: A Social History of Industrial America* that focused on the impact of United States corporations in the Gilded Age with great criticism of big business. In the 1950s and 1960s journalist turned Columbia University professor, Alan Nevins, wrote multi-volume works praising Standard Oil and the Ford Motor Company. In the 1970s, the Research Center in Entrepreneurial History at Harvard University produced a new school of business history based upon the work of Alfred D. Chandler Jr. In 1977 Chandler won a Pulitzer Prize in history for his work *The Visible Hand: The Managerial Revolution in American Business*. This work focused on managers of corporations as the true power behind business because they, not the owners, allocated company resources. Chandler surmised that corporations (such as the Pennsylvania Railroad with 6000 miles of track and \$400 million in capital) could not be overseen by a single owner-manager or even by an extended family. This new "Chandlerian school" influenced the research of the next generation of scholars who looked at a company's inner workings – "business strategy and organization– rather than on power and morality."<sup>25</sup>

In the twenty-first century historians have come full circle with more all encompassing theses that include formerly disenfranchised groups such as female workers. Chandler's work is prevalent in textbooks discussing the Gilded Age and the rise of big business, but Robber Baron historians are not ancient relics relegated to the dustbin. Students in classrooms learn about Carnegie and his steel company and Rockefeller and Standard Oil, not only for their wealth and

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<sup>24</sup> Sicilia, "Industrialization and the Rise of Corporations," 141.

<sup>25</sup> Sicilia, "Industrialization and the Rise of Corporations," 141-143.

power but also for their industrial acumen.<sup>26</sup> A large part of industrial acumen involved engineering, men who harnessed technology with the goal of conquering nature for man's benefit. Engineers received little notice or credit for their work. One of the reasons for this according to Andrea Gabor in her work *The Capitalist Philosophers* is that "in the late 19<sup>th</sup> century engineering was still firmly rooted in the shop floor," meaning it received little validity as a profession requiring highly specialized education and training.<sup>27</sup> Engineering was so new that only professional engineers understood its purpose and the amount of education required to practice it. Within the profession there are many types of engineers: civil, chemical, mechanical, and electrical to name a few. Each played a tremendous and pivotal role in the industrialization of the United States. In 1880, engineers numbered 8000, by 1919 that number had increased to 136,000.<sup>28</sup> Bruce Sinclair believes engineering "grew up in America along with corporate capitalism, and engineers bent their wills to that influence."<sup>29</sup> In other words, corporate capitalism drove the profession but differences existed between engineering as a business, as an art, and as a science.

Not fully understanding engineering has been problematic for historians who could not define it and did not understand its role in the Industrial Revolution. Men who happened to be engineers but also entrepreneurs marketing their products, have not received the attention of historians in the same vein as an Andrew Carnegie or a John D. Rockefeller, even though in some cases their wealth was comparable. Perhaps there was also some measure of prejudice, as early engineers were immigrants, graduates of European universities such as the famed Royal

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<sup>26</sup> Sicilia, "Industrialization and the Rise of Corporations," 144.

<sup>27</sup> Andrea Gabor, *The Capitalist Philosophers*, (New York: Times Business, 2000), 9.

<sup>28</sup> Carroll Pursell, "What the Senate is to the American Commonwealth: A National Academy of Engineers," In *New Perspectives on Technology and Culture*, ed. Bruce Sinclair (Philadelphia, PA: American Philosophical Society, 1986), 19.

<sup>29</sup> Bruce Sinclair, "Inventing a Genteel Tradition: MIT Crosses the River," In *New Perspectives on Technology and Culture*, ed. Bruce Sinclair (Philadelphia, PA: American Philosophical Society, 1986), 1.

Polytechnic Institute of Berlin. The United States failed to develop schools singularly dedicated to engineering until 1824 with the establishment of the Rensselaer Polytechnic Institute in Troy, New York. Not until 1847 did Harvard University establish the Lawrence Scientific School or did Yale University establish the Sheffield Scientific School. The United States Military Academy at West Point claims the distinction of being "the first engineering school in America founded April 29, 1812" even though its program of study was not engineering based.<sup>30</sup> Thomas Cochran commented on this in his work, *200 Years of American Business*: "New development in higher education from 1850 on was largely in practical engineering...by 1870 the United States had nearly a dozen engineering schools."<sup>31</sup>

Engineers, no matter whether they were newly arrived immigrants or American-born citizens, were distinctive individuals entering a new profession. William J. McAlpine, president of the American Society of Civil Engineers (ASCE), remarked in 1869 on his belief that engineering was peculiarly the exponent of modern development, "Its definition," he said, "is the acquisition of that species of knowledge whereby the great sources of power in nature are converted, adapted, and applied for the use and convenience of men."<sup>32</sup> Better-informed entrepreneurial decisions based on a faster flow of information led engineers to congregate in large urban centers (New York and Philadelphia), with the four large East Coast centers exhibiting per capita patent application rates eight or nine times higher than the rest of the

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<sup>30</sup> "Nation's First Engineering School," In United States Military Academy Bicentennial History, accessed 5 November 2010, <http://www.usma.edu/bicentennial/history/FirstESchool.htm>. It is important to note that though West Point was not strictly an engineering school, its historians believe they deserve credit for building the nation's early infrastructure (roads, railways, bridges, and harbors) and for exploring and mapping the uncharted West.

<sup>31</sup> Thomas C. Cochran, *200 Years of American Business*, (New York: Basic Books, Inc., 1977), 85.

<sup>32</sup> William J. McAlpine, "Modern Engineering," *Scientific American* 20, no.9 (February 27, 1869): 130.

nation.<sup>33</sup> This is not surprising considering that the Institution of Civil Engineers' charter defined the organization's mission as:

the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and application of machinery, and in the drainage of cities and towns.<sup>34</sup>

Although nineteenth-century engineers achieved numerous accomplishments, historians have concentrated on the economic aspects of the nineteenth-century economy. In light of their accomplishments, one would think that historians would have written laudatory volumes on engineers. Instead, the focus of historians appears to have been concentrated on the economic aspects –capitalism– or the work forces used –labor relations– again with negative connotations. J. A. L. Waddell, himself an engineer, offered a possible explanation in 1918: "The fundamental reason for this undesirable state of affairs is, undoubtedly, the newness of engineering as a learned profession, but it must be confessed that much of the blame there-for lies with the engineers themselves. They have been so intent on their own individual activities that they have not fully organized for their protection as a class."<sup>35</sup> Perhaps part of the problem stems from the

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<sup>33</sup> Cochran, *200 Years of American Business*, 22.

<sup>34</sup> "Definition of Civil Engineering." In American Society of Civil Engineers, *History and Heritage of Civil Engineering*, (n.d.), accessed 6 November 2010, <http://live.asce.org/hh/index.mxml?versionChecked=true>

<sup>35</sup> J.A.L. Waddell, "The Engineering Profession Fifty Years Hence." *The Scientific Monthly* 6, no. 6 (June 1918): 539.

fact that the public in general, and historians particularly, understand very little of what an engineer does.

Engineers and engineering deserve a rightful place in our history books. James Kip Finch wrote in 1952 that, "engineering has been the great leveling force in the history of man."<sup>36</sup> Bruce Sinclair has written many scholarly articles as president of the Society for the History of Technology (SHOT) and as a professor of the philosophy of science and technology. He believes there is more information about the "engineering profession than any other large topic in the history of American technology...but very little of the vast majority of engineers."<sup>37</sup> However, this is knowledge often limited to scholars in the field of science and technology. More has been written about the profession than the individuals involved. "If technology really stands at the center of the American experience," Sinclair asks, "if its history tells us something both novel and essential about the country's past, why are engineers so invisible in American culture?"<sup>38</sup> If, as Sinclair believes, technology stands at the center of American experience, why we focus more on the technology than on its creators is a viable question.

Technology encompasses a plethora of sciences and industries making it as difficult to study as engineering. The world of technology in academia is insular in nature. Scholars study aspects of technology that fascinate them, much in the same way that a Civil War historian may

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<sup>36</sup>James Kip Finch, "A Century of Engineering Progress: 1852-1952." *The Scientific Monthly* 75, no. 2 (August 1952): 103.

<sup>37</sup> Bruce Sinclair, "Local History and National Culture: Notions on Engineering Professionalism in America." *Technology and Culture* 27, no. 4 (October 1986): 683. In his article, Sinclair cites eight studies as evidence of the knowledge of engineering; they are: Daniel H. Calhoun, *The American Civil Engineer: Origins and Conflict* (Cambridge, MA., 1960); Monte A. Calvert, *The Mechanical Engineer in America, 1830-1910: Professional Cultures in Conflict* (Baltimore, 1967); Raymond H. Merritt, *Engineering in American Society, 1850-1875* (Lexington, KY, 1969); Edwin T. Layton, Jr., *The Revolt of Engineers: Social Responsibility and the American Engineering Profession* (Cleveland, 1971, and [Baltimore, 1986]); David F. Noble, *America by Design: Science, Technology and the Rise of Corporate Capitalism* (New York, 1977); Bruce Sinclair, *A Centennial History of the American Society of Mechanical Engineers* (Toronto, 1980); Terry S. Reynolds, *75 Years of Progress—a History of the Institute of Chemical Engineers*, (New York, 1983); and A. Michal McMahon, *The Making of a Profession: A Century of Electrical Engineering in America* (New York, 1984).

<sup>38</sup> Sinclair, "Local History and National Culture," 685.

chose to focus only on battles or on Reconstruction. This has created a huge void in the overall historiography. SHOT, founded in 1958, posts quotes from leading scholars about the history of technology on their website. Authors Pauline Maier and Merritt Roe Smith made this trenchant observation, "If you look at anything about technology or science in textbooks, it's almost always separated from politics and society...These things needed to be integrated. That was what we tried to do. We call ourselves a technological society, yet we don't pay much attention to technology in our texts. And we surely don't relate it to the politics and the social issues that are important in our society."<sup>39</sup> Created by historians of technology, the mission of SHOT is to further the understanding of technology in America and create an academic outlet for scholars; *The Journal for Technology and Culture* followed in 1959.<sup>40</sup>

One problem with the history of technology is perception, not only the perceptions of historians but also the public. History books teach students about the printing press, the cotton gin, and the telegraph, but the story remained incomplete. Too often, historians have concluded that technology changed society, when in reality, there is a valid argument that society and the demand for better methods and cheaper goods encouraged technological change. American expansion required the harnessing of resources and the harnessing of resources required technology. Technology gets the blame for changing American society but not the praise.

Technology is doubly damned because it works hand-in-hand with science. Formulas to make steel or the calculations required to build a safe bridge require more than rudimentary knowledge of the subject. Mathematics (trigonometry, calculus) is not the normal bailiwick of historians. Historians are storytellers and it is hard to tell the story of the precise calculations

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<sup>39</sup> Pauline Maier and Merritt Roe Smith, "Some Thoughts on the History of Technology from Leading Scholars." In *The Society for History and Technology*, (n.d.), accessed 5 November 2010, <http://www.historyoftechnology.org/thoughts.html>

<sup>40</sup> The Society for the History of Technology, (n.d.), accessed 7 November 2010, <http://www.historyoftechnology.org/index.html>

necessary for the correct tempering of steel or the filament in a light bulb. Instead, historians focus on the ramifications of technology, how technology has affected culture and society. A great deal is lost in the translation. Science and technology have also suffered from a disconnect and in-fighting among academics. "Technology was, unlike science, not the product of great conceptions but rather application or practicality, which they [science historians] deemed common and therefore considered a lesser state," writes Alan I. Marcus in his essay "Science and Technology"; "persons primarily studying technology reacted to the rebuff by splitting with historians of science and establishing their own professional institutions to mark their unique professional identity."<sup>41</sup> Now two different groups of scholars are telling the history in two completely different ways. This appears to be the trend for historians; each technology fields its own historian (or historians) who focus solely on wire history, or steel history and so forth.

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<sup>41</sup> Alan I. Marcus, "Science and Technology," in *A Companion to 19<sup>th</sup>-Century America*, ed. William L. Barney (Malden, MA: Blackwell, 2006), 335.

## CHAPTER 2

### BRIDGING THE GAP: THE OLD WORLD TO THE NEW

In order to understand the fiercely determined, driven, and analytical man John Roebling became, it is necessary to explore not only his formative years but also the history of his nation prior to his birth. Johann August Roebling, the youngest of four children, was born June 12, 1806, in Mühlhausen, Thuringen, Prussia to Christoph Polycarpus "Polycarp" and Friederike Dorothea Roebling.<sup>42</sup> Polycarp was a tobacconist by trade, relatively complacent in his life and work with no desire for upward mobility. According to Washington Roebling's biography of his father John, his grandfather Polycarp "was gifted with a vivid imagination –every evening he would spin the most delightful yarns about his travels in Brazil–Africa & India, whereas in reality he had never left Mühlhausen."<sup>43</sup> Friederike Dorothea was another matter entirely. Highly intelligent, not given to flights of fancy, and with a steely, determined manner, the Roebling matriarch fixated upon bettering the position of her youngest child. A more-than-capable domestic engineer, Friederike "made everybody work, managed her household, family, the business, and her quarter of town besides," all while planning and saving money for the university education necessary for her son Johann August to become a great man.<sup>44</sup> However, factors other than his mother's dreams for his future would have a far greater impact.

Johann August Roebling was born in a time of constant upheaval and political machinations as Prussia formed and re-formed its borders, its people, and its politics. In the late

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<sup>42</sup> Hamilton Schuyler, *The Roebings: A Century of Engineers, Bridge-builders and Industrialists*, (Princeton, NJ: Princeton University Press, 1931), 5.

<sup>43</sup> Washington A. Roebling, *Washington Roebling's Father: A Memoir of John A. Roebling*, ed. Donald Sayenga, (Reston, VA: American Society Civil Engineers Press, 2009), 3.

<sup>44</sup> Washington A. Roebling, *Washington Roebling's Father*, 4. See also Schuyler, 10, who devotes several paragraphs to the subject.

eighteenth and early nineteenth centuries, the nation in some ways remained much as it had been for a thousand years. Towns were walled and relatively small; three-quarters of the population lived on the land dependent upon it for their livelihood, and agriculture products were the number one export. Class divisions consisted of the nobility, landowners, who held privileged civil service or army positions; the middle class, members of academia, and merchants; and the people, consisting of peasants, artisans, tradesmen, journeymen, and soldiers.<sup>45</sup> Yet for the better part of twenty-five years, war with Napoleon had raged on and around German soil. This caused profound changes that affected not only constantly re-drawn land boundaries but also the "cultural landscape with new directions in literature, philosophy, and art, as well as transformations in private sensibilities and public expectations."<sup>46</sup> The war years, and the struggle for representation made a lifelong impression on the young man from Mühlhausen.

The year of Johann Roebing's birth (1806) the Holy Roman Empire dissolved, the foundation of the Confederation of the Rhine, the publication of Georg Friedrich Wilhelm Hegel's *Phenomenology of the Mind*, and Prussian losses in the Battles of Jena and Auerstädt spread "French domination across Europe."<sup>47</sup> Jena-Auerstädt led to the fall of Berlin and marked a temporary end to Prussian military power. The terms of the Paris Convention, a treaty between Prussia and France signed, September 1808, reduced the size of the Prussian army to 42,000 men for ten years, laid the amount of reparations at \$140 million francs (\$4 million per month), and in the event of a war between France and Austria, Prussia was to support France with 16,000 men.<sup>48</sup> This paper alliance was soon not worth the inscribed parchment, as Prussia in the Wars of Liberation (1813-1815) switched alliance in mid-stream to throw off the chains of Napoleon and

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<sup>45</sup> Golo Mann, *The History of Germany Since 1789*, trans. Marian Jackson (New York: Frederick A. Praeger, 1968), 51.

<sup>46</sup> James J. Sheehan, *German History 1770-1866*, (Oxford: Clarendon Press, 1989), 323.

<sup>47</sup> Hajo Holborn, *A History of Modern Germany, 1648-1840*, (New York: Alfred A. Knopf, 1969), 351.

<sup>48</sup> Wilfried Fests, *Dictionary of German History*, (New York: St. Martin's Press, 1978), 116.

the dreaded French. David McCullough writes that, "In the spring of 1815, when Roebling was nine, five hundred of his townsmen had marched off to fight Napoleon at Waterloo."<sup>49</sup> "That same year "Thuringen and neighborhood of Mühlhausen were harassed and plundered by the French armies under Napoleon—Consequently all the children were brought up to hate Napoleon so that while late in life my father hated the French and lost no opportunity to rail at Napoleon," wrote John Roebling's son Washington of his father's youth.<sup>50</sup> This was one memory in John Roebling's childhood that set him on a path away from his native land.

Other memories of privilege versus oppression, education and enlightenment versus repression and censorship helped further his conviction to leave. Following the French Revolution and Napoleon's march across Europe, monarchs and the aristocrats feared revolution of any type and worked desperately to consolidate their power. In Prussia King Friedrich Wilhelm III gave lip service to his promise of a more representative government. Golo Mann in his work *The History of Germany Since 1789* wrote, "Repeatedly—five times as people calculated bitterly—the monarch had promised to give representatives of the people some share in government."<sup>51</sup> This bitterness against the monarch for his failure to grant his people representation began with the emergence of educational reform. In the years immediately following Napoleon's domination of Europe, universities began to be established and education at all levels taken more seriously. For example, in 1810 the University of Berlin, formed by royal charter in 1809, became the model for other new Prussian universities. Founder Wilhelm Freiherr Humboldt (1767-1833) directed the Prussian educational system from 1809 to 1810,

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<sup>49</sup> David McCullough, *The Great Bridge: The Epic Story of the Building of the Brooklyn Bridge*, (New York: Simon and Schuster, 1972), 43.

<sup>50</sup> Washington A. Roebling, *Washington Roebling's Father*, 5.

<sup>51</sup> Mann, *Germany since 1789*, 56-57.

establishing institutional forms of Prussian and German education that lasted until 1933.<sup>52</sup> Humboldt also created the humanist Gymnasium, a ten-year program of study that included Latin, Greek, mathematics, and German.<sup>53</sup> Humboldt made the state the single authority for education, and unlike the previous system, extended schooling to all.<sup>54</sup> Teachers in the new system were graduates of the philosophical faculties of German universities and relied heavily on the Greeks as the absolute model of humanism. A Gymnasium education was an immersion into Greek art, thought, and character, in an attempt to mold the students' personality to the highest ideals with exposure to the spiritual world.<sup>55</sup> Johann August Roebing would be among the first class to be educated under this new system.

Citizens, especially a newly educated youth that questioned the old ways, were not going to sit idly by and wait for change. Student led groups and patriotic societies such as the Tugendbund, the Burschenschaften, and the Deutsche Gesellschaften began to spring up in a grassroots effort to affect change. Their rallying cry, "We are here, we are better than the old ones, we want to stay together," created a community feeling following three years of war.<sup>56</sup> The outcome of the Wars of Liberation led to the Congress of Aachen (September-October 1818). The most important item on the agenda was that of the Russian state councilor, Count Stourdza, who produced a memorandum "On Germany's Present Condition." The "present condition" saw universities as the match-to-the-flame of a brewing revolution aimed at the agitation of the people for a democratic nation state. Stourdza demanded the "limitation of academic freedom

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<sup>52</sup> Holborn, *Modern Germany*, 474.

<sup>53</sup> Fest, *Dictionary of German History*, 72. See also Holborn, *A History of Modern Germany*, 475-478.

<sup>54</sup> Holborn, *Modern Germany*, 474-475.

<sup>55</sup> Holborn, *Modern Germany*, 477.

<sup>56</sup> Mann, *Germany Since 1789*, 57.

and press censorship as well as reprisals against demagogic groups."<sup>57</sup> The restrictive *Karlsbad Decrees* followed the Congress at Aachen on September 20, 1819. The decrees, a reaction against the liberal movement, eliminated university professors who undermined public institutions, prevented publications exceeding 20 sheets, and installed a central committee to investigate offenses.<sup>58</sup> Prussia and Austria were determined to fight the swelling tide of unrest, and the clamor for change thus "statesmen chose to make the persecution of romantic students their chief preoccupation."<sup>59</sup> However, it appears one university professor and philosopher was able to continue his work without threat of persecution to capture and intellectually broaden the minds of young and old alike. George Friedrich Wilhelm Hegel (1770-1831) was to the intellectual history of the period what Napoleon was to the political history.<sup>60</sup>

Georg Friedrich Wilhelm Hegel (1770-1831) was a great intellectual whose philosophy influenced nineteenth century political thought in Germany and abroad. First lecturing at Jena, then at Erlangen, Heidleberg, and finally Berlin; according to Golo Mann he "told the Germans most emphatically in what age they were living."<sup>61</sup> That age, filled with unrest, perfectly defined for the philosopher a spirit that is never content, always seeking new arguments, new struggles, and new means of communicating. Hegel made the German world aware that history is continually in the making, that people live in history, and that there are great decisions one must make.<sup>62</sup> His philosophy of history presupposes the entire history of mankind as a process of spiritual and moral progress and through it wanted to demonstrate the unity of thought and

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<sup>57</sup> Fest, *Dictionary of German History*, 1. Demagogues was the label applied by the government to academics, students, and loosely formed social groups who agitated for *Nationalrepräsentation*, the aspired for constitutional reform aimed at the introduction of an elected national Prussian representative body.

<sup>58</sup> Fest, *Dictionary of German History*, 25.

<sup>59</sup> Mann, *Germany Since 1789*, 57.

<sup>60</sup> Mann, *Germany Since 1789*, 56.

<sup>61</sup> Mann, *Germany Since 1789*, 45.

<sup>62</sup> Mann, *Germany Since 1789*, 42.

reality in the universe.<sup>63</sup> For Johann Roebling, a young man with a keen and analytical mind, nascent in forming his own ideals, Hegel was the epitome of enlightenment.

Roebling completed his early education at the Gymnasium in Mühlhausen with an eye to the more specialized training in mathematics required for his chosen profession, engineering. For this advanced mathematical work, Roebling attended the private institute of Dr. Ephraim Solomon Unger in Erfurt, and "his proficiency in these studies marked him out as a favorite pupil of the celebrated professor."<sup>64</sup> According to family legend, quoted in works by historians McCullough, Steinman, and Schuyler, Roebling was also the favorite pupil of Hegel though no primary source documentation exists to prove or disprove the claim. Following his education at Erfurt, Johann August enrolled in the Polytechnic Institute at Berlin "specializing in sub-construction, bridge building under J.F.W. Dietleyn, and dike construction under the celebrated professor Johann Albert Eytelwein."<sup>65</sup> Under Dietleyn and Eytelwein, Roebling's fascination with bridge construction became a passion. Dietleyn filled his lectures with stories of new suspension bridges in England, and one over the Schuylkill Falls in Philadelphia that had collapsed within a year. Suspension bridges at that time held their roadways suspended in place with chains of linked iron bars.<sup>66</sup> Roebling's education was not all technical; he enhanced his education with special course work in modern languages and excelled at architectural drawing. Two things would greatly influence Johann Roebling's future during this time: first, his assiduous attendance to the lectures of Hegel, and second, a trip to northern Germany, where he

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<sup>63</sup> Fest, *Dictionary of German History*, 64.

<sup>64</sup> Schuyler, *Roeblings*, 11.

<sup>65</sup> Schuyler, *Roeblings*, 12.

<sup>66</sup> D.B. Steinman, *The Builders of the Bridge: The Story of John A. Roebling and His Son*, (New York: Harcourt, Brace and Company, 1945), 12.

saw his first suspension bridge in Bamberg over the River Regnitz.<sup>67</sup>

To bolster the claim of intimacy with Hegel, a short character sketch written by an unattributed friend is included in Schuyler's biography of the Roebling family.<sup>68</sup> It is important to include it here in its entirety as it says much about the man Johann August Roebling was to become:

It is impossible to study him [Hegel] and not be profoundly influenced by his teachings, and for a youth like John A. Roebling to have been brought into intimate contact with his dominating personality, was at once a privilege and a calamity. A privilege, because it opened the boy's eyes to the spiritual reality back of the 'change and decay' of material phenomena...A privilege, because he was taught to think independently, and rely on the validity of his own conclusions. It was a calamity, because it begat a pride and arrogance of opinion and a frigid intellectuality that came near to putting the heart of him into cold storage...Nothing that he [Hegel] has said, by manner of his saying it, makes anyone the braver for reading it, or the better for remembering it. The philosopher has almost, if not altogether, eaten out the man. And John Roebling was the favorite of this prodigy...Hegel was a metaphysician, so was John Roebling –metaphysics was his dissipation. The time others spent in

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<sup>67</sup> Washington A. Roebling, *Washington Roebling's Father*, 5. Sayenga, under advisement of his publisher used annotations in the margins to clarify a point or correct what he felt were errors in Washington Roebling's recollections; on this point, he disagrees, saying that John Roebling made sketches of suspension bridge designs as early as 1828. This does not discount the difference between believing them to be possible and actually seeing one in person.

<sup>68</sup> A shorter, edited version is also included in McCullough, *Great Bridge*, 42.

amusements, the reading of polite literature, or impolite newspapers, John  
Roebing devoted to metaphysics.<sup>69</sup>

Hegel's influence on the young student is evident in the writings of Roebing as an older man. Roebing's "Theory of the Universe" is thousands of legal-size journal pages handwritten in his flowing and forceful script and refers to Hegel often: "In the year 1825 I attended Hegel's lectures in Berlin. Too young and too material in my conceptions, much of his propositions remained a mystery to me. The Spiritual has since somewhat gained the ascendancy, and I can know fully, what formerly was a mystery."<sup>70</sup> Not much was to remain a mystery for Roebing as he gave himself over completely to any topic he studied. According to Washington Roebing's biography of his father, university life in the late 1820s was not for the faint of heart:

...hard work, of constant intense application –the lecture system was in vogue at that time– Notes were taken of the lecturer's remarks & written out at night– These notes were bound in book form, afterwards, and number at least 10 volumes –they are copiously illustrated with pen and ink sketches. To one who has not been through such a course, the amount of laborious application seems incredible, and simply shows how much can be accomplished by steady work from early morn till midnight.<sup>71</sup>

It is not hard to imagine Roebing huddled over an oil lamp with pen, ink, and journal applying himself to his studies with great fervor.<sup>72</sup>

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<sup>69</sup> Schuyler, *The Roeblings*, 11-13. Metaphysics is the branch of philosophy that deals with first principles and seeks to explain the nature of being and of the origin and structure of the world.

<sup>70</sup> John Roebing, "Philosophy of the Universe," unpublished manuscript, 1862, Roebing Family Papers, MC654, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

<sup>71</sup> Washington A. Roebing, *Washington Roebing's Father*, 5. The journals Washington Roebing mentions from his father's university years can be found in the Roebing Family Papers, MC654, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

<sup>72</sup> There is a great deal of discussion among historians concerning whether or not John Roebing actually completed his studies at the Royal Polytechnic Institute of Berlin to be awarded a degree and the title "Civil

Following lectures at the university, it was the custom for young men to progress to fieldwork to gain firsthand training. Roebling left the Polytechnic Institute to work for two years as an assistant highway builder for the Prussian government.<sup>73</sup> Assigned to Arnsberg in Westphalia, the work was to prove valuable to him later in his life, but in the present he chafed at the drudgery. Under the rule of the Prussian government there was little chance for an engineer of Roebling's merchant-class background to excel or promote his own ideas. During this time, government censorship and control subjugated the natural inclinations of university students to promulgate new thoughts and ideals. Mann wrote, "Radicals were taken seriously enough to be feared, and there was a new wave of persecution in Prussia, more vicious than in 1819; thousands were sentenced to death, and although reprieved from execution their spirits were broken in prisons and fortresses."<sup>74</sup> Prussia and Austria were not the only European countries facing unrest and revolt in the early portion of the nineteenth century. This fear of new ideas and revolution swept across the continent. In July 1830, students and workers rose against King Charles X in Paris; in August a revolution in Brussels, Belgium erupted against the bureaucracy of the King of the Netherlands; and in November Poles rose against the Russians. The following year, 1831, saw the rise of Romans against their old-fashioned sovereign, the Pope; and in Britain a growing violent agitation for parliamentary reform.<sup>75</sup> Old orders throughout Europe were under siege.

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Engineer." Schuyler and Steinman both report completion and a degree awarded in 1826. Donald Sayenga argues that there is no evidence of a degree being awarded. Washington Roebling writes that his father did receive his degree upon submitting his final thesis, "a magnificent design for a stone arch bridge with full details of construction, is still in my possession," 8. The drawing dated August 1830 resides in the Rensselaer Polytechnic Institute (RPI) Archives in Troy, New York. RPI is the repository for the technical aspects of the Roebling Family Collection.

<sup>73</sup> Washington A. Roebling, *Washington Roebling's Father*, 9. How long John Roebling spent building roads varies from two to three years dependent upon the historical work. I have chosen Washington Roebling's account of his father's time as a road builder.

<sup>74</sup> Mann, *Germany Since 1789*, 65.

<sup>75</sup> Mann, *Germany Since 1789*, 64.

The city of Mühlhausen, though small in comparison to Berlin, had its own cadre of young liberals clamoring for change. Tired of an autocratic régime, these young men felt that political reform was insoluble. Schuyler quotes a local German historian of the period who listed Roebing among the local representatives of the new Germany: "The generation born in Mühlhausen around the 1800s brought a new world with it. As soon as it became influential (about 1830) the old humdrum of the 'Reichsstadt,' which can mean neither life nor death, disappears and the Renaissance generation which possesses the spiritual value of the new century, the Classicism, the Romance, the Liberalism and the National Thought expresses it bravely."<sup>76</sup> Johann Roebing felt the intensity of the unrest and disagreeing with a political order that afforded him no chance for advancement made an imperative decision –to immigrate to America. Washington Roebing recounts the thought process behind his father's decision:

Should he remain in the fatherland, tied down to strict rules of semi official life—a perpetual subordinate with no opportunity to gratify a laudable ambition or to follow the bent of his own genius. Or should he in the prime of his youth seek his fortune in new fields, untrammled by official supervision—America was the goal which all men aimed to reach then as well as now. A family council was held at Mühlhausen—his meager patrimony was scraped together and paid him in advance... My father often told me when referring to the Pittsburgh suspension aqueduct [one of John Roebing's American triumphs] that he never would have been allowed to build such a structure in Prussia. The dignity and pride of the supervising engineer would have ground down the ambitious attempt of the young engineer in even proposing such a structure which had no precedent.<sup>77</sup>

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<sup>76</sup> Schuyler, *The Roebings*, 14.

<sup>77</sup> Washington A. Roebing, *Washington Roebing's Father*, 8.

America was young, an experiment that other nations watched, especially the German public through newspapers and periodicals.<sup>78</sup> In the 1820s through 1840s, groups of Germans turned their backs on the Fatherland and immigrated to America.<sup>79</sup> America had several advantages that Roebing's native land did not: a government of representatives elected by its citizens, a Constitution protecting a man's rights, and no entrenched aristocracy to thwart a man's ability to succeed beyond his station. "America, the permanent example of a republican constitution," Hegel wrote, adding, "a subjective unity presents itself; for there is a President at the head of the State, who, for the sake of security against any monarchical ambition, is chosen only for four years. Universal protections for property, and something approaching entire immunity from public burdens, are facts which are constantly held up to commendation."<sup>80</sup> Almost utopian sounding, America appealed to young Hegelians. Aptly aware of the responsibilities and the opportunities offered by the discipleship of Hegel, these young men sought new challenges.<sup>81</sup> In all of his life, Johann Roebing was never an impulsive man. This deep thinker appears to have called upon the lessons of his mentor Hegel in making his decision. Hegel in his *Philosophy of History* wrote, "America is therefore the land of the future, where, in the ages that lie before us, the burden of the World's History shall reveal itself...It is a land of desire for all those who are weary of the historical lumber-room of old Europe."<sup>82</sup> Confident of his standards, his abilities, and his ideas to the point that others thought him arrogant, Roebing the young Hegelian and stifled engineer considered the decision to emigrate the only logical choice. Throughout his life,

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<sup>78</sup> Sheehan, *German History 1770-1866*, 205.

<sup>79</sup> Mann, *Germany Since 1789*, 65.

<sup>80</sup> Georg Friedrich Wilhelm Hegel, *Philosophy of History*, trans. J. Sibree (1837, Reprint, Kitchener, Ontario: Batoche Books, 2001), 102, under "Hegel, Philosophy of History," accessed 15 February 2011, <http://www.efm.bris.ac.uk/het/hegel/history.pdf>.

<sup>81</sup> William J. Brazill, *The Young Hegelians*, (New Haven, CT: Yale University Press, 1970), 13.

<sup>82</sup> Hegel, *Philosophy of History*, 104.

Roebing retained the influences of his education in a nation liberated from Napoleon but still bound to a rigidly stratified class structure. To America, he carried the habits of mental and physical discipline learned in his youth and found there the freedom of experimentation that made him renowned among engineers.

## CHAPTER 3

### UNREALIZED EXPECTATIONS

At twenty-five years of age, Johann August Roebling, an accomplished musician trained in philosophy, the classics, and civil engineering, decided to immigrate to America. Rather than settling in a large city with ample opportunities for a young and gifted engineer, Roebling established Saxonburg, a Pennsylvania farming colony. The Europe that shaped Roebling's dreams of establishing a farming colony was awash in a revolutionary fervor of agrarian utopian dreams of communal living. The great American landscape had something that Europe lacked: affordable, available land. Roebling arrived in America at a crucial time, as the market revolution of the 1830s and 1840s prompted societal transformations in response to new technologies and modes of commerce. The market revolution also transformed Roebling's ideal of freedom from an agrarian based one to one of mechanization and technology. Saxonburg and its agrarian-based concept fell far short of Roebling's idea of success in the New World. For the engineer and Hegelian disciple, the concept of freedom proved to be inseparable from the idea of progress that had begun to reshape antebellum America.

The concept of agrarian based utopian living became the ideal to Europeans exhausted by years of war and political and economic chaos. America, spreading from the Atlantic Ocean to the Pacific Ocean, offered land and the freedom to experiment with ideas offered by Old World philosophers, intellectuals, and idealists such as Charles Fourier (1772-1837). The French utopian socialist believed in the liberation of every individual and advanced a society organized into self-sustaining groups that took hold in America. Fourier was one of many who believed that living off the land in colonies fulfilled a paradise ideal of peace, stability, community, and

harmony.<sup>1</sup> The idea of paradise in America based upon an agrarian communal system was not new. Germans who had actually spent time in America returned to the Old World with glowing stories of their travels and added to the utopian fervor. One of these travelers and his ideal for a utopian paradise exerted persuasive authority over Johann Roebling.

Johann Adolph Etzler (1791-c.1846) had an impact on the young and searching Johann Roebling. "I have heard my father speak of one Etzler," Washington Roebling wrote, "who seemed to exercise considerable influence over him."<sup>2</sup> Fifteen years his senior, Etzler and Roebling had been friends and neighbors in Mühlhausen. Both men shared a keen interest in engineering and philosophy and were ardent disciples of Hegel.<sup>3</sup> Etzler strongly believed that "universal wealth could be had from the inexhaustible forces of nature: wind, water, and sunlight."<sup>4</sup> He fled to America in 1822 during the first wave of Prussian government reprisals against revolutionaries. Returning to Mühlhausen in 1829, Etzler immediately attracted the attention of authorities by openly advocating emigration to the United States. Espousing his views from street corners landed him in jail.

Upon his release from prison in 1830, Etzler renewed his friendship with Roebling, and seemed a kindred philosophical and questing spirit. Etzler had seven years of American adventure and experience to impart to his friend. According to historian Steven Stoll, "Together the two printed a pamphlet, which they distributed secretly, *A General View of the United States of North America, Together with a Community Plan for Settlement*, most of it written by Etzler.

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<sup>1</sup> Steven Stoll, *The Great Delusion: A Mad Inventor, Death in the Tropics, and the Utopian Origins of Economic Growth*, (New York: Hill and Wang, 2008), 49.

<sup>2</sup> Washington A. Roebling, *Washington Roebling's Father*, ed. Donald Sayenga (Reston, VA: ASCE Press, 2009) 9.

<sup>3</sup> Stoll, *Great Delusion*, 25.

<sup>4</sup> Stoll, *Great Delusion*, inside cover.

Roebing then organized an emigration society and drew up a plan for escape."<sup>5</sup> The one event that pushed Etzler and Roebing into action was the July Revolution begun in France in 1830. Panic and future uncertainty spread swiftly across Europe affecting Germany as well. The occurrences most portentous for Roebing and Etzler occurred just forty miles west of Mühlhausen. When bread riots broke out in Kessel, citizens roamed the city burning government offices and records. In Dresden, armed citizens took to the streets and terrified government troops fired upon them.<sup>6</sup>

The two men clandestinely gathered like-minded Germans who formed the core of their loosely based emigration society and were, like Roebing's brother Karl, willing to make the journey to America. With the decision made and preparations under way, Roebing assiduously studied everything he could about America, including the language. In May 1831 two groups, one from Mühlhausen and one from Darmstadt, were to meet at the dock in Bremen to sail on the *Henry Barclay*. In the confusion and secrecy things did not go according to plan. Johann Roebing arrived in Bremen to find that the larger of the two parties had already sailed. Never thwarted, Roebing quickly commandeered a smaller vessel, the *August Eduard*, which held ninety-three passengers—forty-four men, women, and children.<sup>7</sup> They set sail May 20, 1831.<sup>8</sup> Eleven weeks passed before Roebing and his party again saw land.

During the arduous sea journey from Germany to America, Roebing—ever the organized and efficient engineer—related through diary entries the minutiae of everyday life at sea while making trenchant observations about his motives for leaving Germany behind and his expectations of America. His *Diary of My Journey from Muehlhausen in Thuringia via Bremen*

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<sup>5</sup> Stoll, *Great Delusion*, 34-35.

<sup>6</sup> Stoll, *Great Delusion*, 36.

<sup>7</sup> McCullough, *Great Bridge*, lists the number as "fifty-three pilgrims," 44.

<sup>8</sup> Washington A. Roebing, *Washington Roebing's Father*, 9. This particular part of the Roebing story is very well known and recounted by McCullough, Stoll, Steinman, and Schuyler.

*to the United States of North America in the Year 1831* provides an in-depth look into Roebling's thoughts as he contemplates his future. Upon his departure from Mühlhausen on May 11 he wrote, "firm conviction and settled views" rather than "exaggerated or extravagant hopes" led him to set out for the New World. "To what extent America corresponds with our moderate expectations and affords us what we seek, the future must teach." There is also the Hegelian influence of his past when he wrote, "the decision to settle in America must arise from personal energy and the power of will of each individual; otherwise it is useless for him to go to America." This is a direct correlation to Hegel's belief that "the sole springs of action and the main efficient cause are the actions of men [which] spring from their needs, their passions, their interests, their characters, and their talents."<sup>9</sup> With every diary entry, sight unseen, America is to Roebling more and more a paradise of freedom in comparison to Prussia. Roebling looked forward but with a tinge of regret, he wanted his motives for leaving understood: "It is not contempt for our Fatherland that causes us to leave it, but an inclination and an ardent desire that our circumstances be bettered and that they have a decidedly human aspect." The concept of personal freedom is one that he wished "fate [would] soon grant to Germany" as it is a "most well-founded right, and which has been so long held unjustly withheld from her." Roebling ended the day of writing with "Farewell, my Fatherland!"<sup>10</sup>

Roebling may have bid farewell to his Fatherland on paper but he retained the resentment and the slights that he suffered under the Prussian system. His thoughts continually turned to freedom. On June 27, he wrote that the openness of the sea "serves altogether to arouse the

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<sup>9</sup> Georg Wilhelm Friedrich Hegel, *Reason in History: A General Introduction to the Philosophy of History*, trans. Robert S. Hartman (Upper Saddle River, NJ: Prentice-Hall, Inc., 1997), 26.

<sup>10</sup> John Augustus Roebling, *Diary of My Journey from Muehlhausen in Thuringia via Bremen to the United States of North America in the Year 1831* (Eschwege, Germany: Roebling Printing-house, 1832; reprint, trans. Edward Underwood, Trenton, NJ: Roebling Press, 1931), 1-2 (page citations are to the reprint edition). Perhaps because the diary was to be published in Prussia, where his father, mother and other siblings remained, Roebling felt inclined to downplay his role in forming a colonizing group.

feeling of personal freedom and natural independence in every breast." As the voyage continued to widen the distance from the Old World, Roebling portrayed Prussia much like the antagonist in a Greek play writing, "the chicanery of the little and the great gods of earth and their vassals now seem petty and small." His most ardent hope for his future was to shake off the shackles of chicanery that produced this class system. Roebling was enamored of American ideals and has made the decision to immigrate "based on the political order which does not chain up human activity in any sorts of fetters," adding, "the citizenship is left to itself and affords appropriate protection to the particular individual." It is thus Roebling's desire to leave "old European prejudices" and fit into the New World.<sup>11</sup> Clearly, Prussian repression had a long-standing effect on Roebling. Throughout his diary, when not recording details of life aboard ship, his mind returned repeatedly to the freedoms of America, the rigidity of thinking of his native land, and his anticipation of life in a nation that valued freedom.

Johann Roebling and his party arrived in Philadelphia after eleven weeks at sea. Ever the logical analyst, he began to record detailed observations of the New World, providing historians with a trenchant look into early nineteenth century America. What he had spent the sea journey speculating on now unfolded before his eyes. In the City of Brotherly Love, Roebling began the final chapter of his work on August 16, 1831. Nothing escaped his attention, from the lack of colorful paint and ornamentation of the residences (in sharp contrast to his native land); to the water mains delivering clean fresh tasting water from the Schuylkill River to every home. It astonished Roebling that whereas in Germany the public buildings were decorated lavishly, in America every "plain citizen so decorates the interior of their home." As to the demeanor of the Americans he encountered, he marveled at their polite and helpful public conduct. He was amazed that "nowhere does one see a person in rags; all even the common workmen go very

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<sup>11</sup> John Roebling, *Diary*, 81-83.

cleanly and neatly dressed" and in comparison, "poor German immigrants contrast with the humbler classes here in high degree." Roebling now saw firsthand what freedom in America meant, writing that, "Every American, even when he is poor and must serve others, feels his innate rights as a man. What a contrast to the oppressed German population!"<sup>12</sup> It is easy to imagine Roebling, the tall-distinguished German, wandering the brick-lined city streets of Philadelphia drinking in the sights and sounds analyzing and recording all that was new and different from the world he left behind.

Roebling contrasts in very specific ways, the differences between the land of his birth and America, the land of opportunity. He wrote, "In all institutions and customs, which concern public life, the American proves himself to be longheaded, and in this particular he stands higher than the German." The lack of governmental interference in the affairs of its citizens astonished him: "The numerous hindrances, restrictions, and obstacles, which are set up by timid governments against every endeavour in Germany, are not to be found here. The foreigner must be astounded at what the public spirit of these republicans has accomplished up to now and what it still accomplishes every day." The privatization of commerce in America was also of keen interest to Roebling who is used to the restrictive tariffs of Prussia. Roebling acknowledged that the principal aim in America is making money, "nevertheless a noble and beneficent public spirit also exhibits itself in the public institutions, which have a purely scientific or charitable design." He lists, the "hospital on the Delaware, the poorhouses, the Peal Museum, the excellent penitentiary, the fire-houses, the temperance societies, churches, schools, the multitude of endowed academies," as examples claiming that, "all do honour to the citizens."<sup>13</sup> This is a direct correlation to the philosophy of Hegel, as Roebling understood it. The accumulation of wealth by

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<sup>12</sup> John Roebling, *Diary*, 110.

<sup>13</sup> John Roebling, *Diary*, 112.

a nation and its citizens was not evil in and of itself, as wealth came with the responsibility and duty to better the material circumstances of everyone. Continuing, Roebling reflected on the vast networks of trade and communication American's had built in a short span of time. Again, by comparison the Fatherland fell short because in the New World, without government interference, commerce was "principally the result of unrestricted intercourse, and the concerted action of an enlightened, self-governing people." In perhaps his most telling discourse, Roebling provided a word-picture that summed up his personal history and led the reader to understand he felt like a powerless puppet in his homeland. Of America he wrote, "the public is not guided by leading-strings like a little child, but is left to its own development." Roebling then questioned the Prussian system. "How can as much good follow for a people from the one-sided head of a single potentate, who is only thinking of his own interests and those of his family as from the union of patriots?"<sup>14</sup>

As the diary concluded, Roebling speculated on the most advantageous portion of America for settlement. It is obvious he had done a great deal of studying on the various sections of the New World and weighed the advantages and disadvantages of each with his typical precision and logic. He carefully considered the potential for disease, the cost of acreage, the climates, and access to water. For a time the South's warmer climate and flat land intrigued him but the South possessed one habit Roebling could not condone—slavery. One of his most ardent passages announced his determination not to settle in a slave state, only in a free state. "We have been frightened away from the South," Roebling wrote, "by the universally prevailing system of slavery, which has too great an influence on all human relationships and militates against civilization and industry with an every-hindering affect."<sup>15</sup> Roebling speculated that were his

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<sup>14</sup> John Roebling, *Diary*, 113.

<sup>15</sup> John Roebling, *Diary*, 117.

colony to settle in the South there would be no available "free German workers in a place where all of the work is done by a despised race of men, namely the blacks," adding that, "in time we should see ourselves compelled to hold slaves." This he believed would have an "injurious effect upon ourselves, and upon the prosperity of the colony." Roebling, with characteristic acumen, summed up the southern labor problem. He was unwilling to own another human being for the sake of profit.

Roebling is quite astute in his assessment of the slave problem in America and of the chasm that it placed between North and South. He felt that "blacks deserved all good fortune in their endeavour to be free," and deplored the restrictions in the Southern States, "to give the slaves no education, in order not to make them more dangerous." The chimera of slavery in America was the "greatest cancerous affliction, from which the United States are suffering," as he said, "it contrasts too greatly with the rest of their political and civic institutions." For an educated man who fled his native land in search of a new world of freedom, he found the dichotomy between slavery and freedom disconcerting. "The republic is branded by it," he wrote, "the entire folk, with its *idealistic* and altogether purely *reasonable* Constitution, stands branded by it before the eyes of the civilized world." For Roebling, the hegemony of slavery was "grounds enough for us not to go into any slave-holding State, even if Nature had created a Paradise there!"<sup>16</sup> Roebling had developed in his own mind an ideal of life in America.

Though that ideal did not condone slavery, it did include personal servants to manage the bulk of the work. Hamilton Schuyler, in his biography of the Roebling family, included a detailed bondservant contract between John Augustus Roebling, Fredric Charles Roebling and

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<sup>16</sup> John Roebling, *Diary*, 118.

"the mechanic and workman, Augustus Grabe."<sup>17</sup> In exchange for payment of their passage to America, the contract binds Grabe and his wife to "work for them [Roebing's] in any manner that may lawfully be required for three years," adding that their children will be bound, "until the day they become of age, that is to say: the sons to twenty-one years and the daughters to eighteen." After their arrival and the building of necessary structures, "there shall be put into the hands of said Grabe a piece of land of such an extent as he and his children are able to cultivate." From the land that they worked, their labors entitled them "for their wages every year the eighth part of the produce raised and prepared for sale," but from that wage Grabe must provide clothing for his wife and children. During their service Grabe and his family were "not permitted the customary use of strong spirits," and his wife must "attend exclusively to the housekeeping business for said Roebings." At the end of Grabe's three-year term his children were to "enter into the immediate service and under the care of said Roebings for the rest of their service." During the children's service, per the contract the Roebings provided for their education in English and in German and with all other necessities.

With economic and social factors driving immigration, contracts like that of the Grabe family were the accepted tools used by immigrants unable to pay their passage to America. German families who looked to America for a new beginning were willing to sign contracts that ensured a measure of stability upon their arrival for them and their children. Ensuring an education for their children made parents more willing to sign contracts that included them. Under a new United States immigration regulation, enacted after 1815, employers were responsible for six weeks of education for every year of a child's service.<sup>18</sup> In early Colonial

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<sup>17</sup> Hamilton Schuyler, *The Roebings: A Century of Engineers, Bridge-builders and Industrialists*, (Princeton, NJ: Princeton University Press, 1931), 23-24.

<sup>18</sup> Farley Grubb, "The End of European Immigrant Servitude in the United States: An Economic Analysis of Market Collapse, 1772-1835," *The Journal of Economic History* 54, no. 4 (December 1994): 800.

America the indentured servant system flourished, eventually replaced for the most part by the redemptioner system. Individuals who entered into the indentured servant system negotiated their contracts with ship captains, who then sold their services to the highest bidder in the New World. Service contracts under the redemptioner system differed in that immigrants bargained directly with an American buyer for their services. This alleviated to some degree the abuse of unscrupulous ship captains. An early diary entry concerning a dispute with the *August Eduard* captain and first mate stress the importance in Roebing's mind of written contracts in any type of business dealing. The commissioner entrusted with chartering the ship had not secured in writing details of passenger treatment and meals. "A binding contract in writing, by which the passengers could be guided and to which one could with every right refer the captain," Roebing wrote, "was altogether lacking."<sup>19</sup> Historians have estimated that fifty percent of German immigrants entered into servitude in Pennsylvania.<sup>20</sup> Roebing's contract with the Grabe's was for personal service, not a contract between the society and Grabe for land. Roebing's colonists paid him as an agent for their land in the New World, not for their passage. Referring to letters John Roebing wrote to a German friend in 1831-1832 (one more than one-hundred pages in length), the friend "is warned not to burden himself with bringing over a family to work for him as they are sure to run away."<sup>21</sup> Far from the ideal of starting his colony with servants to do the work, this is one example of Roebing's vision of life in America not meeting his expectations.

The nation Roebing found upon his arrival was an evolving one. America had begun to undergo a new type of revolution –the market revolution. Manufacturing developments led to

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<sup>19</sup> John Roebing, *Diary*, 17.

<sup>20</sup> Farley Grubb, "German Immigration to Pennsylvania, 1709 to 1820," *Journal of Interdisciplinary History* 20, no. 3 (Winter 1990): 436.

<sup>21</sup> Washington A. Roebing, *Washington Roebing's Father*, 25. It is unclear what became of the Grabes. Editor Donald Sayenga speculates that this portion of John Roebing's letter indicates that the Grabes fled shortly after their arrival in Saxonburg. See editor annotation number 34 on page 25.

improvements in farming, this shifted the nation's economy and created new consumer markets. The advent of mechanization in agriculture opened vast acreage for farming and required less labor. Farmers had surplus goods available for sale, but the cost of transportation over rough roads was prohibitive. The market revolution overcame this initial barrier "mobilizing collective resources through government to fuel growth by providing the essential legal, financial, and transport infrastructures."<sup>22</sup> The United States regionalized as the West farmed to feed the Northeast, the South grew cotton to ship to the Northeast, and the Northeast produced manufactured goods to sell in the West and South. Historian Charles Sellers wrote that Americans had an advantage over their European counterparts who were "overshadowed and hemmed in by aristocrats and postfeudal institutions," adding that Americans "pursued wealth more avidly" because wealth gave them the status of European aristocrats.<sup>23</sup> Roebling could not have arrived in America at a more opportune moment in history.

Johann Roebling did not expect to find a paradise in America, just freedom, and the ability to use that freedom to create wealth and success. For the first time Roebling imparted his intention to not rely solely on farming "as agriculture demands more work, and earns less money." Following a conversation with an American agriculturist, Roebling wrote, "that more is to be made by keeping cattle, and especially sheep," adding, "all well-informed men agree that the most can be made from sheep farms."<sup>24</sup> He envisioned importing English sheep for their fine wool, and with the production of wool escalating in America, he imagined cloth manufacturers and wool spinning mills "that will soon displace the English manufactures." Roebling made informed decisions for the moment but always with one eye out for future gain.

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<sup>22</sup> Charles Sellers, *The Market Revolution, Jacksonian America, 1815-1846*, (New York: Oxford University Press, 1991), 5.

<sup>23</sup> Charles Sellers, *Market Revolution*, 21.

<sup>24</sup> John Roebling, *Diary*, 120-121.

As Roebling closed his diary, he announced his intention to settle his group in Ohio. After a short stop in Pittsburgh, however, he found a tract of land in Butler County, Pennsylvania, a little over thirty miles north of Pittsburgh. The area is familiar to historians because of the towns of Economy and Harmony. Established in 1824, Economy gathered world renown for its piety and industrial prosperity. Johann Georg Rapp, an immigrant from Württemberg, Germany, founded Harmony in 1804. Rapp came to America in search of an area to put into effect his communal religious teachings, and his Harmony Society exerted a major influence on the economic development of Western Pennsylvania.<sup>25</sup> By the 1830s, Germans and Scots-Irish settled the majority of good acreage in Western Pennsylvania. In Pittsburgh, Johann and Karl Roebling purchased seven-thousand acres for \$1.37 an acre.<sup>26</sup> The land, filled with clay soil and rocks, proved unsuitable for serious farming. Roebling called the town Germania, later renaming it Saxonburg.<sup>27</sup> Roebling set about laying out village streets and building a home. His plans were typically high-minded as Washington Roebling recounted his father's plan that his community be "the future center of the universe with the future Saxonburg as head of the center."<sup>28</sup> Johann Roebling had arrived at his destination, and in honor of his new country, Americanized his name. Johann August Roebling became John Augustus Roebling.

Saxonburg became no more than a stepping-stone for someone as ambitious and driven as Roebling. From his diary and notes it is clear that his intentions for the colony were originally long term. However, one failed attempt after another forced Roebling's hand and his idea of

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<sup>25</sup> Washington A. Roebling, *Washington Roebling's Father*, 21. Washington Roebling cites a letter written by his father to relatives in Germany that spoke of his father's awareness of the Rapp colony and its ideals. The residents of Saxonburg traded frequently with those in Harmony and Economy.

<sup>26</sup>David McCullough, *The Great Bridge: The Epic Story of the Building of the Brooklyn Bridge*, (New York: Simon and Schuster, 1972), 46.

<sup>27</sup> The name was changed from Germania to Saxonburg because a majority of the settlers came from the Prussian province of Saxony.

<sup>28</sup> Washington A. Roebling to John A. Roebling II, letter (Winter 1893-1894), Roebling Family Papers, MC654, Reel 3, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

colonization collapsed. He first planned to attract wealthy gentlemen of culture and education, only to find "they do not care to be buried alive in the wilds of Butler County and prefer to settle in the city."<sup>29</sup> Then Roebling decided he wanted a community of artisans, mechanics, and practical working people whose trade goods and skills could supply surrounding farm communities, but that meant he had to have an already established and thriving town. In those early Saxonburg years, John Roebling attempted everything from canary and silkworm farming to establishing a fabric-dyeing factory. He traveled to Economy to buy sheep, only to find that sheep decimated the grass, defied attempts to fence them in, and began to run wild in the village. Washington Roebling said of his father that, "his desire to become independent led him into many schemes."<sup>30</sup> Restless and impatient with failed profit making ventures, Roebling soon cast his eyes and his talents elsewhere. Washington Roebling, knowing his father well, wrote that his father and farming did not fit and he experienced great difficulties in his attempt to learn. "I am constantly amused at his enthusiasm on the land purchase and his commencement of farming," Washington Roebling wrote, adding, "later on he thought it a mistake after all...he always despised Saxonburg and never returned to it after he left in 1849."<sup>31</sup>

Saxonburg provided many things for John Roebling; it was a launching point for the rest of his life and work in America. In spite of ill-fated moneymaking ventures, he started a family, and in 1837 became an American citizen. In 1836 he married Joanna Hertig, who during their time there bore him five children: Washington, Ferdinand, Laura, Elvira, and Josephine. It is his mother, Joanna Hertig Roebling, whom Washington credits with doing the majority of the farming.<sup>32</sup> Saxonburg was the place that Roebling began to create and invent his way to

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<sup>29</sup> Washington A. Roebling, *Washington Roebling's Father*, 24.

<sup>30</sup> Washington A. Roebling, *Washington Roebling's Father*, 36.

<sup>31</sup> Washington A. Roebling, *Washington Roebling's Father*, 23.

<sup>32</sup> Washington A. Roebling, *Washington Roebling's Father*, 43.

unimagined wealth. This was America, whose freedom and politics he had speculated about and yearned for. Washington Roebling believes his father was happy in the early years because "that freedom from social and political tyranny for which all Germans sighed, he had at last attained" but that the freedom once gained "was no longer appreciated." "To be in a country where no one gives a rap for you and where you can do as you please," Washington Roebling wrote, "became rather monotonous – a person must have ties."<sup>33</sup> Washington Roebling, looking back on John Roebling's early years made the judgment that the freedom his father yearned for fell short of his expectations. The son failed to understand the impetus that drove his father to seek new endeavors and to demand ever-greater achievements. John Roebling defined himself by success not failure. He knew that he was destined for great things, but that future greatness had not presented itself – yet.

John Roebling's education fomented a keen and analytical mind. The founding of a colony proved to be more of a headache than a stimulating profit-making enterprise. Overseeing a small colony turned village took very little of his brainpower and bored him greatly. Once Saxonburg became self-sustaining, his family lived off the farm, and as Washington Roebling wrote, "it enabled my father to save his engineering salaries and thus by degrees accumulate a little capital for other enterprise."<sup>34</sup> It was not in his character to be bothered with the mundane or the pettiness of a venture that did not hold his interest. Following Hegel's lead, Roebling believed that the mind should always be engaged in the betterment of self. Roebling's sense of self demanded not only achievement but personal and professional success. Washington

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<sup>33</sup> Washington A. Roebling, *Washington Roebling's Father*, 21.

<sup>34</sup> Washington A. Roebling, *Washington Roebling's Father*, 43.

Roebing wrote, "He early realized that wealth meant power and so he cherished it."<sup>35</sup> Farming was not going to lead John Roebing to wealth, his education and engineering acumen would.

In the spring of 1837, with the crops planted, farmer John Roebing set out to become civil engineer John Roebing. Roebing journeyed to Harrisburg, Pennsylvania and applied for employment as a state engineer. According to Schuyler, his education at the famous Polytechnic Institute of Berlin assured the favorable receipt of his application.<sup>36</sup> His first position, only temporary due to funding, came from the Sandy and Beaver Canal to build dams and locks. The Sandy and Beaver Canal, chartered by the Ohio legislature in 1828, had serious economic problems. The canal extended approximately seventy-three miles and contained ninety locks; it connected Bolivar, Ohio, and Glasgow, Pennsylvania.<sup>37</sup> In a letter to the chief engineer of the Sandy and Beaver Canal, E.H. Hill, dated June 28, 1837, Roebing alludes to the economic instability America experienced writing, "circulatory capital is at present almost reduced to its lowest state." Roebing relates that he has written many letters seeking employment without success. "Although in possession of a fine library and my time being principally occupied by interesting studies, I cannot reconcile myself to be altogether destitute of practical occupation," he wrote, "and I shall embrace at the first opportunity, which offers itself to me, to enter service again." Desperately trying to maintain a foothold in the engineering world, he adds, "But I should decline any offer, if I could entertain the hope of being reengaged by you, when the times are getting better, to serve under you on the S & B or any other line, you may get in charge." This passage exhibits a humbleness unseen in any previous correspondence and attests to Roebing's keen desire to get away from Saxonburg. Roebing's habit of imparting his own ideas

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<sup>35</sup> Washington A. Roebing, *Washington Roebing's Father*, 42.

<sup>36</sup> Hamilton Schuyler, *Roebings*, 43.

<sup>37</sup> "Sandy and Beaver Canal," In Ohio History Central, accessed 28 February 2011, <http://www.ohiohistorycentral.org/entry.php?rec=797>.

unsolicited continued as he sought Hill's approval for several improvements: a new plan for locks and dams and "a simple contrivance in the construction of railroads to make switches and turnouts and passings altogether dispensable." Roebling imparts another idea, this one to improve the channel of the Mississippi River at New Orleans before it loses its ability to accommodate large sailing vessels.<sup>38</sup>

Studying the personal letters and business correspondence of John Roebling from the 1830s to the 1860s, it becomes glaringly apparent that he was the original networker. A voracious reader of technical journals of the period, Roebling kept abreast of all that was happening in a burgeoning industrial world. He had not only an answer for every problem, but in his mind a better way of solving it. Throughout the late 1830s Roebling's mind turned repeatedly to engineering issues. A prolific writer, if he had a thought, an idea for an improvement, he immediately dashed off a completely unsolicited letter with his better idea. This brought him to the attention of men involved with canals, aqueducts, and steam engines, all new and in vogue in the early nineteenth century. Ideas and new inventions proliferated American discourse, and John Roebling was the right man at the right time to become part of the foundation of industrialism. From 1830 to 1837 America underwent a land speculation boom. As citizens spread over an increasingly larger geographic area, a network for the distribution of market goods became of paramount importance. With the completion of the Erie Canal in 1825, and its purported financial success, speculators seized upon canals as the best method for distribution. At an average cost of \$29,000 per mile, canal construction was expensive, approximately twenty-five times the cost to build a turnpike.<sup>39</sup> The Pennsylvania Mainline "stretched 395 miles and evolved

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<sup>38</sup> John Roebling, letter to E.H. Hill, 28 June 1837, Roebling Family Papers, MC654, Reel 7, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

<sup>39</sup> David R. Meyer, *The Roots of American Industrialization*, Baltimore, MD: The Johns Hopkins University Press, 2003), 141.

into a hybrid monstrosity of railroad, portage railroad, and canal sections costing \$12.1 million (\$31,000 per mile), over fifty-percent greater than Erie's per mile cost."<sup>40</sup> Canals are what first allowed John Roebling an escape from his family farm.

For Roebling employment as a civil engineer began with a trickle, performing summer work in 1839 and 1840 on the Allegheny Feeder Canal. This canal brought him to the attention of Chief Engineer of the state Charles Schlatter, who became a benefactor and close friend. On July 19, 1839, the state of Pennsylvania passed a law authorizing the surveying of land for a potential railroad across the state, as canals were not proving to be economically feasible. Having impressed Schlatter with his canal work, Roebling received control of one of the three field parties surveying east from Pittsburgh. Roebling, surveying around the village of Johnstown, encountered the newly constructed Portage Railroad and was fascinated with its engineering. With typical Roebling aplomb, he immediately found a flaw in what others considered an engineering marvel. The railroad, a system of inclined planes devised to haul canal boats up and over the Alleghenies operated with the use of nine-inch thick hemp hawsers. The hawsers, some more than a mile long wore out in relatively short time, snapping in two and sending their loads crashing down the mountain. With a replacement cost of nearly \$3000, their continued breakage was a major problem.<sup>41</sup>

Problems of this nature were what motivated civil engineer John Roebling. He proposed the use of an iron rope that he had heard about but never seen. Not manufactured in the United States, an inch thick wire rope Roebling believed would have a longer life and be more manageable for the work crew. Skeptics abounded, but ever the persistent engineer Roebling did not relent on the merits of his idea. "To bring all of this about," Washington Roebling wrote of

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<sup>40</sup> Meyer, *Roots of American Industrialization*, 149.

<sup>41</sup> McCullough, *Great Bridge*, 48.

his father, "he found that his acquaintance among political people, engineers, and business people would be of the greatest advantage."<sup>42</sup> Roebling's years of networking paid off and he received permission to construct a wire rope for a test. The backyard of his home in Saxonburg became a flurry of activity as Roebling with wire purchased from a mill northwest of Pittsburgh began to manufacture his version of wire rope. Wire spliced inside a farm shed and wound onto reels had to be laid out side-by-side and worked into a larger rope using a machine that Roebling quickly and efficiently designed. The first test failed due to sabotage by a representative of the hawser rope company. With the discovery of the plot, Roebling received a second chance. The wire rope withstood the test and instantly made his reputation.

Roebling, with a keen analytical grasp of technology constantly improved upon existing ideas or inventions. His habit of improvement shows a man never satisfied with the status quo. In an 1841 document titled "Specification," he boldly asserted his claim for his new invention:

Be it known that I, John Augustus Roebling of Saxonburg, in the County of Butler, State of Pennsylvania, have invented and a new and improved mode of manufacturing Wire Ropes, and I hereby do declare the following: The nature of my invention consists of a combination of any number of wires, laid parallel to each other, to form a round cylinder...to be substituted and used in place of hempropes, hemcables, chaincables and chains, for all purposes for which the latter have been applied heretofore. The superior merits of wire ropes over hemp ropes are chiefly their great durability and little cost. Wire ropes manufactured in the above manner, will likewise be superior to twisted Wire Ropes.<sup>43</sup>

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<sup>42</sup> Washington A. Roebling, *Washington Roebling's Father*, 51.

<sup>43</sup> John A. Roebling, "Specification," 1841, Roebling Family Collection, MC654, Reel 3, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

The uniqueness of Roebling's design, wires laid parallel into a thick bundle, as opposed to twisting them in the manner of hemp rope, meant less tension and stress on the wire and greater durability. This design was also cost effective, as it required less wire. In November 1843 the *American Railroad Journal and Mechanics' Magazine* published a four-page article "American Manufacture of Wire Ropes For Inclined Planes, Standing Rigging, Mines, Tillers, ETC." by John A. Roebling, Civil Engineer.<sup>44</sup> Roebling, ever the tireless self-promoter, asked the publisher, D.K. Minor, to send copies to any entity interested in purchasing wire rope. Minor, in a December 1843 letter to Roebling, welcomed any submission as businessmen have "highly and deservedly complimented" his work.<sup>45</sup> Orders poured in not only for every Pennsylvania railroad portage system but also for dredging equipment, pile drivers, coalmines, and U.S. Navy warships.<sup>46</sup>

The freedom to invent and reinvent himself in the New World, along with a great deal of Old World tenacity and training served Roebling well. Always prescient, his arrival in America during the market revolution afforded him the opportunity to recognize that technology greatly changed and affected commerce. Roebling, bored with farming, struck out on a path that used his intelligence and rewarded him with the wealth, fame, and influence of his mother's dreams. Roebling's ties with the Old World of his youth and education gave him the perseverance to succeed; his ties with the New World forever distinguished him as an American inventor and

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<sup>44</sup> John A. Roebling, "American Manufacture of Wire Ropes for Inclined Planes, Standing Rigging, Mines, Tillers, ETC." *American Railroad Journal and Mechanics' Magazine* 1, no. 11, series 3 (November 1843):321-324. Roebling Family Collection, MC654, Reel 7, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

<sup>45</sup> D.K.Minor, manuscript letter to John A. Roebling, 29 December 1843, Roebling Family Collection, MC654, Reel 3, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

<sup>46</sup> In 1911, the U.S. Navy named a Liberty class ship, *John A. Roebling*, in gratitude for his contribution of wire rope to the maritime industry.

entrepreneur. Wire rope set Roebling on the path to fame and fortune, but his greatest achievements were yet to come.

## CHAPTER 4

### FROM BACKYARD TO BRIDGES

In little more than a generation, America began to transform Thomas Jefferson's pastoral landscape ideal based on agriculture to a landscape filled with factories and technology.

Jefferson acknowledged the practicality of the steam engine and its eventual place in society but saw mechanized factories dotting the rural landscape, not the cities. The predominant theme of nature coexisting with technology for the betterment of man popularized this paradise archetype. This model argued that the two—man and machine—could live in harmony for the betterment of both. Americans, once transfixed by the beauty and grandeur of the nation's natural wonders, were now awe inspired by man's creation, not God's creation. Harnessing nature, using the vast natural resources at the nation's disposal, sparked a tremendous debate among the deep thinkers of the day, Henry David Thoreau and Ralph Waldo Emerson. Washington Roebling called his father an "Emersonian" leaving no doubt as to John Roebling's feelings on a burgeoning technological world.<sup>1</sup> The debate did not constitute a new argument for Roebling, who learned under Hegel that nature existed as a tool for man. "Since it is our end which is paramount," Hegel wrote, "not natural things themselves, we convert the latter into means, the destiny of which is determined by us, not by the things themselves."<sup>2</sup>

The ensuing debate as to how to proceed in a new age, separated not only philosophical thought, but separated old friends. Johann Etzler and John Roebling parted ways soon after their arrival in America. Roebling's idea of an agriculture-based community did not fit in with Etzler's

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<sup>1</sup> Washington A. Roebling, *Washington Roebling's Father*, ed. Donald Sayenga (Reston, VA: American Society of Civil Engineers Press, 2009), 6.

<sup>2</sup> Georg Wilhelm Friedrich Hegel, *Philosophy of Nature*, quoted in Steven Stoll, *The Great Delusion A Mad Inventor, Death in the Tropics, and the Utopian Origins of Economic Growth* (New York: Hill and Wang, 2008), 31.

more grandiose plan. Etzler thought that farming did nothing more than recreate the life they had left behind, and it bored him, as it eventually bored Roebling, but for entirely different reasons.<sup>3</sup> Roebling believed that endeavors resulting from hard work and an active mind provided wealth, while Etzler believed in a utopian paradise where no one had to work. Both acknowledged the role technology played in progress but gave the technology far different meaning. For Etzler technology liberated man to a life of leisure, while for Roebling technology advanced man's thought in a perpetual work process, not as an end result.

In 1836 Etzler published *The Paradise Within the Reach of all Men*, a book that promised men, using technology, would bring about the new Eden. Humans in Etzler's new Eden, lived in the lap of luxury without performing manual labor because machines carried out the work. For example, one of Etzler's ideas, far ahead of its time, harnessed the power of the wind. He believed that sails, erected two-hundred feet high and more than a mile long would generate 10,000 horsepower, power that equaled what 200,000 men could produce. Historian Thomas P. Hughes wrote that, "Etzler provided a mix of dominion-over-nature aspirations and utopian technological-transformation expectations."<sup>4</sup> Not everyone agreed with this utopian vision of a new Eden. There was something inherently decadent in man as only a creature of leisure. This philosophy confused men brought up to believe that the work of their hands and the sweat of their brow rewarded them. Yet for others, the newly educated generation, this vision somewhat affirmed their belief that their great intellect, not their hands, proffered a vast reward.

Henry David Thoreau (1817-1862) rebutted Etzler in an essay entitled "Paradise Regained." Thoreau believed that humans were not capable of the cooperation necessary to build

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<sup>3</sup> Steven Stoll, *The Great Delusion: A Mad Inventor, Death in the Tropics, and the Utopian Origins of Economic Growth*, (New York: Hill and Wang, 2008), 38.

<sup>4</sup> Thomas P. Hughes, *Human-Built World: How to Think About Technology and Culture*, (Chicago: University of Chicago Press, 2004), 35.

in such a short time span Etzler's purported new Eden. For Thoreau, the world's technological modification required a slow and gradual process. Thoreau, like Edmund Burke (1729-1797), found in nature noble, awe inspiring grandeur. Americans in the nineteenth century had begun to view nature in a completely different way, as a tool for their immediate use. According to Thomas Hughes Americans became awe-inspired by man-made creations, such as steamboats, and locomotives.<sup>5</sup> Ralph Waldo Emerson (1803-1882) and John Roebling believed that the technological transformations of a human-built world were an expression of the creativity of the human mind. Emerson's philosophy inculcated a generation of Americans with the exemplar of wealth flowing from the ability to harness nature.<sup>6</sup> The technology that both men embraced "galvanized the market into wealth" and reaped unimaginable benefits for Roebling whose mind was awl whirl creating new inventions and improvements for existing ones.<sup>7</sup>

John Roebling's mind was never idle. Washington Roebling said of his father, "the time that most people waste in reading works of fiction, newspapers, at cards or amusements, he spent in earnest thought."<sup>8</sup> Roebling's invention of wire rope set off thirty years of intense productivity. Throughout the 1830s Roebling's journals reveal precisely drawn schematics for a steam locomotive and a steam-driven plough among letters seeking United States patents as early as 1839. His prolific intellect constantly sought methods of improvement. Roebling's first patent, a method for the "spiral laying of the wires around a common axis without twisting the individual wires" while also having them "each under a uniform and forcible tension," invented in his

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<sup>5</sup> Hughes, *Human-Built World*, 38.

<sup>6</sup> Charles Sellers, *The Market Revolution, Jacksonian America, 1815-1846*, (New York: Oxford University Press, 1991), 380.

<sup>7</sup> Charles Sellers, *Market Revolution*, 379.

<sup>8</sup> Washington A. Roebling, *Washington Roebling's Father*, 7.

Saxonburg meadow, was awarded July 16, 1842.<sup>9</sup> During the next twenty-five years, the United States Patent Office awarded this prolific inventor eight more patents for inventions ranging from a trussed component bridge girder to an improvement in metallic railroad cars. Roebling's ability to assess a technological problem and invent a solution took him far beyond the meadow behind his Saxonburg home.

On October 19, 1842, Charles Schlatter, Roebling's mentor and friend, appointed Roebling to the post of Principal Assistant Engineer of the state of Pennsylvania to "report as to the most economical and expeditious manner of transferring section boats from the Canal to the Rail Road."<sup>10</sup> A part of this "expeditious manner" included a wooden aqueduct across the Allegheny River transporting the canal boats to the western terminus located in downtown Pittsburgh. A vital part of the system, the aqueduct carried thousands of tons of freight into the city. From 1835 to 1844 a wooden structure on seven stone piers served this purpose, until an ice jam rendered it inoperable. After months of political maneuvering, the State Legislature passed a bill authorizing the construction of a new aqueduct under the direction and funding of the Mayor, Aldermen, and citizens of Pittsburgh. The city held a contest for the best design with a \$100 prize, and Roebling won. John A. Roebling, Civil Engineer, filed on August 14, 1844, twenty-seven handwritten pages of specifications, laying out his design and calculations with typical attention to detail. For \$62,000, Roebling dismantled the existing structure and replaced it using an entirely new concept –wire-rope suspension. Designing and manufacturing wire rope had already begun to bring him fame; however, this was Roebling's first structure. Undaunted and

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<sup>9</sup> Donald L. Gibbon, "How Roebling Did It: The Building of the World's First Wire-Rope Suspension Aqueduct," accessed 28 August 2010, <http://www.matcoinc.com/files/PublicationPDFs/HOWROEBLINGDIDIT.pdf>, n.d., p. 7. An abridged version of this paper may be found in *JOM* 58, no. 5 (May 2006): 20-29. Roebling's first patent is US Patent #2720.

<sup>10</sup> Charles L. Schlatter, letter to John Snodgrass, Esq., 19 October 1842, Roebling Family Collection, MC654, Reel 3, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, New Jersey.

self-assured, with typical Roebling determination, he set about construction at once, and built all through the frigid Pittsburgh winter.<sup>11</sup> He completed the project in nine months.

Washington Roebling believed the "construction of the Pittsburg Aquaduct [sic] in many respects the greatest feat of his [father's] life," not only because it had to be built in winter, but also because "it was an untried problem, without a precedent."<sup>12</sup> The aqueduct consisted of seven spans, each 162-feet in length, with a wooden flume wide enough for the passage of one boat. The suspension wire rope carried not only the weight of the structure, but also 2100 tons of water. This monumental task had its fair share of scoffers. With no margin for error and no second chance, Roebling acted as his own engineer as well as procurer of all the materials and workers. Roebling called on a bevy of foundry men, lumbermen, stone workers, and iron men in addition to his laborers from Saxonburg. Without their experience, spinning the seven-inch thick cables of the aqueduct would not have been possible.<sup>13</sup>

John Roebling had long been fascinated with suspension bridges. His experience with them came only from his university lectures, the one he had visited in his school years over the River Regnitz, and from reading technical journals. The problem during this period consisted of the manner in which the cables passed from the shore anchorage to tower and back again, a long arduous process. Typically, the wire rope stretched out upon the shore, transferred to boats, and lifted into place with floating derricks. This time consuming process proved inefficient, and costly. Roebling, always ready to improve, invented a system upon which a wheel moving along a top wire played out the suspension wire underneath from one side of the river to the next.<sup>14</sup>

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<sup>11</sup> Gibbon, "How Roebling Did It," 3.

<sup>12</sup> Washington A. Roebling, *Washington Roebling's Father*, 81.

<sup>13</sup> Washington A. Roebling, *Washington Roebling's Father*, 81.

<sup>14</sup> This ingenious method, "Apparatus for Passing Suspension Wires for Bridges across Rivers" received US Patent Number 4945 on January 26, 1847. In an updated form, this method is still the standard for building modern suspension bridges.

This continuous method proved much more efficient. For the Allegheny Aqueduct the construction crew had to "be out on the river stringing wire 3800 times, back and forth, to create two seven-inch cables 1100 feet long, each with 1900 wires in them."<sup>15</sup> On Thursday, May 22, 1845, water once again flowed into the aqueduct, and Roebling demonstrated his integrity and skill as a builder.<sup>16</sup> Roebling's ledger showed the total cost of the aqueduct to be \$58,297, leaving him with a payment for nine months work of \$3,703. Roebling had no need to worry about money, before the aqueduct's completion he received a contract to build a bridge.

Calamity of one type or another always managed to bring opportunity to Roebling. Whether it was a broken hawser sending canal boats crashing or an ice jam destroying an aqueduct, Roebling knew he could invent or build something better. In April 1845, one month before the aqueduct's completion, a fire raged through downtown Pittsburgh. One of the victims of the fire, an old covered bridge over the Monongahela at Smithfield Street, became Roebling's next project. Washington Roebling wrote of the Monongahela Bridge, "it consisted of eight spans, each 188-feet in length, with two abutments –a double roadway and two narrow sidewalks." For \$46,000, Roebling built the new one, again with just a little money to spare.

The 1840s proved to be a busy time for Roebling. From 1844 to 1850 Roebling built six aqueducts and the Smithfield Street Bridge. Each project brought him more acclaim. In 1847 he presented a twelve-thousand-word paper in two sittings before the Pittsburgh Board of Trade entitled "The Great Central Railroad from Philadelphia to St. Louis." The *American Railroad Journal* later published it as a sixteen-page article. The article provided incredible insight into Roebling's mind and the way in which he viewed technology as a tool to better the human condition. Having spent years with politicians and businessmen, Roebling was keenly aware of

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<sup>15</sup> Gibbon, "How Roebling Did It," 15.

<sup>16</sup> McCullough, *Great Bridge*, 51.

the problems that loomed in America. Political battles raged, the United States declared war on Mexico (which he strongly disapproved of), and Roebling analyzed the factious undercurrents swirling in America.<sup>17</sup> Fearing the South and the continuing slavery debate, investors held tight fistedly to capital for innovations and improvements to infrastructure. Yet, Roebling saw a brighter future. He believed that of all the modern inventions –railroads and telegraphs, "will contribute more to the interests of mankind." He wrote there was no nation on earth that could benefit as much from the "astonishing developments of mechanical science," than America.

Roebling's next statement foreshadowed future events, warning what should be important to America: "One of the best proofs of the advancement of mankind in *true* civilization is that the industrial efforts of nations are no longer squandered upon the creation of vast monuments of pride and war." The war with the South that many felt was coming could in Roebling's mind, be avoided. He believed that technology should act as a unifier of men and ideals. Roebling wrote:

Like a *magic wand*, they [railroads] open the slumbering resources and long-hidden treasures of the earth; convert stone and iron into gold; draw into bonds of union and amity isolated individuals, as well as communities and nations; unchain long-cherished prejudices and selfishness, and cause to be made more simultaneous, exertions in all that is useful and good.<sup>18</sup>

When Roebling spoke of "bonds of union and amity" and "unchain long-cherished prejudices and selfishness," he spoke directly to his adopted nation in the midst of a moral dilemma that saw no quick answer. Intimately familiar with the prejudice and selfishness of the Old World,

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<sup>17</sup> Washington A. Roebling, *Washington Roebling's Father*, 137.

<sup>18</sup> John A. Roebling, "The Great Central Railroad from Philadelphia to St. Louis," *American Railroad Journal* Extra (1847): 1. Roebling Family Collection, MC654, Reel 7, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

Roebing put his own philosophical experiences to work with his words in the hope that an awe of all that technology could accomplish would avert the bloodshed of his youth.

Long aware of slavery and the stain it placed on the fabric of his new country, Roebing wanted Americans to be aware of all that the nation as a whole entity, had to offer. He wrote that others thought the geography of the "Mississippi valley" was "the best guarantee for the stability of the Union," but Roebing said, "with confidence" he disagreed because "we may entrust the future fate of our country to railways and telegraphs" spread over its surface. Roebing believed that the North's supremacy in technology and industrialization to be a deterrent of war, however, should war come, also an asset. He warned that a network of railroads and telegraph communication would be most valuable "in case of war." Railroads would be especially effective "as they will serve as the most effective means for the concentration of troops at the points where they are wanted," and for "the rapid transportation of supplies." Leaving no doubt as to his feelings, Roebing wrote that railroads would repel an invasion by the most powerful enemy with little effort. He perhaps gave railroads too much credit as, "they will vastly contribute to prevent long protracted wars – civil, as well as national."<sup>19</sup>

Roebing was very cognizant of the state of the Union. Having journeyed to America filled with the tales of the natural wealth and riches at the disposal of its citizens, he was eager for the nation to explore and benefit from them. He wrote in great depth about the riches that future railroad extensions "westward toward those distant regions which, even now, are ready to pour their rich treasures into our laps." Roebing exhibits a firm conviction that the United States "abounds in the elements of wealth," citing as an example, "inexhaustible supplies of coal and iron invite us to use and apply them for the construction of these and other useful works of art." This one sentence is a summation of what Roebing believed natural resources harnessed by

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<sup>19</sup> John A. Roebing, " Great Central Railroad," 2.

technology should be for humanity. His phrase "useful works of art" is most evident in his next projects, his bridges.

Roebing's travels took him away from his farm for months at a time. Saxonburg had by this time attracted a fair number of mechanics and craftsmen, and with their influx the ability to be self-sustaining. The addition of Roebing's wire rope factory in his meadow helped provide community employment, creating artisans in a new industry. This had been one of Roebing's original visions for the colony, but now it was not enough. As his wire rope company grew, it became evident that Saxonburg was not an advantageous location for a business. Wire rope drawn in Roebing's meadow required a wagon trip to Pittsburgh before transfer to canal or riverboat for delivery. Bad weather and muddy roads made for a hazardous and expensive journey. Shipment of wire to places such as the U.S. Navy Yard required prompt deliveries. Roebing spent a great deal of time looking for the most advantageous area to relocate his business. Having established a correspondence with Peter Cooper through *American Railroad Journal* publisher D.K. Minor, Roebing heeded Cooper's advice to move to Trenton, New Jersey. Cooper had recently relocated his own business, an iron works to the small old colonial city.<sup>20</sup> In 1849 Roebing purchased twenty-five acres of land for \$100 an acre. Trenton had one tremendous advantage for Roebing –a railroad. Roebing occupied elsewhere would, however, leave the moving to his wife and children.

John Roebing's preoccupation with business fits the description of him as driven to succeed in anything he set his mind to. This drive garnered him both friends and rivals. His biggest rival, and the only other man in the country considered knowledgeable on suspension bridges, was Charles Ellet, Jr. Ellet left his family farm to become a common laborer on Pennsylvania canal projects. In 1830, the twenty-year old Ellet, enamored of surveying and

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<sup>20</sup> Washington A. Roebing, *Washington Roebing's Father*, 115.

realizing his lack of technical education, traveled to France where he secured admission to the prestigious *École nationale des Ponts et Chaussées* (School of Bridges and Roads).<sup>21</sup> After a European tour of the latest in bridge design, he returned to America and began work on a Virginia canal project. Bored and frustrated with canal work, in 1839 Ellet published a pamphlet entitled, *A Popular Notice of Wire Suspension Bridges*. The pamphlet's reprinting in the *American Railroad Journal* immediately brought him to Roebling's attention and a correspondence ensued. The two men eventually parted ways over an article in which Roebling appeared to claim credit for an Ellet idea. Over the ensuing years, Ellet and Roebling vied for many of the same bridge projects. Some historians credit Charles Ellet, Jr. as having created America's first successful wire bridge and John A. Roebling the first successful wire rope.

Ellet built his first permanent wire suspension bridge between July and December 1841 at the foot of Callowhill Street in Philadelphia. The 342-foot span crossed the Schuylkill River. After publishing papers on his triumph, Ellet took his wife on an extended vacation to Cuba and then Europe. He did not return to the United States until 1845. Upon his return, Ellet engaged himself in river projects, including a grandiose vision for an inland water route thousands of miles long. He began to lobby Congress and in 1849 published *Navigation of the Ohio and Other Rivers*. In 1851 the War Department commissioned him to examine the Mississippi River. By this time, John Roebling had successfully built six aqueducts and his first bridge. Ellet, as much on the lookout for projects as Roebling, had advocated many years before connecting the United States and Canada with a railroad bridge over the Niagara Gorge. Roebling had also written on the subject.<sup>22</sup> Canada and the United States each formed companies to explore the possibilities. A

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<sup>21</sup> Donald Sayenga, *Ellet and Roebling*, (York, PA: The American Canal and Transportation Center, 1983), 8-9.

<sup>22</sup> A heated debate among historians rages to this day, as to who should receive credit for the Niagara Gorge Bridge idea, Ellet or Roebling. Considering that both men were greatly interested in suspension bridges, read

suspension bridge between the two countries that could support the weight of the tracks and train, established European bridge builders thought to be impossible. Europe had an ongoing problem with suspension bridges destroyed in high wind. Roebling was aware of the question of stability and wrote in an 1847 letter, "I answer this question in the affirmative, and maintain that wire-cable bridges, properly constructed, will be found hereafter the most durable and cheapest."<sup>23</sup> Roebling and Ellet both submitted bids; Roebling's was the lowest at \$180,000. Fractious international politics threw the project into disarray and Ellet ended up with the contract.

Charles Ellet erected a temporary footbridge over the gorge, and in a bit of showmanship made the first trip across the Gorge in a basket, then with a horse-and-buggy. People fascinated with the daring crossing clamored to follow his example. Ellet allowed it for a fee and promptly got into trouble with the bridge companies who felt the fees belonged to them. In the midst of the contention, a strong wind destroyed Ellet's footbridge. Claiming too much bickering Ellet withdrew from the project, collecting a \$10,000 settlement fee.<sup>24</sup> The companies contacted Roebling and he accepted the Niagara Gorge Railway Suspension Bridge project on a cost-plus basis. This type of contract paid Roebling for bridge expenses plus additional payment to allow for a profit. Work began in 1851 and continued for four years. Suspended from four cables, 245 feet above the rapids, the 821-foot long bridge had two decks. The upper deck carried railroad traffic while the lower deck accommodated foot and carriage travel. In a report to the Niagara Falls Suspension and Niagara Falls International Bridge companies, Roebling said the secret to

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virtually the same journals, and had originally traded ideas, there is no way of determining which man can claim the right to this idea.

<sup>23</sup> David B. Steinman and Sara Ruth Watson, *Bridges and Their Builders*, (New York: G.P. Putnam's Sons, 1941), 219.

<sup>24</sup> Sayenga, *Ellet and Roebling*, 32.

stability were "weight, trusses, girders, and stays."<sup>25</sup> The civil engineer had long been aware of two things he thought fatal to suspension bridges, high winds and vibration. Roebling added in his letter, "High wind acting upon a suspended floor, devoid of inherent stiffness, will produce a series of undulations."<sup>26</sup> One of the reasons Ellet so easily walked away from the Niagara Bridge project was a contract he won to build a bridge over the Ohio River in Wheeling, Virginia.<sup>27</sup> Having planned to build both bridges simultaneously, Ellet now devoted his attention to Wheeling. Sweeping squalls and tornadoes that swept through the Ohio River valley completely destroyed Ellet's Wheeling Bridge flooring. He regrouped and changed his design to a single-lane structure. In 1854, with a single span of just over one-thousand feet, it stood as the longest suspension bridge in the world. For a short time Ellet reveled in praise and congratulations as the master of suspension bridges.<sup>28</sup>

As the United States transportation network evolved, connecting communities by spanning rivers became increasingly important. Market goods and people needed reliable means of travel unimpeded by rivers. Since 1815 citizens of Cincinnati had discussed the need for a bridge. However, attempting to span a river one-quarter of a mile or 1320 feet wide seemed impossible. Groups were formed, designs bandied about, until finally in 1846 the bridge company asked Roebling to survey the river and comment on the feasibility of a structure. It took another ten years before politicians and businessmen would come to an agreement and raise the

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<sup>25</sup> Steinman and Watson, *Bridges and Their Builders*, 222.

<sup>26</sup> It is amazing to note that Roebling had worked out this problem in the 1840s. One-hundred years later, the Tacoma Narrows Bridge (dubbed Galloping Gertie for the movement travelers felt driving across it) crashed into Puget Sound under 40-mile-per-hour (64 km/h) wind conditions the morning of November 7, 1940.

<sup>27</sup> John Roebling also placed a bid for the Wheeling Bridge but lost out after calling for a mid-river pier that investors felt would impede ship traffic. See Sayenga, *Ellet and Roebling*, 32.

<sup>28</sup> Ellet was mortally wounded during the Civil War Battle of Memphis while on board *Queen of the West*, dying fifteen days later on June 21, 1862. See Sayenga, *Ellet and Roebling*, 47.

necessary capital. The president of the Cincinnati-Covington Bridge project, Richard Ransom, personally sought John Roebling to offer him the contract.

However, Roebling had taken a detour from engineering work. Roebling had not let go of his ideal for the self-sustaining agricultural based utopian community of his youthful dreams. His son Washington claimed he had "land fever." Convinced by a Kentucky college professor, Alexander Gower, that great money awaited investors in Iowa, he set out with his son Washington to buy up vast acreages of land. Washington Roebling called the professor "the prince of promoters and schemers," he explained the scheme, "land bought with soldiers warrants could be bought for a dollar and a quarter an acre, to be sold later on for 7 or 10 or more—my father could not resist—He sold \$30,000 of Del & Hudson stock."<sup>29</sup> It seemed that any opportunity to own land excited the elder Roebling. He ended up purchasing 45,000 acres. Father and son spent the summer on the Iowa prairie where they fended off rattlesnakes, and broke up the prairie sod with an ox team. Provisions gave out and the oxen became dinner. Once again, Roebling chose his land poorly and proved himself unsuitable for a life involving any type of agriculture. Thankfully, the Cincinnati-Covington Bridge called for his return.

By September of 1856, with \$314,000 in bridge stock raised, Roebling began excavation for the foundations upon which the stone bridge towers rested. The winter of 1856-1857 proved disastrous for the project when the Ohio River froze. Jagged chunks of ice crushed boats when in February the river thawed and triggered massive flooding. A far worse calamity loomed for the bridge company and its builder. The bridge, in financial difficulties due to huge delinquencies of stock subscriber payments, fell victim to the panic of 1857. The Ohio Life Insurance and Trust Company, with its main office in Cincinnati, failed setting off a nationwide

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<sup>29</sup> Washington A. Roebling, *Washington Roebling's Father*, 169.

financial crisis.<sup>30</sup> With only the anchorage towers completed, all work on the bridge stopped for lack of funds. By the time the financial crisis stabilized, and capital became available to resume work on the bridge, a new cataclysmic event swept the nation –the Civil War.

Thirteen years earlier John A. Roebling predicted in his address to the Pittsburgh Board of Trade the consequences of not setting aside long held prejudices. With the election of Abraham Lincoln, and Southern states seceding, Roebling a staunch Republican was contemplative. In a document dated October 1861, Roebling sat and wrote "A Few Truths for the Consideration of the President and the People of the U.S." It is a purposeful set of philosophical thoughts, part warning, part exhortation, and provides a look into the despair he felt seeing war loom on the horizon. He began:

All progress is positive and affirmative, All failure is negative and conservative. To overcome Evil by Good is not done by conserving the Evil, but by instituting the Good, and thus allowing Evil to perish for want of support. Providence is not a covert Divine Agency, that makes itself felt here or there by mysteriously directing human affairs... You Mr. President are now the most responsible, the most promised Agent of Divine Providence, and as such Providence will make you individually accountable for all your deeds.<sup>31</sup>

Roebling continued for a few more sentences on the motivation of good and evil, and the power of evil men versus good men. "God's Providence," he wrote, "acts by revolutions and by peaceable means." In closing, he got to the crux of his long held belief against slavery. He wrote:

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<sup>30</sup> Steinman and Watson, *Bridges and Their Builders*, 224-229.

<sup>31</sup> John A. Roebling, "A Few Truths for the Consideration of the President and the People of the U.S.," October 1860, Roebling Family Collection, MC654, Reel 6, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

Earthquakes and Tornadoes are as necessary to the Worlds process as are sunshine and rain. When a Whole Nation has been steeped for a whole-century in the sins of iniquity, it may require a political tornado, to purify its social atmosphere. You can direct this tornado either for backing good or more Evil.

Future generations, will either honor your memory or curse it.

This is quintessential John Roebling, the American Hegelian, who once more appeared unnaturally prescient. Studying the speeches of Abraham Lincoln in 1859 and 1860, Roebling uses much of the same phraseology. Lincoln's passages that include the words "Divine Providence" and his paraphrasing of Thomas Jefferson concerning "God's Divine justice wrapped up in the enslaving of any man" show Roebling's familiarity with the president. It is obvious that Roebling felt a kinship with Lincoln and understood the threat to his adopted nation. Roebling's grave concern as to the impact of war on his growing wire empire was valid; thirty-years of effort faced destruction. If war came, what if anything would remain weighed heavily on his mind.

When war finally broke out between the North and the South, Washington said his father bemoaned his age, believing that "had he been a little younger he would have entered the army and become its commander in chief in a year!" His father did not tolerate idleness on the part of Washington. "One day about Fort Sumpter [sic] time," Washington wrote, "we were eating dinner when my father suddenly remarked to me, Washington! you have kicked your feet under my table long enough, now you clear out this minute."<sup>32</sup> Washington Roebling borrowed train fare from his father's factory superintendent, Charles Swan, and headed to New York where he

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<sup>32</sup> Washington A. Roebling, *Washington Roebling's Father*, 192.

enlisted in Ninth New York regiment.<sup>33</sup> The son would do what the father could not, distinguish himself in the service of his country. That did not mean that John Roebling did not help in other ways. Just before the Battle of Gettysburg, Washington Roebling received orders urging him to proceed immediately to his home in Trenton. General Robert E. Lee's foray into Pennsylvania caught the Army of the Potomac unprepared. The Union generals urgently needed detailed maps of the terrain, highly detailed maps that John Roebling had drawn during his years surveying for the Pennsylvania Main Line. Arriving home, Washington found a different father than the man he had left, a man who "was sure that Lee's army would beat ours, that he would capture Philadelphia, that he would come up and take Trenton, burn up his wire mill, his rope shop, his fine new house, and make him a beggar on the face of the earth."<sup>34</sup> This is understandable as people in the North were shocked at Lee's boldness in venturing so far from his home advantage. If Lee were capable of this, what else could he do? However, John Roebling believed in the Union and in a patriotic outburst "advanced the United States government \$100,000 at a time when bankruptcy stared the nation in the face."<sup>35</sup>

Washington Roebling's service in the Union Army is another aspect of the Roebling legacy. He drew detailed maps, designed and built bridges, and spent time aloft in a hot air balloon reconnoitering and reporting on enemy troop movement. John Roebling kept busy during the wars years, becoming obsessed with designing the perfect iron clad vessel to destroy enemy ships. The detailed drawings very much resemble early American submarines. As the war drug on, events in Cincinnati called John Roebling back to his unfinished bridge. Threats of Confederate forces approaching from Kentucky to seize Cincinnati, had soldiers all over Ohio

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<sup>33</sup> After graduation from Rensselaer Polytechnic Institute in 1857, Washington Roebling joined his father's bridge projects.

<sup>34</sup> Washington A. Roebling, *Washington Roebling's Father*, 192.

<sup>35</sup> Washington A. Roebling, *Washington Roebling's Father*, 193.

rushing to the city's defense. A hastily erected pontoon bridge sent Union soldiers across the river to Kentucky to hold the line, and avert disaster. Finishing the bridge now seemed vitally important as a means of keeping the rebels out of the city. Work resumed on the Cincinnati-Covington Bridge on July 1, 1863.<sup>36</sup> Two years later, upon his release from the Army, Washington Roebling joined the work as Assistant Engineer. Completed in 1866, it formally opened for traffic on New Year's Day 1867 hailed as America's longest suspension bridge.

Washington Roebling called the Cincinnati-Covington Bridge "a striking example of what can be accomplished by one man overcoming great difficulties." He also provided an intimate portrait of his father's force, writing, "Few people that I have ever met possessed such an amount of vital energy, coupled at the same time with an amazing perseverance which never rested." The character and philosophy of John Roebling, formed under Hegel, demanded that his mind "week day or Sunday –from early morn to dewy night was incessantly at work," for as Washington Roebling wrote, "we all know that mere thought without expression or action is useless." Every ounce of John Roebling's work ethic and diligence to detail would be required for his next project, the one that would cement his fame –to build the Eighth Wonder of the World.

The Brooklyn Bridge was a whisper on the horizon for many years, "the first serious proposal having been recorded in Brooklyn in 1800." Travel between boroughs required a ferry across the East River. On a ferry, the trip over an area stretching more than five football fields laid end-to-end could be fraught with danger. McCullough writes that safety and reliability, not found with the ferries was paramount in the minds of the people of Brooklyn:

Winds, storms, tides, blizzards, ice jams, fog...no more shoving crowds at the  
ferry house loading gates...no more endless delays...one Christmas night a gale

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<sup>36</sup> Steinman and Watson, *Bridges and Their Builders*, 230-231.

had caused the river to be so low the ferries ran aground and thousands of people spent the night in the Fulton Ferry House...many winters when the river froze solid, there had been no service at all for days on end.<sup>37</sup>

Safety and reliability was not the only impetus behind spanning the gap between the two cities. A bridge would put Brooklyn on the map, raising its status, and turn the community into a boomtown. Manufacturers would have closer ties with New York, and Long Island farmers and Brooklyn brewers could move goods expeditiously. Some politicians, anticipated with joy a larger voting bloc as disaffected Manhattan residents with "no decent place to make a home" would flock across the river in search of a place to live.<sup>38</sup> Nevertheless, the bridge was to be more than that, in the minds and hearts of America it was to be a symbol of progress, of great change, of man's triumph and command over the elements of nature –the Great Bridge– was a symbol of the future and all its possibilities. The bridge would be the culmination of John Roebling's philosophy.

In 1867 he was poised for a leap into history with a formal proposal to the committee of men interested in spanning the East River. Of the bridge Roebling wrote in his proposal:

The completed work, when constructed in accordance with my designs, will not only be the greatest bridge in existence, but it will be the greatest engineering work of the continent, and of the age. Its most conspicuous features, the great towers, will serve as landmarks to the adjoining cities, and they will be entitled to be ranked as national monuments. As a great work of art, and as a successful

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<sup>37</sup> McCullough, *Great Bridge*, 26.

<sup>38</sup> McCullough, *Great Bridge*, 24-25. The Brooklyn Bridge was designated a National Historic Landmark by the federal government in 1964 and a National Historic Civil Engineering Landmark by the American Society of Civil Engineers in 1972.

specimen of advanced bridge engineering, this structure will forever testify to the energy, enterprise and wealth of that community which shall secure its erection.<sup>39</sup>

An engineering design to solve the functional problem of transportation between two communities; the Brooklyn Bridge was not just a means to an end. With a deeper meaning imbued by her designer, it stood to become a symbol for the new age of man. Congressman Demas Barnes delivered his fervent and heartfelt ideal on the expectations of the Great Bridge:

This bridge is to be built, appealing as it does to our pride, our gratitude and our prosperity. When complete, let it illustrate the grandeur of our age; let it be the Mecca to which foreign peoples shall come. Let Brooklyn now take up the pen of progress. Babylon had her hanging gardens, Nineveh her towers, and Rome her Coliseum; let us have this great monument to progress.<sup>40</sup>

To compare a bridge to the Seven Wonders of the Ancient World or to classic architectural design such as the coliseum may seem far-fetched in the twenty-first century. Yet this is indicative of the grandeur of the attitude of the age that technology created. The mightiness of a rushing river did not inspire men and women, but the bridge across it did.

As with any project that involved the investment of millions of dollars and affected the businesses and citizens of two communities, clamor against the bridge proved just as loud as praise for it. No one had ever before attempted a bridge across such a wide span of river. Ferry operators fearing the loss of their livelihood led the negative charge joined by shipping interests who feared the bridge would impede traffic up the East River. Others in Chicken Little fashion believed the bridge would go the way of so many suspension bridges of that time, collapsing into the river the first time the wind blew. Two things turned the tide for the bridge. Washington

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<sup>39</sup> McCullough, *Great Bridge*, 27.

<sup>40</sup> McCullough, *Great Bridge*, 90.

Roebing wrote, "After awhile it was determined that the proper thing to do was to get a board of highly respectable consulting engineers to pass upon the plans and give their unqualified endorsement –this scheme was hailed with joy."<sup>41</sup> The second plan once again proved John Roebing's belief in himself and in his promotional skills. Roebing insisted that members of the committee and other invited guests, such as the politicians, accompany him on a tour of his past triumphs, the Niagara Falls Suspension Bridge and the Cincinnati-Covington Bridge. The properly awed committee after months of design study climaxed with the tour issued a resounding endorsement for the Brooklyn Bridge in May 1869.

With the naysayers silenced and the capital raised, work should have been able to begin in earnest. As Washington Roebing wrote, "instead of work came the crowning catastrophe of all in the death of John A. Roebing." Her designer, chief architect and champion, John Augustus Roebing would not live to see work begin on the bridge. On June 28, 1869, while he was surveying at the Fulton Ferry, a little more than a month after the endorsement, Roebing had his foot crushed against a piling by an incoming tugboat. Washington Roebing, on hand to help survey, bundled his wounded father into a carriage and transported him to his home. Washington Roebing agonized over that fateful decision when he wrote, "The mistake I made was in not taking Mr. Roebing to a hospital at once –but I had been brought up to look upon hospitals as the abode of the devil and upon a doctor as a criminal."<sup>42</sup> Washington Roebing overcame his misgivings and called for a doctor who cleaned the wound and applied the first bandage. However, when the doctor returned the next day, John Roebing had rallied enough to resort to his arrogant and demanding demeanor. Roebing railed at the doctor that he "would take

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<sup>41</sup> Washington A. Roebing, *Washington Roebing's Father*, 226.

<sup>42</sup> John Roebing, for his entire life, did not believe in modern medicine calling it "quackery." He was an avid proponent of hydrotherapy, believing soaking baths in hot, then cold water cured any ailment. He had a room specifically for water therapy constructed in all of his homes.

command of his own cure and would take no orders or treatment from him."<sup>43</sup> To do this, John Roebling ordered a tinsmith who fixed up a large dish supplied with a hose of running water. Into the tin dish, John Roebling inserted his injured foot.

The doctor, not willing to give up on the recalcitrant Roebling exclaimed, "You are inviting certain death for yourself." John Roebling ordered the doctor from the room. Within three days, Washington Roebling took note of his father's inability to eat or speak and once again summoned the physician. The doctor's diagnosis –tetanus- "and incurable at that," wrote Washington Roebling. Tetanus, commonly called lockjaw, is a serious bacterial disease that usually involves muscle stiffness in the jaw and neck that then progresses to involve other parts of the body. The tetanus bacterium, commonly found in soil contaminated with manure, and animal and human feces is present throughout the environment.<sup>44</sup> Considering New York City sanitation conditions mid-nineteenth-century, tetanus was a common occurrence.

It is unfathomable to think of John Roebling's transcendent mind trapped in a silent and painful shell of a body. Washington Roebling wrote that with, "feverish haste" his father "started to write all kinds of directions about his treatment, about the bridge and his financial affairs –As his powers waned the writing became more and more illegible." In an increasingly difficult struggle to make his wishes known, John Roebling's deathbed notes are heartbreaking to read. They command, "Never waver the foot without my consent;" they worry, "Wash must not stay up this night;" they question, "What are these spasmodic twitches?" and they remember philosophers of his youth, "To explain, would require 2 sheets according to Leibniz and my own

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<sup>43</sup> Washington A. Roebling, *Washington Roebling's Father*, 231.

<sup>44</sup> "Tetanus," *New York State Department of Health*, accessed 10 March 2011, [http://www.health.state.ny.us/diseases/communicable/tetanus/fact\\_sheet.htm](http://www.health.state.ny.us/diseases/communicable/tetanus/fact_sheet.htm).

personal experience."<sup>45</sup> Acting as his father's nurse, Washington Roebling stood by his father, forced to watch the incredible ordeal. He wrote:

Daily and hourly, I was the miserable witness of the most horrible titanic convulsions, when the body is drawn into a half circle, the back of the head meeting the heels, with a face drawn into hideous distortions –each attack sapping the rapidly waning vital forces– hardened as I was by the scenes of carnage on many a bloody battlefield, these horrors often overcame me.<sup>46</sup>

John Augustus Roebling, civil engineer and suspension bridge designer and builder, died after an agonizingly painful two weeks on July 13, 1869.

Informed of the Chief Engineer's death, the board of directors of the Brooklyn Bridge project adopted the following, part resolution and part fitting tribute:

This board receives the death of John A. Roebling, Esq. with the deepest concern and sorrow. Connected with him officially for a considerable period, we have learned to appreciate his unsurpassed merits as an engineer and adviser in our work, and to admire his eminent genius and virtues as a man. In all his qualities which exalt human nature he deserved and had won our unqualified support.<sup>47</sup>

Roebling's funeral drew New York and New Jersey dignitaries, all two-hundred of his factory workers, and his friends and family. Several thousand gathered on the lawn of his Trenton home and waited patiently to file past his body to pay their respects. His burial took place July 25,

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<sup>45</sup> John A. Roebling, deathbed notes, Roebling Family Collection, MC654, Reel 7, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ. Gottfried Wilhelm Leibniz (1646-1716) was a German mathematician and philosopher.

<sup>46</sup> Washington A. Roebling, *Washington Roebling's Father*, 231.

<sup>47</sup> "Funeral Services of John A. Roebling: Memoir, Resolutions, Address by Rev. John Hall. D.D., Sermon by Rev. John C. Brown," pamphlet (Trenton, NJ: Murphy and Bechtel Printers, 1870), Roebling Family Collection, MC654, Reel 3, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

1860, in the family plot beside his wife Joanna and three of their children.<sup>48</sup> Roebling, ever the autocrat, divided his considerable fortune (estimated at several million dollars) equally between his surviving heirs but only after the deduction of any funds he had advanced them in their lifetime. One of the caveats of his will assured his name would forever be synonymous with the wire rope business. The name of the business immediately changed to John A. Roebling's Sons Company.

Into the void left by his father's death, stepped Washington Augustus Roebling. He began work on the Brooklyn Bridge, breaking ground in October of 1870, and completing it in 1883. His story and the actual building of the bridge is a long and complicated one of trials, tribulations, pain, and endurance. This monument to man's progress in a new age was not going to be born without great pain, personally and professionally.

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<sup>48</sup> Joanna Hertig Roebling died during the Civil War. In July 1867, five years after her death, John Roebling married his second wife, Lucia Cooper from Trenton, NJ.

## CHAPTER 5

### CONCLUSION

The Board of Directors of the New York Bridge Company voted unanimously to appoint Washington Roebling Chief Engineer. Fraught with political machinations, shoddy deals, and backroom manipulation—another symbol of postwar industrialization—the building of the bridge is a story in its own right. During his thirteen-year tenure as Chief Engineer of the Brooklyn Bridge, Washington Roebling dealt with a plethora of problems. One was the initial involvement in the bridge project of the notorious William Marcy "Boss" Tweed. Another problem arose when a few nefarious New York City newspapers attempted to whip the public into a frenzy implying scandal and dirty dealings. A project this monumental meant everyone had an opinion, and not all of them were favorable. No one had ever built a bridge across a quarter of a mile span, and many detractors called it a folly. Politically astute, Roebling knew that his best chance to build the bridge rested on its technological superiority, not its politics, and remained as removed from the raucous fray as possible. Constantly on his toes, Roebling needed to concentrate his intellect on moving his father's dream from a design on paper to a working bridge.

From the outset of the design of the Brooklyn Bridge, both father and son wisely decided not to purchase any stock in the bridge. This meant they had no financial stake in its success. To ensure there could be no charges of collusion, when named Chief Engineer, Washington Roebling sold all of his stock in the John A. Roebling's Sons Company (JARS), three-hundred shares worth \$300,000.<sup>1</sup> The son, like his father, did not suffer fools gladly, nor tolerate dishonesty and inferior materials in construction bearing his name. Though corruption swirled

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<sup>1</sup> McCullough, *Great Bridge*, (New York: Simon and Schuster), 379.

around the bridge, Roebling as Chief Engineer dealt only with construction matters. Scandal, a sign of the greed of the era, never tarred the Roebling name. This too would be another example of the American spirit that John Roebling believed in, the ability of honorable men to accomplish a great feat for the ideal of something bigger than financial gain. Personal pride and accomplishment, not wealth served as Washington Roebling's impetus.

To support the granite towers soaring 273 feet into the air, John Roebling determined digging down to bedrock on the river bottom would be vital. The problem of how to accomplish this fell to Washington Roebling. Two caissons in the shape of an inverted ship's hull built of heavy timber, floated down the East River to the tower sites. Men inside the caissons submerged below the river, worked to dig out the sandy bottom. This began a new chapter in the ingenuity of man in dealing with adversity. Working inside the caisson several feet under water, in low light and stale air, men began to experience a "mysterious" illness. Chief Engineer Washington A. Roebling correctly surmised that the pounds of pressure exerted upon the workers inside the caisson, (a pound for every two feet of depth) made them ill. Roebling, concerned for his workers, hired a New Yorker and former Army surgeon, Andrew H. Smith as Surgeon to the New York Bridge Company.<sup>2</sup> Dr. Smith instituted strict directions for how long men could remain in the caisson and restricted their intake of alcohol. Not everyone followed the doctor's rules. Washington Roebling fell victim to the illness in the summer of 1872 after a fire required the Chief Engineer's presence underwater for an extended period. Dr. Smith diagnosed him as having a severe case of the "bends." For the next eleven years, Roebling remained painfully handicapped and became known as "the man in the window." He never returned to the site of the Brooklyn Bridge but watched it through a spyglass from his townhouse. Roebling, determined to see the construction of the bridge to completion, directed the construction from his Brooklyn

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<sup>2</sup> McCullough, *Great Bridge*, 298.

Heights home. His wife Emily Roebling acted as an intermediary between the Colonel and his bridge.<sup>3</sup>

Another intriguing story of the Brooklyn Bridge is the invaluable assistance provided by Washington Roebling's wife, Emily. Among the first women leaders in the management of technology, Emily earned a law degree and championed women's suffrage.<sup>4</sup> Her acceptance, by the workers, bridge contractors, and directors of the bridge company as a capable aide-de-camp to her husband Washington was astonishing in the 1870s. Many of the assistant engineers and contractors solicited her advice and suggestions and considered her the Chief Engineer. Emily Roebling had studied engineering topics related to bridge construction including mathematics, strength of materials, and cable construction. Her name is included on the plaque dedicating the bridge, recognizing her role in helping to create one of her era's greatest engineering achievements.<sup>5</sup>

At two o'clock on the afternoon of May 24, 1883, after thirteen arduous years, the Brooklyn Bridge opened to foot traffic with great acclaim and fanfare; 150,300 individuals paid a penny each to walk across the bridge. President Chester A. Arthur and Governor Grover Cleveland were two of a multitude of dignitaries in attendance for the three-hour ceremony. At five o'clock, the bridge opened to vehicles at the cost of a nickel, and 1800 made the crossing. At the time of its completion, the Brooklyn Bridge, "The Eighth Wonder of the World," was fifty-percent longer than any previous suspension bridge, the first to use pneumatic caissons, and the first steel suspension cable bridge.<sup>6</sup> With 14,060 miles of wire rope, an elevated promenade for

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<sup>3</sup> D.B. Steinman, *The Builders of the Bridge*, (New York: Harcourt, Brace & Co., Inc., 1945), 233.

<sup>4</sup> The Sounds of Progress, Part II: Emily Roebling, in *Women in Science, Technology, Engineering and Mathematics ON THE AIR*, <http://www.womeninscience.org/transcript.php?storyID=28> (accessed 1 April 2010).

<sup>5</sup> Engineer Girl, Emily Roebling, in *The National Academy of Sciences, National Academy of Engineering*, accessed 10 April 2010, [www.engineergirl.org/?id=3507](http://www.engineergirl.org/?id=3507).

<sup>6</sup> McCullough, *Great Bridge*, 543.

foot traffic, train tracks, and two roadways suspended from four 15 3/4 inch cables, it was more than just an engineering masterpiece. As John Roebling had envisioned, the bridge was a work of art, aesthetically pleasing, with its two arched stone towers standing watch over the masses of Brooklyn and New York. Congressional representative, industrialist, and philanthropist, the Honorable Abram S. Hewitt proclaimed on opening day, "It stands before us today as the sum and epitome of human knowledge; as the very heir of the ages."<sup>7</sup>

The bridge has been the backdrop for hundreds of movies, many plays, and works of art, the most recognizable being Joseph Stella's powerful abstract painting *The Bridge*, in 1918. The 1943 novel by Betty Smith, *A Tree Grows in Brooklyn*, one of the characters said, "I thought if I ever got to New York, I'd like to walk across the Brooklyn Bridge."<sup>8</sup> Songs include lines about the bridge. Poets Walt Whitman, Hart Crane, and Jack Kerouac immortalized the bridge in poetry. Emma Lazarus famous ode to immigrants inscribed on the Statue of Liberty contains the line, "...the air-bridged harbor that twin cities frame."<sup>9</sup> To immortalize a man-made structure in film, song, poetry and art well into the twenty-first century is a testament to the importance of the structure. Not just a bridge between two cities, the Brooklyn Bridge was and is a romantic and artistic ideal embraced with a heretofore unheard of passion. It is the stone, mortar and wire bridging of two worlds, the Old World and the New.

To put the meaning of the bridge into perspective, David McCullough recounted the story of an elderly woman on Long Island who, when Neil Armstrong walked on the moon, commented that the public's excitement in 1969 paled in comparison to what she had witnessed

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<sup>7</sup> Alan Trachtenberg, *Brooklyn Bridge: Fact and Symbol*, (Chicago: University of Chicago Press, 1965).

<sup>8</sup> McCullough, *Great Bridge*, 548.

<sup>9</sup> Emma Lazarus, "The New Colossus," *Statue of Liberty State Park*, accessed 10 September 2010 <http://www.libertystatepark.com/emma.htm>. The public fund raising efforts for the Statue of Liberty's pedestal began in 1883 just after the opening of the bridge.

the day they opened the Brooklyn Bridge.<sup>10</sup> The bridge in 1883 was a very real symbol of man's progress. More than a bridge between two cities, many felt it was a symbol of the unity of a new nation. Designed by an immigrant, built mostly by immigrants, its world famous cathedral arch towers were one of the first symbols immigrants looked for upon arrival. The Brooklyn Bridge, far from the personification of ugliness embodied by steel and coal towns, proved that technology could be more. The bridge came to be exactly what John Roebling had envisioned for it, a work of art. Critic Lewis Mumford said in 1920:

All that the age had just cause for pride in –its advances in science, its skill in handling iron, its personal heroism in the face of dangerous industrial processes, its willingness to attempt the untried and the impossible – came to a head in Brooklyn Bridge.<sup>11</sup>

The Brooklyn Bridge is the realization of the philosophy of Hegel, the youthful dreams of John Roebling, and the awe-inspiring grandeur of man's capabilities and triumph over nature.

John Roebling accomplished every goal he set for himself in the New World. He established a colony of mechanics and craftsmen. He garnered fame and fortune as an inventor, bridge designer and builder. None of this would have been possible without his Old World classical education and his early training under Hegel. In Roebling's philosophical writing, he found one fault with his mentor, as he wrote, "Hegel has wronged himself by ignoring the immortality of individualism." Roebling strongly believed in the power of the individual to make his mark upon the world. That mark, be it a community or a bridge, would stand for all time as the triumph of the intellect of one man. Roebling's many accomplishments came from the power of his mind to create and invent and from a work ethic that demanded no idleness. No matter

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<sup>10</sup> McCullough, *Great Bridge*, 542.

<sup>11</sup> McCullough, *Great Bridge*, 551.

what Roebling attempted in life, he drew a correlation to Hegel. "The Philosophy of Hegel is greatly in advance of the Spiritual capacity of the age," he wrote, "but science is making raised strides and its disjointed activities will by force of necessity also rally around the standard of a truthful philosophy."<sup>12</sup> Man in conjunction with technology in the nineteenth century finally caught up to the philosophy of the eighteenth century.

Roebling's ideas of freedom, science, and nature stemmed from the overarching theme of man's progress and his place in the historical realm. In his mind, every idea built upon the one before and the one to follow in a natural order of the universe, and in the advancement of humanity. Dominion over natural resources – bridging rivers, digging coal, and expanding railroads– were duties required of educated, freethinking men. Roebling believed that ensuring men's salvation was the great task of science. He wrote, "Man's slavery to nature shall be abolished, that man shall be emancipated, and that he shall become the Master, and nature the servant, this is the great problem, which science has to solve."<sup>13</sup> In a letter to his father Polycarp written March 30, 1844, John Roebling wrote that, "If we simply cling to nature (God's work), we shall always bring it about that the good rewards itself and the evil punishes itself."<sup>14</sup> He goes on to add, "There is only one true religion, and that is in nature; Jews, Christians, heathen and Baptist will in the end, when universal culture and civilization have made one single great family out of all mankind which is now rent asunder, finally come back to that." From the bold, heavy manner in which he underlined this passage, this was something Roebling passionately believed. Nature subdued by science would create the perfect and unified world. "Entrust your feelings,"

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<sup>12</sup> John A. Roebling, *Philosophical Writings*, n.d., Roebling Family Collection, MC654, Reel 6, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

<sup>13</sup> John A. Roebling, "The Truth of Nature," unpublished manuscript, 1862, Roebling Family Collection, MC654, Reel 6, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

<sup>14</sup> John A. Roebling, letter to Polycarp Roebling, 30 March 1844, Roebling Family Collection, MC654, Reel 5, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

he wrote his father, "to the bosom of nature which deceives no one, but is a kindly mother to all." Nature would eventually reunite the world. In Roebling's new world, man would master nature and be released from the bondage of the irrationalities of history.<sup>15</sup>

John Roebling is the nineteenth century paradigm of progress. His classical education, heavily steeped in philosophical thought, afforded him the opportunity to formulate an ideal for not only his future but also the world's future. A belief in man's ability to harness nature for the benefit of all is not only altruistic but also realistic. In Roebling's mind progress was a part of nature, part of a duty to build, grow, and improve because to do so filled a spiritual void in man. Man's nature and destiny was to create. In one of his philosophical works, he wrote, "Man is a progressive Being and not a finished or segmented creature, the truth of today must be enlarged for tomorrow, to each an expanded mind."<sup>16</sup> Out of his ideals for progress grew men like Andrew Carnegie and John D. Rockefeller. These men twisted the altruistic ideal, hijacking the role and place in history of progress for the sake of personal wealth. Yet, it is Rockefeller and Carnegie—the Robber Barons—who fill our history texts. Historians have focused their work on the latter half of the nineteenth century, ignoring that it was the engineers and entrepreneurs of earlier in the century who laid the foundation, and built the infrastructure that made America an industrial power. Without men such as John Roebling, Johann Etzler, Charles Ellet, and Washington Roebling progress might have taken a different course.

The civil engineering profession may be another possible reason historians have overlooked men such as Roebling. Engineering is a science unknown to a majority of the modern public. Yet it is interesting to note that engineers have been celebrated pop culture figures. In

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<sup>15</sup> Alan Trachtenberg, *Brooklyn Bridge: Fact and Symbol*, 2d ed. (Chicago: University of Chicago Press, 1979), 48.

<sup>16</sup> John A. Roebling, *Religion*, unpublished manuscript, 1862, Roebling Family Collection, MC654, Reel 6, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.

1920s Hollywood, the male lead in more than fifty feature films was an engineer.<sup>17</sup> With a combination of book learning and hard work, Hollywood's celluloid engineers were rugged men with the ability to overcome any problem. These engineers portrayed by screen legends such as Clark Gable and Spencer Tracy, spurred a twentieth-century generation of young men to embrace the profession. They were not quite the classically educated, philosophical equivalent of John Roebling, but their characters all took dominion over the forces of nature. If engineers captured the imagination of the silver screen, how can they not have garnered the attention of historians?

America's rise to industrial prominence would not have been possible without an established and progressive infrastructure. That infrastructure required three vital components: capital, inventors, and civil engineers. On October 18, 1931, President Franklin Delano Roosevelt said, "There can be little doubt that in many ways the story of bridgebuilding is the story of civilization. By it we can readily measure an important part of a people's progress."<sup>18</sup> However, wire rope did more than build bridges. The Washington Monument, the Empire State Building, the Eiffel Tower, the Wright Brothers Kitty Hawk, Charles Lindbergh's Spirit of St. Louis, and U.S. Navy warships all contained Roebling wire rope. Millions of feet of John A. Roebling's Sons Company wire rope made up the 600-mile anti-submarine nets off the East Coast during World Wars I and II.

John Roebling's story is more than one of an immigrant's success in America. It is the story of the American ideal of freedom and progress embodied in the philosophy of a disciplined intellect. How can historians ignore a man who foresaw the Civil War, the transcontinental

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<sup>17</sup> Bruce Sinclair, "Inventing a Genteel Tradition: MIT Crosses the River," in *New Perspectives in Technology and Culture*, Bruce Sinclair ed. (Philadelphia, PA: American Philosophical Society, 1986), 3.

<sup>18</sup> David B. Steinman and Sara Ruth Watson, *Bridges and Their Builders*, (New York: G.P. Putnam's Sons, 1941), vi.

railroad, the first transatlantic cable, globalization, and a bridge becoming a national monument. These are just a few of the many. Roebling's life and work transmogrify what we believe about technology and its role in American life. With his bridges and inventions, he proved that technology is not inherently an ugly blight but a work of art that also helps humanity reach beyond the realm of the possible to embrace the impossible.

## BIBLIOGRAPHY

- Ackerman, Carl W. *George Eastman*. Clifton, NJ: Augustus M. Kelley Publishers, 1973.
- Billington, David P. and Robert Mark. "The Cathedral and the Bridge: Structure and Symbol." *Technology and Culture* 25, no. 1 (January 1984): 37-52.
- Brazill, William J. *The Young Hegelians*. New Haven, CT: Yale University Press, 1970.
- Brewer, Thomas B., ed. "Introduction." In *The Robber Barons: Saints or Sinners?* ed. Thomas Brewer, 1-6. New York: Holt, Rinehart and Winston, 1970.
- Cochran, Thomas. *200 Years of American Business*. New York: Basic Books, Inc., 1977.
- Cole, Arthur H. "A History of Business in the United States." *The Business History Review* 32 (Winter 1958): 451-455.
- Condit, Carl W. "The First Reinforced-Concrete Skyscraper: The Ingalls Building in Cincinnati and Its Place in Structural History." *Technology and Culture* 9, no. 1 (January 1968): 1-33.
- "Definition of Civil Engineering." In *History and Heritage of Civil Engineering*, American Society of Civil Engineers, accessed 6 November 2010, <http://live.asce.org/hh/index.mxml?versionChecked=true>. .
- Derry, T.K., and Trevor I. Williams. *A Short History of Technology: From the Earliest Times to A.D.1900*. New York: Dover Publications, 1960.
- "Engineer Girl - Emily Roebling." In *The National Academy of Sciences*, National Academy of Engineering, accessed 10 April 2010, [www.engineergirl.org/?id=3507](http://www.engineergirl.org/?id=3507).
- Fest, Wilfried. *Dictionary of German History*. New York: St. Martin's Press, 1978.
- Finch, James Kip. "A Century of Engineering Progress: 1852-1952." *The Scientific Monthly* 75, no. 2 (August 1952): 99-108.
- Firestone, Harvey S. *Men and Rubber: The Story of Business*. Garden City, NY: Doubleday and Company, 1926.
- Forman, Richard. "History Inside Business." *The Public Historian* 3 (Summer 1981): 40-61.
- Fosdick, Raymond B. *John D. Rockefeller: A Portrait*. New York: Harper and Brothers, 1956.
- Gabor, Andrea. *The Capitalist Philosophers*. New York: Times Business, 2000.

- Gibbon, Donald L. "How Roebling Did It: The Building of the World's First Wire-Rope Suspension Aqueduct in the Pittsburgh of the 1840s." *Journal of the Minerals, Metals and Materials Society* 58, no. 5 (May 2006): 20-29.
- Grubb, Farley. "German Immigration to Pennsylvania, 1709 to 1820." *Journal of Interdisciplinary History* 20, no. 3 (Winter 1990): 417-436.
- "The End of European Immigrant Servitude in the United States: An Economic Analysis of Market Collapse, 1772-1835," *The Journal of Economic History* 54, no. 4 (December 1994): 794-824.
- Hegel, Georg Wilhelm Friedrich. *Reason in History: A General Introduction to the Philosophy of History*, trans. Robert S. Hartman. Upper Saddle River, NJ: Prentice-Hall, Inc., 1997.
- Hidy, Ralph W. "Business History: Present Status, Future Needs." *The Business History Review* 44 (Winter 1970): 483-497.
- Hofstadter, Richard. "The Pervasive Influence of Social Darwinism." In *The Robber Barons: Saints or Sinners?*, ed. Thomas B. Brewer, 34-39. New York: Holt, Rinehart and Winston, 1970.
- Holborn, Hajo. *A History of Modern Germany, 1648-1840*. New York: Alfred A. Knopf, 1969.
- Holbrook, Stewart H. *The Age of Moguls*. Garden City, NY: Doubleday and Company, 1954.
- Hughes, Thomas P., *Human-Built World: How to Think About Technology and Culture*, Chicago: University of Chicago Press, 2004.
- Josephson, Matthew. *The Robber Barons: The Great American Capitalists, 1861-1901*. New York: Harcourt, Brace and World, Inc., 1934.
- Kao, John J. *The Entrepreneur*. Englewood Cliffs, NJ: Prentice Hall, 1991.
- Launius, Richard. "American Memory, Culture Wars and the Challenge of Presenting Science and Technology in a National Museum." *The Public Historian* 29 (Winter 2007): 13-30.
- Lazarus, Emma. "The New Colossus," *Statue of Liberty State Park*, accessed 10 September 2010, <http://www.libertystatepark.com/emma.htm>.
- McAlpine, William J. "Modern Engineering," *Scientific American* 20, no.9. (February 1869): 130.
- McCormick, Blaine and Burton W. Folsom, Jr. "A Survey of Business Historians On America's Greatest Entrepreneurs." *The Business History Review* 77 (Winter 2003): 703-716.

- McCullough, David. *The Great Bridge*. New York: Simon and Schuster, 1972.
- McDermott, John. *Corporate Society: Class, Property, and Contemporary Capitalism*. Boulder, CO: Westview Press, 1991.
- McElfresh, Earl B. *Maps and Mapmaker of the Civil War*. New York: Harry N. Abrams, Inc., 1999.
- Maier, Pauline and Merritt Roe Smith. "Some Thoughts on the History of Technology from Leading Scholars." In *The Society for History and Technology*, accessed 5 November 2010, <http://www.historyoftechnology.org/thoughts.html>.
- Magaziner, Henry J. "The Rebirth of an Engineering Landmark." *APT Bulletin* 18, no. 4 (1986), 52-64.
- Mann, Golo. *The History of Germany Since 1789*. Translated by Marian Jackson. New York: Frederick A. Praeger, 1968.
- Marcus, Alan. "Science and Technology," in *A Companion to 19<sup>th</sup>-Century America*, ed. William L. Barney, 334-344. Malden, MA: Blackwell, 2006.
- Meyer, David R. *The Roots of American Industrialization*. Baltimore, MD: Johns Hopkins University Press, 2003.
- Micklethwait, John and Adrian Wooldridge. *The Company: A Short History of a Revolutionary Idea*. New York: Modern Library, 2003.
- Nasaw, David. *Andrew Carnegie*. New York: Penguin Press, 2006.
- "Nation's First Engineering School." In *United States Military Academy Bicentennial History*, accessed 5 November 2010, <http://www.usma.edu/bicentennial/history/FirstESchool.htm>.
- Petroski, Henry. *To Engineer is Human: The Role of Failure in Successful Design*. New York: Vintage Book, 1992.
- Porter, Gary. *The Rise of Big Business*. New York: Thomas Crowell Co., Inc., 1973.
- Pursell, Carroll W. Jr. "A Trade Catalog on the Transmission of Power by Wire Rope." *Technology and Culture* 16 (January 1975): 70-73.
- "What the Senate is to the American Commonwealth: A National Academy of Engineers," In *New Perspectives on Technology and Culture*, ed. Bruce Sinclair (Philadelphia, PA: American Philosophical Society, 1986), 19-29.

- Redlick, Fritz. "The Robber Baron: Creative and Destructive." In *The Robber Barons: Saints or Sinners?*, ed. Thomas Brewer, 88-100. New York: Holt, Rinehart and Winston, 1970.
- Roebing Family Collection, MC654, Special Collections and University Archives, Rutgers University Libraries, New Brunswick, NJ.
- Roebing, John A. *Diary of My Journey from Mühlhausen in Thuringia via Bremen to the United States of North America in the Year 1831*. Translated by Edward Underwood. Trenton, NJ: Roebing Press, 1931.
- Roebing, Washington. *Washington Roebing's Father*. Edited by Donald Sayenga. Reston, VA: American Society of Civil Engineers Press, 2009.
- Saltow, James H. "The Business Use of Business History." *The Business History Review* 29 (September 1955): 227-237.
- "Sandy and Beaver Canal." In Ohio History Central, accessed 28 February 2011, <http://www.ohiohistorycentral.org/entry.php?rec=797>.
- Sayenga, Donald. *Ellet and Roebing*. York, PA: American Canal and Transportation Center, 1983.
- Schuyler, Hamilton. *The Roebing's: A Century of Engineers, Bridge-builders and Industrialists*. Princeton, NJ: Princeton University Press, 1931.
- Sellers, Charles. *The Market Revolution: Jacksonian America, 1815-1846*. New York: Oxford University Press, 1991.
- Sheehan, James J. *German History 1770-1866*. Oxford: Clarendon Press, 1989.
- Sicilia, David B. "Industrialization and the Rise of Corporations, 1860-1900." In *A Companion to 19<sup>th</sup> Century America*, ed. William L. Barney. Malden, MA: Blackwell Publishing, 2006: 139-151.
- Sinclair, Bruce. "Inventing a Genteel Tradition: MIT Crosses the River." In *New Perspectives on Technology and American Culture*, ed. Bruce Sinclair, 1-18. Philadelphia: The American Philosophical Society, 1986.
- "Local History and National Culture: Notions on Engineering Professionalism in America." *Technology and Culture* 27, no. 4 (October 1986): 683-693.
- Slappey, Sterling G. ed. *Pioneers of American Business*. New York: Grosset and Dunlap, 1973.

- Smith, Michael W. "Back to the Future: EPCOT, Camelot, and the History of Technology." In *New Perspectives on Technology and American Culture*, ed. Bruce Sinclair, 69-79. Philadelphia: The American Philosophical Society, 1986.
- "The Sounds of Progress, Part II: Emily Roebling." In *Women in Science, Technology, Engineering and Mathematics ON THE AIR*, accessed 1 April 2010, <http://www.womeninscience.org/transcript.php?storyID=28>.
- Steinman, D. B. *Builders of the Bridge*. New York: Harcourt Brace, 1945.
- Steinman, David B., and Sara Ruth Watson. *Bridges and Their Builders*. New York: G.P. Putnam's Sons, 1941.
- Stoll, Steven. *The Great Delusion: A Mad Inventor, Death in the Tropics, and the Utopian Origins of Economic Growth*. New York: Hill and Wang, 2008.
- "Tetanus," *New York State Department of Health*, accessed 10 March 2011, [http://www.health.state.ny.us/diseases/communicable/tetanus/fact\\_sheet.htm](http://www.health.state.ny.us/diseases/communicable/tetanus/fact_sheet.htm).
- "The Roebling Wire and Concrete Construction for Floors and Walls," *Engineering News*, XXXIV, No. 3 (July 18, 1895), 45-46.
- Trachtenberg, Alan. *Brooklyn Bridge: Fact and Symbol*. Chicago: University of Illinois Press, 1965.
- *The Incorporation of America: Culture and Society in the Gilded Age*. New York: Hill and Wang, 1982.
- Waddle, J. A.L. "The Engineering Profession Fifty Years Hence." *The Scientific Monthly* 6, no. 6 (June 1918): 538-548.
- Weinberg, Steve. *Taking on the Trust: How Ida Tarbell Brought Down John D. Rockefeller and Standard Oil*. New York: W.W. Norton and Company, 2008.
- Wohl, R. Richard. "The Significance of Business History." *The Business History Review* 28 (June 1954): 128-140.
- Wyllie, Irvin G. "Alternatives to Spencerism." In *The Robber Barons: Saints or Sinners?*, ed. Thomas B. Brewer, 40-46. New York: Holt, Rinehart and Winston, 1970.

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